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Dual-Credit Program Leadership and Student Engagement

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Abstract

Under dual enrollment, high school students take college or university courses from post-secondary institutions or external agencies for both post-secondary and high school credits. Dual credits include college/university, Advanced Placement, and International Baccalaureate courses. This study uses hierarchical linear modelling to determine whether grade in school (e.g., grade 12) or enrollment in multiple dual-credit courses impacts student engagement before and after moderation by leadership and dual-enrollment related variables. In this study, dual-credit students (n = 676) in New York and Ontario completed the *Classroom Survey of Student Engagement* (CLASSE), an adapted version of the *National Survey of Student Engagement*, regarding their dual-credit courses. They also completed the revised *Multifactor Leadership Questionnaire* (MLQ 5x) to rate their dual-credit instructors' transformational leadership. The dual-credit instructors (n = 43) completed the MLQ 5x to rate their principals' or college deans' transformational leadership. Research sites in New York and Ontario were included to capture various dual-enrollment delivery models. The analysis phase of the research involved two main steps: establishing the reliability and validity of the instruments and performing hierarchical linear modelling. Exploratory factor analyses (EFAs) established the construct validity of both the MLQ 5x and CLASSE with dual-enrollment students—a new context for both instruments. The EFAs and reliability tests revealed that the MLQ 5x was a suitable tool for measuring students' perceptions of their dual-credit instructors' transformational leadership. Initial EFAs on the CLASSE

revealed clear facets of student engagement but showed several cross-loading questionnaire items, so further psychometric work was conducted to determine a subset of items with high factor loadings, low cross loadings, and acceptable reliability. This reduced subset was then used to generate average student-engagement scores for use in 2-level and 3-level hierarchical linear models that explored student, teacher, and school effects on student engagement for those in dual-credit programs. Hierarchical linear modelling revealed that teachers' transformational leadership and the type of dual-credit teacher (high school or post-secondary) had a significant impact at the .05 level on the relationship between enrollment in multiple dual-credit courses and student engagement. This research can aid in the design of effective dual-enrollment programs.

Keywords: dual credit, Advanced Placement, International Baccalaureate, transformational leadership, teacher leadership, principal leadership, student engagement

Dedication

This thesis is dedicated to my mother Barbara, late father Lyle, and my partner and best friend Quentin.

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Chapter 1. Introduction

Although the policies and delivery models vary, most Canadian provinces and territories and all fifty American states have dual-credit programs (Andrews, 2013). Under dual enrollment, high school students take college-level courses from post-secondary institutions or external agencies for both college and high school credits. This research considers three types of dual credits: college/university, Advanced Placement (AP), and International Baccalaureate (IB) courses. The growth of these dual-enrollment programs in North America has been phenomenal. In 2013, approximately 19,000 Ontario students participated in dual-credit programs via community colleges, a nearly seven-fold increase from the 2,865 who participated in 2007 (Ontario Ministry of Education, 2013b, p. 2). Dual enrollment via universities is not supported or funded by the Ministry of Education in Ontario, but university-level dual-credit opportunities are available to Ontario high school students via AP and IB exam-based courses. In 2013, approximately 5,307 Ontario students wrote 8,233 AP exams in their high schools (The College Board, 2015a, para. 1). In 2007, Ontario high school students wrote 20,992 IB exams in their schools (IB Schools of Ontario, 2007, p. 16). In the United States (U.S.), the National Center for Educational Statistics has reported that 98% of community colleges, 77% of four-year universities, and 40% of private four-year institutions currently enroll high school students in post-secondary classes for credit (as cited by Andrews, 2013, para. 13). In 2003, 1.2 million U.S. high school students were enrolled in dual credits via post-secondary institutions (Smith, 2007, p. 373). In 2011, this figure grew to 2.04 million (Borden, Taylor, Park, & Seiler, 2013, p. 2). An additional 3.5

million American students enrolled in AP or IB courses for a total of over 5 million dual enrollments nationally in 2011 (Thomas, Marken, Gray, Lewis, & Ralph, 2013, p. 3). Dual enrollment continues to expand, but research into program quality, leadership, and student outcomes has failed to keep pace (Delicath, 2000; Farrell & Seifert, 2007; Hoffman, 2003; Lichtenberger, Witt, Blankenberger, & Franklin, 2014). The purpose of this study is to examine relationships between dual-credit program leadership, related dual-enrollment variables (e.g., whether the dual credit is delivered in a high school or post-secondary institution, type of dual-credit teacher, etc.), and student engagement. This research can aid in the design of effective dual-enrollment programs.

Introduction to the Problem

Policy makers have identified the need for research to determine the impact of dual-credit programs on students (Andrews, 2001; Delicath, 2000; Farrell & Seifert, 2007; Greenberg, 1989; Hoffman, 2003). Farrell and Seifert (2007) have emphasized the lack of formal evaluation procedures for college-based dual-credit programs and the need for long-term empirical research to assess the impact of these programs on student accessibility, retention, achievement, and career aspirations. Farrell and Seifert have also stressed that little research has been conducted on social equity, teacher leadership, and administrative leadership in college-based dual-enrollment programs. Lichtenberger et al. (2014) and Smith (2007) have stated that limited quantitative evidence relates dual enrollment via post-secondary institutions to positive student outcomes, especially for low-income, rural, and minority students. Hoffman (2003) has argued that more research is needed on how to improve access to AP, IB, and college/university dual-credit courses

for underserved student populations. Delicath (2000) has emphasized the need to investigate the efficacy of college-based and AP dual-credit programs on college matriculation and goal achievement, especially for students at risk of not completing college. Hertberg-David, Callahan, and Kyburg (2006) have stressed that more research is needed to explore the impact of intensive AP and IB courses on the personal and social experiences (life factors) of all learners, in particular for the gifted and/or underserved. Karp, Calcagno, Hughes, Jeong, and Bailey (2007) have noted that few studies use rigorous quantitative methods to investigate the efficacy of dual enrollment, especially those of vocationally based dual credits across states. The dual-credit literature has not kept pace with its rapid student growth.

Cognitive student outcomes. The few quantitative dual-credit studies that do exist tend to focus on cognitive measures of school effectiveness such as student achievement, degree enrollment, and degree-attainment rates (An, 2013; Delicath, 2000; Lichtenberger et al., 2014; Michael, 2003; Swanson, 2008). These cognitive measures fail to capture students taking vocational dual credits who may proceed directly into the workforce after high school. Forty-two percent of U.S. high schools reported that their students enrolled in vocational dual credits offered by universities and colleges (Thomas et al., 2013, p. 3). In 2012–2013, 7% of dual credits attached to colleges in Ontario were vocationally based apprenticeship courses (Ontario Ministry of Education, 2013b, p. 2). Cognitive measures of school effectiveness, such as achievement and graduation rates, do not adequately measure students' enjoyment of dual-credit courses or the goodness of fit between dual-credit curricula and the needs of individual students or groups of students

(e.g., underserved student populations, gifted learners, etc.). Non-cognitive measures of student success can capture enjoyment, curriculum fit, individual student learning styles, attributes (effort, perseverance, mindset), and engagement (Gutman & Schoon, 2013). This research focuses on student engagement, a non-cognitive measure of school effectiveness that includes students' participation and identification in school, sense of self-worth, and aspirations (Finn, 1989; Kuh, 2003, 2009).

Non-cognitive student outcomes and dual enrollment. Limited research in relation to dual-credit programs has been conducted on the non-cognitive domain, especially quantitative. There are some studies, but they are narrow in scope and do not look specifically at student engagement. Heath (2008) explored the social experiences of community college dual-enrollment students as compared to traditional (non-dual-enrollment) students using repeated measures analysis of variance and found dual-enrollment students had higher levels of satisfaction with their post-secondary experiences than non-dual-enrollment students. Smith (2007) explored the effect of dual enrollment via a community college on rural students' career aspirations using multiple regressions and found dual enrollment had a greater impact on career aspirations than other variables such as student achievement and parental achievement expectations. Hertberg-David et al.'s (2006) mixed methods research explored the impact of the fast-paced course delivery, the one-size-fits all curricula, and heavy workload (e.g., time for sleep and social activities) on students in academically demanding AP and IB courses. Their research revealed that curricular and workload aspects of exam-based dual-credit courses had a greater impact on non-traditional students as compared to more hegemonic

groups. Hertberg-David et al. therefore argue that more research is needed to determine the efficacy of AP and IB programs on the academic, social, and personal experiences of traditionally underserved student populations. Thus, there is a definite need to relate dual enrollment to a broader set of student outcomes beyond cognitive measures of success for students enrolled in all types of dual credits—especially for underserved students. None of these aforementioned studies related student engagement to leadership for those in dual-enrollment programs.

Background of the Study

Dual-credit delivery models. Secondary school students take accelerated dual-credit learning opportunities on high school and/or college campuses in courses taught by secondary school teachers and/or post-secondary professors. Delivery models for AP and IB courses are the same in both Ontario and the U.S.—these courses are taught by secondary school teachers in high schools. Delivery models for dual credits attached to specific universities and colleges vary but all are "true" post-secondary classes delivered by post-secondary institutions. These institutions concurrently enroll high school students as part-time college or university students. Dual credits attached to colleges and universities may be team-taught by both high school and post-secondary teachers, or they may be taught exclusively by either type of instructor (Borden et al., 2013; Vargas et al., 2014). These courses are delivered in high schools, colleges, and universities (Greenberg, 1989). On college campuses, high school students may take regular classes alongside college freshmen or "congregated" classes alongside other high school students (Ontario Ministry of Education, 2013a; Vargas, Roach, & David, 2014). Some dual credits are also

delivered through distance education or intensive summer programs on college and university campuses (Ontario Ministry of Education, 2013a, p. 21; Syracuse University, 2015b). College and university professors may travel to high schools to deliver dual-credit courses. Thus, there are many different delivery models for dual credits attached to specific universities and colleges. The next paragraphs describe delivery differences that exist in regards to dual credits *delivered via post-secondary institutions* in the U.S. and Ontario.

International delivery differences. First, no universities in Ontario, except Laurentian University which operates on several community college campuses in Ontario, offer Ontario Ministry of Education recognized (or funded) dual credits. In the U.S., dual credits have been offered through universities since the early 1960s with pioneering dual-enrollment programs such as Syracuse University's *Project Advance* in Syracuse, New York and the City University of New York's *College Now* project in New York City. As of 2014, Project Advance offers 38 courses to 9,400 students in 184 high schools in five U.S. states and across three continents annually (Syracuse University, 2015a, para. 1). College Now is New York City's largest post-secondary-based dual-enrollment program and currently serves more than 20,000 students annually in 400 New York City high schools (City University of New York, 2015, para. 1). Both programs continue to grow. American school boards and state departments of education have supported, monitored, and funded many partnerships between high schools and universities since the 1960s (Andrews, 2001; Greenberg, 1989; Khazem & Khazem, 2012; National Alliance of Concurrent Enrollment Partnerships, 2015).

Ontario offers no comparable Ministry of Education-supported university dual-enrollment programs. There are some reach-ahead university programs for high school students such as Western University's *Initiative for Scholarly Excellence* and *School Within a University* with the Thames Valley District School Board (in London, Ontario) and the University of Waterloo's, St. Jerome's University, and Wilfred Laurier University's *University Cooperative Education Program* with the Waterloo Catholic District School Board (in Waterloo, Ontario). These matriculation programs provide high school students with opportunities to take university courses tuition-free while still in high school, but the university courses in these programs do *not* currently give students *both* high school and university credit (Thames Valley District School Board, 2015; Western University Student Success Center, 2015). Every Ontario Ministry of Education-approved *college* dual credit has an equivalent *Ontario Secondary School Diploma* course code, which is published on a master list (School College Work Initiative, 2015). No university courses from Western, St. Jerome's, Wilfred Laurier, or Waterloo are identified as Ministry of Education approved, funded or monitored dual credits on this list (School College Work Initiative, 2015). Similar reach-ahead programs exist in New York State. For example, students may take a Calculus course from the State University of New York solely as a reach-ahead opportunity through teleconferencing. Successful reach-ahead students receive post-secondary credit but not high school credit. Thus, programs exist in North America where high school students can take university courses, but these are *not* dual-credit programs unless the post-secondary course counts for *both* high school and post-secondary credit.

At the time of writing, no Ontario universities (except Laurentian University operating on college campuses in Kingston and Barrie) offer Ministry of Education monitored or funded dual credits. Ontario colleges compete for government funding through regional planning teams to offer dual credits, and no universities are currently part of this *tender*-competition process (School College Work Initiative, 2015). Thus, there is a major difference between dual-credit university providers in the U.S. and Ontario at the time of writing.

Second, there are major differences in who actually delivers and teaches college and university dual credits in the U.S. and Ontario. Borden et al. (2013) have reported that American high school teachers deliver 77% of college and university dual credits in their local secondary schools (p. 2). In this model, the high school teacher acts as an adjunct college instructor and teaches the dual credit in the local high school using the college-approved syllabus and textbook. No college professor assists in the delivery of the dual credit. According to the Ontario Ministry of Education (2013b), in 2012–2013, 73% of community college-based dual credits in Ontario were college-delivered courses at the colleges, 20% were team-taught by both college and secondary teachers, and 7% were apprenticeship courses (p. 2). Under no official Ontario public model were college dual credits delivered *solely* by a high school teacher in a local secondary school. College dual credits in Ontario always involve a post-secondary professor and high school teacher in some capacity (Ontario Ministry of Education, 2013a). Dual-credit secondary teachers in Ontario may simply oversee and monitor high school students taking a dual-enrollment course alongside college peers on the college campus (and collaborate with the college

professor when necessary), or they may actually team-teach college courses with post-secondary instructors in high schools or in colleges. At the time of writing, a high school teacher in Ontario *never* delivers a Ministry-supported dual credit without college professor oversight.

Thus, due to major differences in dual-credit delivery models, this research includes sites in New York and Ontario to capture all types of dual-credit programs. This research does not consider reach-ahead programs where students receive college or university credit but not credit on their secondary-school graduation diploma.

Curricula and assessment. Dual credits delivered via post-secondary institutions may be academic or vocational in nature, as opposed to AP or IB courses, which are solely academic (Borden et al., 2013). The IB is an institutionally independent, internationally focused high school diploma with a rigorous global curriculum. High school students may pursue the entire IB diploma or take individual subject certificates. Post-secondary institutions routinely accept IB credits earned at the "higher level" and "standard level" for advanced standing and/or transfer credits (IB Organization, 2015b; Newfoundland and Labrador Department of Advanced Education and Skills, 2014a, 2014b). The final grade in an IB course is based on a combination of course work (graded by the classroom teacher) and a standardized exam (graded by external examiners) with scores ranging from 1 to 7 (IB Organization, 2015a). IB exam scores of 6 or 7 are typically needed for post-secondary credit transfer (IB Organization, 2015a). This grading scheme is similar to AP, but grades in AP courses are determined solely on the basis of a standardized exam graded externally (The College Board, 2014). AP exam

scores range from 0 to 5, and AP exams with scores of 4 or 5 are most likely to transfer as credits to post-secondary degree programs (The College Board, 2014). Prior to the 2015–2016 school year, AP courses were offered as single-subject credentials, awarded to students who received a passing score of 3 or higher on each external AP exam. Beginning in 2015–2016, students who complete four AP courses with passing grades of 3 or higher on the external exam and successfully complete the *AP Seminar* and *AP Research* courses can apply to receive the *AP Capstone Diploma* (The College Board, 2015b). Students who successfully complete the AP Seminar and AP Research courses and complete fewer than four additional AP subject exams with scores of 3 or higher can apply to receive the *AP Capstone Certificate*. (The College Board, 2015b). In contrast to IB and AP credentials, college or university dual-credit courses are not graded by external examination nor tied to an institutionally independent review board. Grading in college and university dual-credit courses typically follows traditional post-secondary syllabi and includes a mixture of project, assignment, and test scores as determined by individual faculty and institutions (Andrews, 2001). University and college dual-enrollment students do not typically receive diploma or certificate credentials for their dual-credit courses, but they receive both high school and post-secondary credit. Passing the post-secondary portion of the dual credit yields "real" college and university credit. Dual-enrollment students are registered as part-time post-secondary students and can receive a college or university transcript at the completion of the dual-credit course.

Dual-enrollment can provide some unique concurrent learning opportunities for students. For example, students may pursue dual credits attached to more than one post-

secondary institution concurrently. One high school in this study was partnered with six universities and colleges; students at this high school could pursue European History from a public university and Introductory Calculus from a private college during the same semester. In many jurisdictions, students can also attempt dual credits through multiple means—AP, IB, and post-secondary institutions at the same time. Moreover, the three types of dual-enrollment models can also co-exist within each other and within regular high school courses. In other words, AP and IB courses can be taught on their *own* as dual credits or *within* dual credits offered via post-secondary institutions in high schools (thereby increasing post-secondary credit transferability) (Khazem & Khazem, 2012; Swanson, 2008). For example, a course can be both AP Calculus and dual-enrollment Calculus from a specific university. AP, IB, and college/university dual credits can also co-exist within *regular* high school courses. For example, AP Calculus or IB Higher Level Mathematics Year 2 can be concurrently delivered within Grade 12 Calculus and Vectors, MCV4U, in Ontario. In these concurrent delivery models, a student could achieve the high school credit but not attain the post-secondary credit(s) if college or university learning outcomes were not met. While some researchers exclude exam-based AP and IB courses when describing dual credits (Bailey, Hughes, & Karp, 2002), other research (and this research) includes all three types of concurrent-enrollment credits (Andrews, 2001; Delicath, 2000; Greenberg, 1989). Post-secondary college/university, IB, and AP dual credits are all examples of reach-ahead student matriculation programs.

Dual-enrollment student outcomes. Dual enrollment improves high school graduation rates, post-secondary preparedness, educational aspirations, post-secondary enrollment, and degree attainment (Allen & Dadgar, 2012; Delicath, 2000; Farrell & Seifert, 2007; Lichtenberger et al., 2014; Smith, 2007). Several researchers conducted retrospective dual-credit studies with large pre-existing data sets and found positive outcomes related to improved high school and college graduation rates (persistence), faster time to completion of post-secondary programs, and higher first-semester and second-semester college grade point averages (An, 2013; Karp et al., 2007; Lichtenberger et al. 2014; Swanson, 2008). Other researchers found through empirical quantitative research that dual enrollment increased student motivation and lead to higher student satisfaction ratings with school and improved career aspirations (Heath, 2008; Johnson & Brophy, 2006; Shaunessy, Suldo, Hardesty, & Shaffer, 2006; Smith, 2007).

Dual-enrollment system outcomes. In addition to student-level benefits, dual-credit programs also offer important system-level benefits. Dual-enrollment partnerships increase dialogue and build social capital between districts, secondary schools, and colleges (Andrews, 2013; Farrell & Seifert, 2007). This collaboration can help the pre-tertiary and post-secondary sectors align curriculum to prevent redundancies and transition gaps. The U.S. National Center for Public Policy and Higher Education (2010) has described the increasing need for colleges to remediate nearly 60% of incoming students in core subject areas such as communications and mathematics (p. 1). The *College Student Achievement Project* (CSAP), funded by the Ministry of Education and Ministry of Colleges, Training, and Universities in Ontario, has confirmed the same need

for remediation in Ontario (Orpwood & Brown, 2013). The CSAP has analyzed the success of all first-semester college students ($n \approx 95{,}000$) in math and communications in Ontario annually for the past several years; all 24 Ontario colleges and 72 school boards in the province are currently involved. The CSAP continually identifies the need for core remediation in communications and mathematics. Dual credits offer great promise in the area of improving college readiness. Kim and Bragg (2008) conducted a retrospective study with data from 1,141 students in four community colleges and found a significant effect for college readiness in terms of reading, writing, and mathematics for students who had taken dual credits via post-secondary institutions versus those who had not. Students who are better prepared for college contribute positively to the institutions' retention rates. Dual credits further benefit colleges by providing student recruitment opportunities and building community relations. Higher college retention rates and graduation rates further benefit local and more global economies and help students become lifelong learners. The literature review in Chapter 3 of this work elaborates on the benefits of dual enrollment and provides a critique of research conducted in this area.

Need for additional research on leadership within dual-enrollment programs. There is a need to relate dual-enrollment student outcomes to teacher and administrator leadership to build strong dual-credit programs that foster the student, system, and community benefits outlined above. Only one of the several hundred studies reviewed for this project, namely Michael (2003), attempted to relate student outcomes to leadership within dual-enrollment programs. Michael conducted a correlational study to try to find a relationship between the transformational leadership of administrators in America's

middle college high schools and their feeder institutions (i.e., high schools and middle schools located on college campuses) to indicators of school effectiveness. Middle college high schools "are explicitly designed to provide dual-enrollment opportunities to students who may not have had access to college in the past" (Barnett, Maclutsky, & Wagonlander, 2015, p. 39). All of Michael's school effectiveness measures were cognitive and included high school attendance, dropout rates, graduation rates, and college-attendance rates. Michael focused on transformational leadership, a more positive leadership style, as opposed to more negative leadership styles such as laissez-faire or passive-avoidant leadership. Burns (1978), the seminal father of transformational leadership theory, wrote that "[transformational] leaders and their followers raise one another to higher levels of morality and motivation" (p. 83). In a school context, transformational leaders inspire second-order and deep sustainable educational reform. Although Michael was unable to find a relationship between administrator transformational leadership and her school effectiveness measures because of possible administrator self-rater bias, her research is important because it attempted to link school leadership to student outcomes in a concurrent-enrollment context.

Researchers have demonstrated that dual credits improve student outcomes at both the high school and post-secondary level, but more research is needed to determine *how* leadership in dual-enrollment programs influences such outcomes. Other researchers have shown in a general context that effective transformational school leadership is necessary for school reform, organizational learning, and for improving student outcomes (Leithwood & Jantzi, 1999a, 1999b, 2000; Silins & Mulford, 2002, 2003). It is time to

replicate and build on this research in a dual-credit context. Spillane (2005) has argued that successful school leadership is *distributed* between teachers, administrators, and students. Transformational leadership can help build the effective distributed leadership structures necessary for maintaining successful dual-enrollment partnerships. Thus, it is important to study transformational leadership in the context of dual-credit student engagement.

Statement of the Problem

To fill a gap in the literature, this research sought to explore relationships between dual enrollment, teacher and administrator leadership, and student engagement using rigorous quantitative methods. Dual enrollment has been shown to foster positive outcomes related to cognitive measures of student success (such as school achievement, graduation, post-secondary enrollment, etc.), but little quantitative research has related dual enrollment and leadership to non-cognitive student outcomes such as student engagement and future aspirations. Establishing such relationships in this study may offer insight into the creation of leadership-based professional development programs for dual-credit instructors and administrators. It will also help establish the efficacy of all types of dual enrollment for students. Several researchers have conducted retrospective dual-credit studies with large pre-existing data sets, but several of these data sets did not distinguish between the types of dual credits (e.g., academic or vocational), type of dual-credit teacher (e.g., college/university, high school, or team-taught), or dual-credit delivery location (high school or post-secondary institution) (An, 2013; Swanson, 2008). In addition, the retrospective research reviewed for this project did not consider teacher or

administrator leadership. This research avoids issues with retrospective data analysis because data were collected in real-time, so collection of leadership and dual-enrollment related variables was possible. Thus, it should be clear that there is a need to relate student engagement to teacher and administrator leadership for those in dual-enrollment programs in the context of potential confounding variables (e.g., type of dual credit, dual-credit delivery location, etc.). Dual-credit partnerships require complex distributed leadership structures between schools, school boards, governments, external agencies, universities, and colleges. Research in this area can help strengthen dual-enrollment partnerships and improve outcomes for students.

Purpose of the Study

The purpose of this quantitative survey project was to determine the impact of student-, classroom-, and school- related factors on dual-credit students' engagement. In this study, dual-credit students (n = 676) from 16 schools in New York and Ontario completed the *Classroom Survey of Student Engagement* (CLASSE), an adapted version of the *National Survey of Student Engagement*, regarding their dual-credit courses. They also completed the revised *Multifactor Leadership Questionnaire* (MLQ 5x) to rate their dual-credit instructors' transformational leadership. The dual-credit instructors (n = 43) completed the MLQ 5x to rate their principals' or college deans' transformational leadership. Research sites in New York and Ontario were included because each jurisdiction has different dual-credit delivery models. The goal of this correlational study was to assess whether grade in school (e.g., grade 12) or enrollment in multiple dual credits impacts student engagement before and after moderation by leadership and dual-

enrollment related variables at the classroom and school level. Validation of the MLQ 5x and CLASSE was a necessary prerequisite for performing hierarchical linear modelling in this analysis, and this dissertation documents the validation of the MLQ 5x and CLASSE with high school dual-credit students before performing hierarchical linear modelling with student, classroom, and school variables. Student-level independent variables included the student's grade in school (grade 12 or other) and the number of dual credits taken (multiple or not). Classroom-level independent variables (moderators) included the type of dual credit (academic or vocational), type of dual-credit teacher (high school teacher or post-secondary professor), and students' perceptions of their teachers' transformational leadership. School-level independent variables (moderators) included the dual-credit delivery location (high school or post-secondary institution), state/province (New York or Ontario), and teachers' perceptions of their principals' or deans' transformational leadership style. All independent variables were selected because they were identified in the dual-credit literature as having a potential impact on dual-credit student outcomes. The dependent (outcome) variable was student engagement.

Thus, the overall aim was to use average student engagement, aggregate teacher transformational leadership, and aggregate administrator transformational leadership scores in 2-level and 3-level hierarchical models that related student, classroom, and school effects on dual-credit student engagement (the outcome variable). The creation and interpretation of the 2-level and 3-level hierarchical models were the main goals/purpose of this study (see Tables 21 and 22 and Figures 1–3 for overview of the theoretical models).

General benefits of the research. Research into what leadership practices positively influence dual-credit student engagement is essential to ensure that successful dual-enrollment partnerships continue to grow, are maintained, are accessible, and positively benefit all student populations. This research helps stimulate a dialogue about what constitutes effective dual-credit programs that adequately serve all student populations. Studying dual enrollment in relationship to leadership is essential for building strong dual-credit programs that foster high student achievement with deep and meaningful engagement. This research may be useful to dual-enrollment leaders, policy makers, instructors, superintendents, and school board administrators who work to build and maintain these programs.

Significance of the study. The study holds significance because it is the first to establish and perform psychometric (reliability and validity) analyses on the CLASSE and MLQ 5x with high school dual-enrollment students. This study is also significant because it is one of only a few (if any) to relate student engagement within dual-enrollment programs to leadership using rigorous quantitative methods. Transformational leadership was selected as the focus of this study as opposed to other leadership styles (such as moral, ethical, instructional leadership, etc.), because of its potentially positive impact on student engagement (Leithwood & Jantzi, 1999a, 1999b, 2000; Silins & Mulford, 2002, 2003). Leithwood and Jantzi (1999a, 1999b, 2000) and Norton (2012) provide examples of studies that relate student engagement to transformational teacher and principal leadership but in a more general school context without HLM analysis. HLM is the desired statistical technique for examining hierarchically structured data at

the student, classroom, and school level. HLM is preferred over ordinary least squares (OLS) regression because HLM can account for the shared variance students share in the same classroom and teachers share in the same school, whereas OLS regression cannot. Leithwood and Jantzi (1999a, 1999b, 2000) wanted to use HLM in their teacher and principal leadership and student engagement studies, but they could not because they were unable to link responses of individual students to their teachers (a prerequisite of HLM). Norton (2012) faced the same problem in her study on the impact of teacher leadership on student engagement in the middle school classroom because she was unable to link student responses to teacher responses in her study for ethical reasons. As a result, Norton's study used simpler correlational analyses which could not account for multiple confounding influences in the same model. This research was successful in overcoming linkage problems because the researcher was able to join student responses to teacher responses using randomly-generated anonymous bar codes. Thus, this study is one of the first to look at transformational teacher and principal leadership in relation to dual-credit student engagement in the context of other potentially confounding variables using the preferred statistical technique of HLM. Research on the efficacy of leadership within dual-credit programs using rigorous quantitative analysis is sparse.

Significance of the study for underserved student populations. This study offers significance for underserved student populations—both at-risk and/or gifted. In Ontario, college-based dual credits are targeted at students at risk of not completing high school or who have left before high school graduation (Ontario Ministry of Education, 2013a, p. 5). Helping at-risk students graduate high school and proceed into the

workplace or post-secondary education is essential for building stronger, more productive communities. The Ontario Ministry of Education's renewed vision aims for schools to "partner with parents, guardians and communities to develop graduates who are personally successful, economically productive and actively engaged citizens" (Ontario Ministry of Education, 2014, p. 1). The U.S. has a similar focus on improving life outcomes for at-risk students through educational policy changes, "Tech Prep" (vocational) dual-credit programs, and pilot programs aimed at increasing access to dual enrollment for underserved student populations (Hugo, 2001; Vargas et al., 2014; Wathington & Pretlow, 2014). Karp et al.'s (2007) seminal empirical research found that dual enrollment via post-secondary institutions had more significant impacts on college enrollment and grade point averages (GPAs) for males, lower achieving, and low-income students than for other student populations. Wathington and Pretlow (2014) studied the results of government policy changes in Virginia that required that all students, particularly seniors and/or minority students, were made aware of dual-enrollment opportunities. After the policy changes, dual enrollment increased in the state. More Virginia students matriculated into four-year post-secondary institutions sooner after high school graduation, but the results were not uniform across all student populations. Minority students were still underrepresented in dual-enrollment programs. Based on extensive secondary data analysis, Hoffman (2003) wrote, "Achievement rises when schools with large numbers of underrepresented students offer AP courses and tests" (p. 6). Hertberg-David et al. (2006) have argued that more research is needed to determine the efficacy of AP and IB programs for traditionally underserved student populations

(e.g., gifted and/or at-risk). Dual enrollment has the potential to significantly impact the life outcomes of at-risk students if dual-credit programs are physically and financially accessible.

With tight educational fiscal budgets, there needs to be solid evidence that dual-enrollment programs are worth the extra expenditures for students, particularly for the underserved. Some U.S. school boards cover dual-enrollment students' post-secondary tuition and related expenses and AP/IB exam-based fees (Hoffman, 2003; Vargas et al., 2014). In addition, funding is often more expensive for some types of dual-enrollment programs than for regular high school programming. For example, in Florida, dual enrollment via a post-secondary institution has been funded at 1.0 *Full-Time-Equivalent* units, but AP and IB courses within high schools have been funded at 1.16 Full-Time-Equivalent units (Khazem & Khazem, 2012). Some states have additional AP and IB merit-pay bonuses for teachers based on student performance (Figlio, 2007; Janowski, 2010). When budgets are tight, programming for gifted and/or at-risk students often faces the first financial cuts. Research into which leadership practices contribute most to student engagement help establish the efficacy of dual-enrollment programs and is essential for improving and sustaining dual-enrollment programs.

Research Design

This research had three phases: 1) establishing the reliability and validity of the MLQ 5x, 2) establishing the reliability and validity of the CLASSE, and 3) performing 2-level and 3-level HLM analyses to relate dual-credit student engagement to teacher and administrator leadership and other variables shown to potentially impact dual-credit

student outcomes (see Figures 1–3 for visual overview). Due to the large sample sizes required of HLM, it was not possible to run all independent variables (covariates) in one HLM model in this research.

Overview of the Research Method

This study used rigorous quantitative analysis in the form of HLM to explore relationships between dual enrollment, program leadership, and student engagement. In this study, dual-credit students (n = 676) in New York and Ontario completed the Classroom Survey of Student Engagement (CLASSE), an adapted version of the National Survey of Student Engagement (NSSE), regarding their dual-credit courses. They also completed the revised Multifactor Leadership Questionnaire (MLQ 5x) to rate their dual-credit instructors' transformational leadership styles. The dual-credit instructors completed the MLQ 5x to rate their principals or college deans. EFAs were used to establish the construct validity of both the MLQ 5x and CLASSE with dual-enrollment students (a new context for both instruments). These analyses and reliability tests (Cronbach's alpha, average inter-item correlations) revealed that the MLQ 5x was a suitable tool for measuring students' perceptions of their dual-credit instructors' transformational leadership, but further psychometric work was needed on the CLASSE to determine a suitable subset of engagement items for use in the hierarchical linear models. This reduced item subset from the CLASSE was used to generate average student-engagement scores for use in 2-level and 3-level hierarchical linear models that attempt to relate elements of transformational teacher and administrator leadership to student engagement. Other variables in the 2-level and 3-level hierarchical models

included the student's grade in school (grade 9, grade 10, etc.), whether the student had taken multiple dual credits, the type of dual credit (academic or vocational), the type of dual-credit teacher (high school or post-secondary), delivery location (high school or post-secondary institution), and state/province (New York or Ontario).

Overview of the Design Appropriateness

EFAs were the most appropriate statistical tool for psychometrically validating student responses on the MLQ 5x and CLASSE since both instruments were used in a new context by high school dual-enrollment students. The MLQ 5x was designed for business use and the CLASSE for post-secondary contexts (as opposed to high schools). No published psychometric work on the latent factors underlying the CLASSE was available at the time of analysis, so an EFA on the CLASSE data set was essential. Additionally, some researchers have found discrepancies in the number of subscales (e.g., leadership styles/dimensions) measured by the MLQ 5x, so an EFA on the MLQ 5x was also deemed necessary. EFA is the desired statistical technique when reducing a set of questionnaire items to measure underlying relationships without item (question) duplication. EFAs were performed on the CLASSE to find a subset of items to measure student engagement without duplication. Hierarchical linear modelling (HLM) was the most appropriate statistical technique to relate the independent variables to student engagement to account for the shared variance that students share in the same classroom and classrooms share in the same school. The HLM analyses depended on the EFAs done on the student responses to the MLQ 5x and CLASSE (see Figure 1 for diagram of the

overall study design; see Figures 2 and 3 for schematic diagrams of the 2-level and 3-level HLM analyses respectively.)

Research Questions

The central research question was, "Does grade in school (e.g., grade 12) or enrollment in multiple dual credits impact student engagement before and after moderation by leadership and dual-enrollment related variables at the classroom and school level? Classroom-level variables (moderators) included the type of dual credit (academic or vocational), type of dual-credit teacher (high school or post-secondary), and students' perceptions of their dual-credit instructors transformational leadership. School-level variables (moderators) included the dual-credit delivery location (high school or college), state/province (New York or Ontario) and teachers' perceptions of their administrators' transformational leadership style. The supporting research questions were:

1. Using EFAs and reliability analyses, is the MLQ 5x a suitable tool for measuring students' perceptions of their teachers' transformational leadership so teachers' leadership scores could be used in HLM? If not, is there a combination (subset) of questions from the MLQ 5x that could measure students' perceptions of their dual-credit instructors' transformational leadership with acceptable validity and reliability for use in HLM?
2. Using EFAs and reliability analyses, is the CLASSE a suitable tool for measuring students' engagement in their dual-credit courses so students'

engagement scores could be used in HLM? If not, is there a combination (subset) of questions from the CLASSSE that could measure student engagement with acceptable validity and reliability for use in HLM?

3. Does the student's grade in school (grade 12 or other) or enrollment in multiple dual-credit courses impact student engagement before and after moderating for the following classroom-level variables: students' perceptions of their teachers' transformational leadership style (as measured by the MLQ 5x), type of dual credit (academic or vocational), and type of dual-credit teacher (high school or post-secondary); and before and after moderating for the following school-level variables: dual-credit delivery location (i.e., high school or post-secondary institution), school location (New York or Ontario), and teachers' perceptions of their administrators' transformational leadership style (as measured by the MLQ 5x)?

Hypotheses

The central hypothesis was that grade level (e.g., grade 12) and enrollment in multiple dual-credit courses would impact student engagement. It was hypothesized that dual-credit teachers' and administrators' transformational leadership would affect the relationships between grade level (e.g., grade 12) and student engagement *and* between enrollment in multiple dual-credit courses and student engagement. Here is a summary of the relevant supporting hypotheses:

1. The MLQ 5x was hypothesized to be a valid and reliable tool for measuring dual-credit students' perceptions of their teachers' transformational leadership as specified by its scoring manual and other educational research (Avolio & Bass, 2004; Norton, 2012; Stewart, 2006). However, due to discrepancies in the factor loadings specified (e.g., the leadership dimensions measured) by other researchers and the use of the MLQ 5x in a new context, it was unknown whether one or multiple transformational leadership subscales (factors) would emerge (Schedlitzki & Edwards, 2014). It was hypothesized that the MLQ 5x could be used to generate accurate teachers' transformational leadership scores through one or more scales for use in HLM.
2. A combination of questions on the CLASSE was hypothesized to be a valid and reliable measure for determining dual-credit student engagement because many items on the CLASSE are derived directly from the National Survey of Student Engagement (NSSE) which has undergone extensive on-going psychometric analysis with extremely large national and international data sets (Kuh, 2009). Since the CLASSE itself has not currently undergone any psychometric analysis in the literature, it was unexpected that the full set of CLASSE questions would adequately capture all facets of student engagement without high cross loading of questionnaire items across latent factors (e.g., across underlying facets of student engagement). Due to parsimony, it was pertinent to have a measure of student engagement that used the fewest number of items from the CLASSE as possible. Kuh, Cruce, Shoup, Kinzie,

and Gonyea (2008) used a subset of questions from the NSSE to generate student-engagement scores for use in a model to predict first-year college grades and persistence, so it was hypothesized that such a subset could be found from the CLASSE in this research. It was hypothesized that a combination of questions from the CLASSE could be used to generate accurate student-engagement scores for use in HLM.

3. It was hypothesized that the student's grade in school and enrollment in multiple dual-credit courses would impact student engagement based on findings of other researchers. Karp et al. (2007) found that the number of dual credits taken had an impact on degree attainment in New York State. Johnson and Brophy (2006) demonstrated that students' academic and social reasons for choosing dual credits differed depending on their grade level. The relative impact of moderating teacher and administrator transformational leadership variables on dual-credit student engagement was unknown. Silins and Mulford (2002, 2003) conducted a study with 2,503 high school teachers and 3,508 grade 10 students in Australia and determined through path analysis that principals' transformational leadership *indirectly* impacted student outcomes (including engagement) through teachers' leadership. Leithwood and Jantzi (1999a) actually found the opposite in a similar study of 1,762 teachers and 9,941 students in a large Canadian school district. Principals' leadership had a weak, but significant, *direct* effect on student engagement (identification and participation with school) in the Leithwood and Jantzi (1999a) path-analysis

study. Teachers' leadership had no significant *direct* impact on student engagement in this study. Other researchers have found differing results. For example, Norton (2012) found strong direct correlations between teachers' transformational leadership and measures of student engagement. Thus, the moderating effects of teacher and principal transformational leadership on student engagement needed to be determined in this study, and no hypotheses were made surrounding their potential impacts. The dual-credit context may not be directly comparable to studies conducted in more general school settings. Hypotheses were made however regarding the impact of moderating classroom-level variables (e.g., type of dual credit and type of dual-credit teacher) and school-level variables (e.g., dual-credit delivery location and the state or province the school is located in) based on the findings of other researchers. Vargas et al. (2014) found that students taking dual credits in their high school were *not* at a disadvantage compared to those who took dual-enrollment courses on college campuses. Thus, it was hypothesized that the dual-credit delivery location (school or post-secondary institution) and type of dual-credit teacher (high school or post-secondary) may not affect the relationship between enrollment in multiple dual-credit courses and student engagement *and* between grade level and student engagement. Karp et al. (2007) found results held for all dual-enrollment students and the subgroup of vocational dual-enrollment students, so it is hypothesized that the type of dual credit (academic or vocational) may not affect relationships between student-

level variables and student engagement. Finally, Karp et al. (2007) found dual-credit outcomes related to degree attainment differed between Florida and New York, so it was hypothesized that the state or province in this study might affect the relationship between enrollment in multiple in multiple dual-credit courses and student engagement.

Theoretical/Conceptual Framework

This correlational study is based on the following theoretical and conceptual frameworks:

Dual-enrollment programs. This research postulates that studying dual enrollment in relation to leadership and student engagement is meaningful. Dual-credit programs have grown at a phenomenal pace across North America, but research into social equity, student outcomes, and leadership has not (Delicath, 2000; Farrell & Seifert, 2007). This study looked at dual enrollment in New York and Ontario because both jurisdictions had different dual-credit delivery models at the time of writing. Both academic and vocational dual credits were considered. Karp et al. (2007) have noted that few studies use rigorous quantitative methods to investigate the efficacy of dual enrollment, especially those of vocationally based dual credits across states. Thus, the locale and type of dual credit were handled carefully in the statistical analysis using indicator variables. Karp et al. (2007) also found that the number of dual credits taken had an impact on degree attainment for students in New York State but not in the State of Florida, so an indicator variable for the number of dual credits taken was included in the hierarchical linear models in this research to attempt to capture potential jurisdictional

differences. Furthermore, many retrospective dual-credit studies (Allen & Dadgar, 2012; An, 2013; Swanson, 2008) did not specify the dual-credit delivery location (i.e., in the high school or college), so this was another indicator variable in the HLM analysis. Lastly, Johnson and Brophy (2006) found that the student's grade level was also an important dual-enrollment indicator variable, so it was also included in the hierarchical models. Dual enrollment has been shown to reduce senior students' aimless drifting and have a greater impact on twelfth grade students as compared to more junior students (Johnson & Brophy, 2006; Johnstone, 1993). This research does not consider all possible variables related to student engagement and dual enrollment. Some potentially confounding variables such as student socio-economic status, school climate, and student parental expectations, shown to impact student engagement in other studies were excluded in this research due to scope, logistical, and ethical issues (a possible limitation of this research).

Full range leadership model. This study accepts that leadership is measurable on a continuum beginning with the most negative leadership style, non-transactional laissez-faire, then moving to transactional passive management-by-exception, transactional active management-by-exception, transactional contingent-reward leadership, and then to the most positive leadership style, transformational leadership (Norton, 2012). This study establishes that the MLQ 5x is a psychometrically valid tool for measuring dual-credit students' perceptions of their teachers' transformational leadership using EFAs and reliability analyses. This research accepts, based on other research, that the MLQ 5x is a psychometrically validated tool for measuring dual-credit instructors' perceptions of their

administrators' transformational leadership; the instructor sample size (n = 43) was too small to establish the construct validity of the teachers' perceptions of administrators' leadership using EFAs in this research. It is suggested that factor analyses require at least 500 participants to achieve adequate power (Comrey & Lee, 1992), so the instructor sample size in this research was too small to perform an EFA with acceptable statistical power. Reliability analyses were performed on the teacher data set. The use of the MLQ and MLQ 5x by teachers and administrators in educational settings is established (Norton, 2012; Stewart, 2006), so this was deemed acceptable.

Student engagement. This study assumes that student engagement is a measurable construct that gauges students' identification and participation with school (Finn, 1989). Engagement can be measured across course, program, and cognitive, social, and emotional domains. Kuh (2009) wrote the deeper the student engagement "the more adept [students] become at managing complexity, tolerating ambiguity, and working with people from different backgrounds or with different views. Engaging in a variety of educationally productive activities also builds the foundation or skills and dispositions people need to live a productive, satisfying life after college" (p. 5). The National Survey of Student Engagement (NSSE) has a strong theoretical basis and has been extensively psychometrically validated in North American settings, including New York and Ontario (Kuh, 2009; Zhao, 2011). This project helps establish through rigorous analysis that the course-specific NSSE, the CLASSE, is a valid and reliable tool for measuring dual-credit student engagement. This research postulates that a subset of questions on the CLASSE can be used to generate student-engagement scores as was done by Kuh et al. (2008).

Kuh et al. (2008) used a subset of items on the NSSE to generate an aggregate student engagement score for each university student in their study. Kuh et al. (2008) called this aggregate student engagement measure a subscale of "educationally purposeful activities" (p. 558).

Transformational leadership. Transformational leadership was selected for this study because transformational leaders embody the authentic, ethical, and moral aspects found in many other desirable leadership styles. Transformational leaders are honest, just, ethical, and authentic; they motivate, inspire, consider their followers as individuals, work toward shared goals with their followers, and always lead according to a sound moral compass (Bass & Riggio, 2006). They are of the highest moral fibre. The Ontario Leadership Framework, a seminal 2013 publication from the Institute for Educational Leadership, describes why it is so important that Ontario's educational leaders embody transformational characteristics and values to improve student outcomes. At the heart of transformational leadership is a sincere desire on the part of the leader to improve the conditions of those he or she serves. In an educational context, followers include students, parents, teachers, colleagues, and communities. Stewart (2006) writes, "Instructional leaders focus on school goals, the curriculum, instruction, and the school environment. Transformational leaders focus on restructuring the school by improving school conditions" (p. 4). Dual-credit programs are inherently designed to improve the future academic and life opportunities for the students they serve; this is particularly true in Ontario's college dual-credit program and the U.S.'s TechPrep program. Both of these programs target underserved or at-risk student populations. Therefore it makes sense to

study transformational leadership in the context of dual-enrollment programs, because transformational leaders drive the positive change necessary to make and restructure dual-credit programs to be successful and accessible to all student populations.

Dual-credit programs challenge norms by melding pre-tertiary and tertiary education systems together to provide positive opportunities for students. Much attention has been paid in the education literature to first-order and second-order changes in relation to school reform and school-related innovation. Marzano (2005) writes that first-order change is incremental; it builds on the previous step and takes the most logical next step in a school or district. Marzano defines second-order change as "anything but incremental. It involves dramatic departures from the expected, both in defining a given problem and in finding a solution" (p. 66). Second-order change can be described as *deep* change. Transformational leaders drive sustainable second-order change by:

- being knowledgeable and willing to share how the innovation will affect curriculum, instruction, and assessment practices (Knowledge);
- driving the innovation and gaining support of followers (Optimizer);
- deeply understanding the research and theory behind the innovation and by encouraging teachers to gain this same knowledge through reading and professional development (Intellectual Stimulation);
- challenging the current norms without a guarantee of success (Change Agent);
- monitoring the impact of the innovation continually, using proven metrics (Monitoring);
- being flexible in distributing and delegating leadership when necessary

(Flexibility); and

- leading in an ethical manner consistent with his/her beliefs about the innovation (Ideals/Beliefs) (Marzano, 2005, p. 72).

Marzano (2005) explains that transformational leaders act as change agents because they challenge the current norms without a guarantee of success. The role of transformational leadership in the education system has been well established through the empirical and theoretical work of researchers such as Leithwood and Jantzi (1999a, 1999b, 2000), Norton (2012), Silins and Mulford (2002, 2003), and Stewart (2006). There are validated tools for measuring transformational teacher and principal leadership (Leithwood & Jantzi, 1999a, 1999b, 2000; Norton, 2012; Stewart, 2006). For these reasons, transformational leadership was selected as the basis for this study because it captures the innovative nature of dual-credit programs.

Statistical tools. EFAs are the most appropriate type of factor analyses (as opposed to confirmatory factor analyses) for both the MLQ 5x and CLASSE because dual-enrollment high school students used both instruments in a new context. The MLQ 5x was designed for use in business and industry, and the CLASSE was created to measure post-secondary (as opposed to high school) students' engagement in college or university courses. EFAs were also preferred because no psychometric work was available on the CLASSE at the time of writing, and there were discrepancies in the underlying structure (number of subscales) on the MLQ 5x. This study argues that HLM and correlational analyses are the most appropriate statistical tools to draw conclusions about relationships between student engagement, administrator and teacher leadership,

and dual enrollment. HLM is used as opposed to multiple OLS regression to account for shared variance at the classroom and school level.

Definition of Terms

Academic dual credits are university/college, AP, or IB courses in traditional liberal arts subject areas such as mathematics, languages, science, or the arts as opposed to vocational or trade courses geared toward workplace preparation. Business courses (such as accounting and marketing) are considered academic. AP and IB courses are academic in nature.

Administrator refers broadly to dual-credit leaders (i.e., college deans or high school principals) who directly oversee dual-credit instructors.

College refers to a three-year publically funded college of applied arts and technology in Ontario or to a two- or four- year post-secondary institution (public or private) in the United States. The word "college" is synonymous with "university" in many instances in this paper.

Concurrent enrollment is synonymous with dual credit and dual enrollment.

Confirmatory factor analysis is used to test for the presence of a specific underlying latent structure of a survey instrument.

Congregated dual-credit courses refer to courses taught exclusively to AP, IB, college, or university dual-enrollment students. Congregated dual-credit classes may be taught by high school teachers or post-secondary professors on high school, college, or university campuses. Regular college freshman do not take congregated courses.

Contingent Reward leadership is a type of transactional leadership under which the leader rewards followers (often financially) for compliance and for completing tasks.

Cross loading refers to a questionnaire item that measures two underlying latent constructs. For example, the survey question: "How much do you enjoy group work?" on the Classroom Survey of Student Engagement (CLASSE) in this research measured both collaborative and emotional engagement in school (e.g., two different underlying facets of student engagement).

Dual credit refers to courses taken by high school students from post-secondary institutions or external agencies for both college/university and high school credits. This research considers three types of dual credits: college/university, Advanced Placement (AP), and International Baccalaureate (IB) courses. High school teachers and/or post-secondary professors may deliver these courses in high schools, colleges, or universities. They may also be delivered online through distance education or live teleconferencing.

Dual-credit delivery location refers to whether the dual credit is delivered in a high school or college/university setting.

Dual-credit delivery mode refers to whether the dual credit is delivered by a high school teacher, post-secondary professor, or is team-taught by both a high school and post-secondary instructor.

Dual-credit student refers to a high school student taking one or more post-secondary courses from universities, colleges, or external agencies for both high school and post-secondary credits. In this study, student dual-credit participants needed to be between the ages of 16 and 21, be currently enrolled in a dual-credit course, have

provided written consent and/or parent assent (if under age 18), and have both school board and teacher permission to participate in the research. Dual-credit students comprised all genders. See Letters of Information in Appendix F for detailed inclusion and exclusion criteria for dual-credit student participants.

Dual enrollment is synonymous with dual credit and concurrent enrollment.

Exam-based dual credit is an AP or IB course.

Exploratory factor analysis (EFA) is a statistical technique for determining what latent constructs underlie a set of items on a questionnaire or survey. EFA is the best technique for an instrument used in a new context or for an instrument in which the underlying latent factor structure is unknown.

Laissez-faire leadership is a negative leadership style in which the responsibilities of leadership are completely avoided or ignored. Laissez-faire leadership is considered a non-transactional form of leadership and is part of the passive-avoidant leadership style.

Management-by-Exception is a leadership style under which a leader *actively* or *passively* monitors for mistakes and deviance. No action is taken until complaints are received. Management-by-Exception is a type of transactional leadership and comes in two forms: active or passive.

Passive-avoidant leadership is the most negative leadership style where the responsibilities of leadership are partially or completely avoided or ignored. Passive-avoidant leadership is comprised of two leadership styles: transactional passive management-by-exception and non-transactional laissez-faire leadership.

Post-secondary-based dual credit refers to a college or university course from a specific post-secondary institution taken by a high school student for both high school and post-secondary credit. Post-secondary-based dual credits are "actual" post-secondary courses offered by brick-and-mortar post-secondary institutions. A post-secondary dual credit may be delivered in a high school, college, or university by a high school and/or post-secondary professor.

Senior student refers to a high school student in grade twelve. Post-graduation students, returning to high school to take additional credits, are also considered senior students.

Student engagement is a non-cognitive measure of school effectiveness that includes students' participation and identification in school, sense of self-worth, and aspirations (Finn, 1989; Kuh, 2003).

Transformational leadership refers to a positive style of leadership in which leaders inspire, motivate, mentor, collaborate and support their followers, and commit to a shared mission and vision (Bass & Riggio, 2006; Stewart, 2006).

Transactional leadership is a style in which leaders offer and deny subordinates rewards (often financial) for productivity. In this study, transactional leadership refers to the contingent-reward leadership and active management-by-exception.

Vocational dual credits are post-secondary courses offered by specific institutions that prepare dual-enrollment students directly for the workplace in areas such as trades, construction, and industrial arts.

Assumptions

This correlational study makes several assumptions and justifies them as necessary.

General methodological assumptions. This research assumes that the MLQ 5x is the best instrument available for measuring students' perceptions of their teachers' transformational leadership and teachers' perceptions of their administrators' transformational leadership. This project assumes that the course-specific NSSE, the CLASSE, is a valid and reliable tool for measuring dual-credit student engagement. This research postulates that a standardized survey administration protocol and rigorous statistical analysis will enhance reliability and validity of results and findings. EFAs were assumed to be the most appropriate technique to psychometrically validate the student use of both the MLQ 5x and CLASSE—a new context for both instruments. HLM was assumed to be the best technique to look at the impact of student-, classroom-, and school- level factors on dual-credit student engagement. This study assumes that aggregating New York and Ontario data into a single sample for analysis is appropriate because the combined sample includes all types of dual-credit delivery models. The sample is assumed to be well balanced because academic and vocational dual credits were included for both New York and Ontario. School sites were pseudo-randomly selected for convenience using a geographical information system. The results are therefore not assumed to be completely generalizable to all dual-credit programs, but results may be representative of dual-credit programs in regions with similar socio-economic, urbanity, and diversity profiles. Non-identifying school and community

profiles with respect to these factors are given in the methodology chapter (e.g., Chapter 3).

Instrument-specific assumptions. This research assumes that students and instructors answered the MLQ 5x and/or CLASSE honestly and accurately to the best of their abilities under standard survey protocols. The EFAs in this research helped establish the construct validity of both the MLQ 5x and CLASSE when used by students. The MLQ is considered the gold standard for measuring transformational leadership (Bass & Riggio, 2006), so the MLQ 5x was assumed to be a suitable tool for measuring teachers' perceptions of their administrators' transformational leadership. It was not possible to conduct an EFA with sufficient power on the teachers' MLQ 5x data due to the small instructor sample size (n = 43). Reliability analyses on the teacher leadership data was still performed.

Theoretical assumptions. This study assumes that leadership is measurable using the MLQ 5x on a continuum beginning with the most negative leadership style, non-transactional laissez-faire, then moving to transactional passive management-by-exception, transactional active management-by-exception, transactional contingent-reward leadership, and then to the most positive leadership style, transformational leadership (Avolio & Bass, 2004; Bass & Riggio, 2006; Norton, 2012). Transformational leadership is assumed to be comprised of five leadership traits: idealized influence (attributed charisma), idealized influence (behaviours), inspirational motivation, individualized consideration, and intellectual stimulation as specified by the MLQ 5x scoring manual (Avolio & Bass, 2004). In this study, transactional leadership is defined

as contingent reward and active management-by-exception. Passive-avoidant leadership style refers to transactional passive management-by-exception and non-transactional laissez-faire leadership in this research. These definitions are consistent with the MLQ 5x scoring manual (Avolio & Bass, 2004, p. 3).

Topic assumptions. This study broadly defines dual credit to courses taken by high school students for both high school and potential post-secondary credit. Dual credits include college/university, AP, and IB courses. This study assumes that student engagement is a measurable construct that gauges students' identification and participation with school (Finn, 1989; Kuh, 2003). This study postulates that studying dual enrollment in relation to leadership is essential for building stronger, more effective dual-credit programs.

Limitations

This study has potential limitations regarding sampling, the conceptual framework, methodology, and instruments. Due to scope and logistics, this study employs the use of convenience, cluster, and quota sampling. These non-probabilistic methods may influence the generalizability of the study results. This has been a common limitation in other similar quantitative dual-enrollment research (Delicath, 2000; Vargas et al., 2014). Due to logistical, ethical, and sample-size concerns, this research only involves surveying dual-credit students from congregated dual-enrollment classes. Students taking dual-credit courses alongside college freshmen on post-secondary campuses were excluded. Since nearly 80% of dual-credit classes attached to post-secondary institutions are congregated in the U.S. and most are in Ontario (Borden et al.,

2013, p. 2; Borovilos, 2015, p. 41), this limitation is acceptable. In addition to potential sampling limitations, study participation rates, classroom sizes, and the nature of the dual-credit courses (academic or vocational) were not controllable. Limitations also exist surrounding the conceptual framework, methodology, and instruments. Only transformational, transactional, and passive-avoidant leadership styles were considered because the EFAs on the student responses to the MLQ 5x only revealed these leadership styles. Student academic performance (i.e., past or present course marks, number of course completions, etc.), ethnicity, gender, age, parental, organizational and socioeconomic status variables were not collected because these variables were not part of the research framework. Some of these variables have been shown to correlate with student engagement in other studies (Leithwood & Jantzi, 1999a, 1999b, 2000; Silins & Mulford, 2002, 2003). Despite the exclusion of these potentially confounding variables, the conceptual model still contained a rich array of potential covariates including type of dual-credit teacher (high school or post-secondary), dual-credit delivery location (high school or post-secondary institution), state/province, number of dual-credit courses taken (multiple or not), and the student's grade in school (e.g., grade 12 or other) in addition to teacher and administrator leadership. No comment is made in this research on team-taught dual-credit courses because of the small number of students enrolled in team-taught courses (n = 25; 3.7% of the entire student sample) in this study.

Expected Outcomes

This study has several expected outcomes. The MLQ 5x was expected to be a reliable and valid tool for measuring dual-credit students' perceptions of their teachers'

transformational leadership style as specified by its scoring manual. Due to discrepancies in the number of factors (e.g., leadership dimensions measured or subscales) specified by researchers using the MLQ 5x (Antonakis, Avolio, & Sivasubramaniam, 2003; Avolio, Bass, & Jung, 1999; Schedlitzki & Edwards, 2014), it was unknown how many factors would emerge when dual-credit students used the MLQ 5x in a new setting for the instrument.

A combination of questions on the CLASSE was expected to be a reliable and valid measure for determining dual-credit student engagement. Since the CLASSE had not undergone any psychometric analysis in the literature at the time of writing, it was unexpected that the full set of CLASSE questions would adequately capture all facets of student engagement without high cross loading of some items across underlying factors. It was therefore expected that the researcher would have to conduct many EFAs and add/remove items to find a subset of questions that measure dual-credit student engagement without significant cross loading.

It was expected that the student's grade in school, enrollment in multiple dual-credit courses, and state/province would impact student engagement in the HLM analysis based on findings of other researchers. The impact of teacher and administrator leadership was unknown since other researchers found differing results (Leithwood & Jantzi, 1999a, 1999b, 2000; Norton, 2012; Silins & Mulford, 2003, 2003). The moderating impact of the type of dual credit, type of dual-credit teacher, dual-credit delivery location, and state/province needed to be determined in this research.

Summary

The rationale for this study is to add to the body of literature surrounding dual enrollment, program leadership, and student engagement using quantitative methods. This chapter has communicated relevant background information, defined the problem of practice and purpose of the study, presented the theoretical and conceptual framework, provided an overview of the methodology, and reported relevant assumptions. Research into dual-credit program quality, leadership, and student outcomes (both cognitive and non-cognitive) is essential for improving dual-enrollment programs and the leadership within them. Determining which leadership practices contribute most to student engagement for at-risk students and for students facing accessibility barriers to post-secondary education is especially important for building stronger, more effective dual-credit programs.

Chapter 2. Literature Review

This chapter lays the theoretical foundation for this quantitative study by critically examining the strengths and weakness of other dual-enrollment studies, tracing the development of student engagement theory and research at both the secondary and post-secondary levels, and providing an overview (including a critique) of transformational leadership theory. This chapter provides an overview of the search techniques used while conducting this research.

Dual-credit programs motivate students to reach higher curricula standards and career aspirations, ease the transition to post-secondary, and increase college retention and completion rates (An, 2013; Delicath, 2000; Farrell & Seifert, 2007; Hoffman, 2003; Lichtenberger et al., 2014; Smith, 2007; Wathington & Pretlow, 2014). The dual-enrollment section of this chapter includes detailed information about the methodologies behind large-scale dual-enrollment studies, their assumptions, and strengths and weaknesses. Studies on both dual enrollment via post-secondary institutions and exam-based Advanced Placement (AP) and International Baccalaureate (IB) courses are considered. The dual-enrollment section of the chapter also includes a detailed overview of the survey tools considered for use in this study. Emphasis is placed on the reliability and validity of these tools and their suitability for use with dual-credit students. Tools examined for this research include the Student Engagement and Family Culture Survey (Leithwood & Jantzi, 1999a, 1999b, 2000), Tell Them From Me (Willms, Friesen, & Milton, 2009), the Student Engagement Instrument (SEI; Appleton, Christenson, Kim, & Reschly, 2006), the Patterns of Adaptive Learning Survey (PALS; Midgley et al., 2000),

the National Survey of Student Engagement (NSSE; Indiana University Center for Postsecondary Research [IUCPR], 2014a, 2014b, 2014c), the High School Survey of Student Engagement (HSSSE; Indiana University Center for Evaluation and Educational Policy, 2015), and the Classroom Survey of Student Engagement (CLASSE; IUCPR, 2015a). This chapter justifies why the CLASSE was the best possible tool for this research.

Transformational leaders actively foster a vision for change, inspire followers to reach shared goals (the vision for change), and consider followers' individual needs. Transformational educators can nurture student engagement by inspiring, motivating, mentoring, collaborating, supporting their followers, and committing to a shared mission and vision (Bass & Riggio, 2006; Stewart, 2006). The transformational leadership section of the literature review fully defines transformational leadership theory, establishes its role importance in educational research, and relates this leadership style to student engagement by examining relevant research studies. Some critiques of transformational leadership theory are also included. This section of the literature review also provides an overview of the two major survey instruments considered for this study—the revised Multifactor Leadership Questionnaire (MLQ 5x) and the Leadership Practices Inventory (LPI). This chapter justifies why the MLQ 5x was the best possible tool to measure students' perceptions of their dual-credit instructors' transformational leadership and teachers' perceptions of their administrators' transformational leadership.

The chapter concludes with a summary of the key points about the benefits of dual enrollment, student-engagement research, and transformational leadership.

Title Searches, Journals, Articles and Research Documents

Four different approaches were used to locate relevant literature: 1) online search portals (Scholars Portal, ProQuest Theses and Dissertations database, the Education Research Information Center (ERIC), and Google Scholar/eBooks), 2) the research study database of the Higher Educational Quality Council of Ontario, 3) the library of the Ontario Ministry of Education, and 4) key article reference searches. Over 2,000 items were located through searches, and a detailed search log was maintained. For online searches using Google Scholar, the first 200 items were reviewed out of thousands of possible items. For Scholars Portal, all items located were reviewed (between 10 and 100 items per search). A combination of different search terms was used when searching for articles in these online databases. Specifically, searches were conducted using the discrete terms of "dual credit," "dual enrollment," "concurrent enrollment," "advanced placement," or "international baccalaureate" followed by one of the following or a combination of the following terms: "leadership," "transformational," "MLQ," "student engagement," and "outcomes." Some further searches were conducted on the general topic of "student engagement" and "transformational leadership." These same terms were used to search the Ontario Ministry of Education online library index, the Higher Education Quality Council of Ontario database of research studies, and the ProQuest Theses and Dissertation database. Two books were located through the ERIC database and nine theses through the ProQuest database. Theses with small sample sizes (i.e., at a single high school or college campus) were generally excluded. This research will be quantitative in nature, so small-scale non-generalizable case studies with one or two sites

were generally not included in the literature review. Whenever possible, large-scale quantitative studies or qualitative studies with multiple research sites were selected. Multiple campuses of the same college or university were considered multiple sites.

Additionally, some targeted searches on special survey tools for measuring leadership, such as the "Leadership Practices Inventory" and "Multifactor Leadership Questionnaire" and for measuring student engagement, such as the "Patterns of Adaptive Learning Questionnaire," "National Survey of Student Engagement," and "Tell Them From Me Student Engagement Survey" were conducted. Several of the survey tools' authors were contacted directly to ask for more information about their tools and their psychometric properties (if such information was not publicly available). Although promoted by the Ontario Ministry of Education and in widespread use in Ontario, the proprietary "Tell Them From Me Student Engagement Survey" was excluded because at the time of writing, it had not been psychometrically validated.

Literature Review

Dual enrollment. Dual-enrollment programs offer advantages to students, high schools, post-secondary institutions, and communities. This section of the literature defines dual enrollment and describes its benefits to students, schools, and communities. Special attention is paid to large-scale dual-enrollment studies that have explored these benefits using rigorous quantitative methods.

Definitions and general benefits. Dual credits give secondary students an opportunity to take post-secondary courses while they are still in high school. Under dual enrollment via post-secondary institutions, departments of education cover all or most of

the associated costs, so students' future tuition fees and time for degree completion may be reduced (Andrews, 2013; Farrell & Seifert, 2007; Greenberg, 1989). Some American school boards cover students' exam-based fees for AP and IB courses (Hoffman, 2003). This is beneficial to students given increasing costs of post-secondary education and growing student debt loads (Canadian Federation of Students, 2013). Furthermore, dual enrollment exposes secondary students to college-level work and can help them reaffirm their career aspirations without financial penalty before they commit to multi-year college programs (Farrell & Seifert, 2007). Since departments of education often subsidize students' secondary and post-secondary tuition, it is in the best interests of the economy for students to graduate on-time. Changing majors in university or college costs students and governments time and money. Dual enrollment improves on-time high school and post-secondary graduation rates (Bergeron, 2015; Delicath, 2000; Mattern, Marini, & Shaw, 2013).

Dual-enrollment and benefits to underserved students. Dual enrollment also benefits underserved student populations. When Fairfax County, Virginia removed all admission requirements and paid all exam fees for AP courses in 1998, enrollment in AP courses doubled in a single year; exam pass rates dropped from 75% to 61%, but rose to 65% in subsequent years (Hoffman, 2003, p. 6). Vargas et al. (2014) conducted a five-semester dual-enrollment pilot with Tulsa Community College (TCC) in Oklahoma with 990 high school juniors and 1618 seniors and experienced similar success with underserved student populations. Before their pilot study, potential TCC dual-enrollment students faced strict admission guidelines. For example, the State of Oklahoma required

that high school juniors have GPAs of 3.5 or higher and American College Test (ACT) scores of 21 or higher to access dual-enrollment courses delivered by universities or colleges; seniors required GPAs of 3.0 or higher and ACT scores of 19 or higher (Vargas et al., 2014, p. 168). Moreover, dual-enrollment students were also responsible for their own dual-credit tuition and transportation to the TCC campus. The pilot by Vargas et al. (2014) exempted high school students from normal Oklahoma post-secondary admission requirements, paid dual-credit students' tuition fees through the Oklahoma State Regents for Higher Education Board, and sent TCC faculty into high schools to deliver TCC courses, thereby eliminating access, financial, and transportation barriers to dual enrollment. These (pilot) policy changes were a huge success; dual enrollment for African-American students increased five-fold as compared to traditional dual-enrollment students on TCC campuses and three-fold for Hispanic students (Vargas et. al, 2014, p. 169–170). In addition, the high school-based dual-enrollment students persisted and matriculated to first-year post-secondary studies at the same rate as compared to dual-enrollment students taking courses on TCC campuses. Thus, there was no disadvantage to the student for taking the dual credit in the high school as opposed to the college campus.

Other researchers have found similar positive outcomes for underserved student populations with larger data sets. Dougherty, Mellor, and Jian (2006) conducted a longitudinal study of 67,412 eighth-grade Texas students who enrolled in a public college or university in Texas within twelve months of high school graduation; students were followed for five years. Using descriptive statistics, hierarchical linear modelling (HLM), and ordinary least squares (OLS) regression, Dougherty et al. (2006) found that

underserved students who scored 3 or more on an AP exam had a higher probability of graduating college within five years compared to non-AP students of similar socio-economic and ethnic backgrounds. Doughtery et al.'s results held after controlling for students' prior academic achievement, student-level demographic variables, and school-level demographic variables. Other researchers support these findings and offer reasons why dual enrollment benefits underserved students. Hugo (2001) wrote that "dual enrollment [via a post-secondary institution] provides a long-term strategy to improve the preparation of minority students so that they will be competitive for the college admission" (p. 69). Dual enrollment via post-secondary institutions and exam-based IB and AP courses has positive outcomes for underrepresented students.

Dual enrollment and benefits to senior students. Dual credits have also been shown to benefit senior students. Johnstone (1993) found that dual-credit enrollment via post-secondary institutions increased student motivation and decreased aimless "drifting." Johnson and Brophy (2006) conducted an exploratory factor analysis (EFA) with data from rural grade 11 and 12 dual-enrollment participants (n = 162) and found statistically significant differences for students' academic and social reasons for participating in dual enrollment via a community college. Their results showed that grade 12 students placed higher emphasis on academic and social reasons for choosing college-based dual credits than grade 11 students. Johnson and Brophy have suggested that dual-enrollment programs help students develop social capital (i.e., productive groups, networks, norms, and trust) and transition smoothly into post-secondary. Increased high

school and college retention rates benefit local communities through increased human capital.

Overview of large-scale quantitative research on the benefits of dual enrollment for all students. Dual enrollment via a post-secondary institution has positive outcomes for students related to post-secondary enrollment, degree attainment, college preparedness, and career aspirations (An, 2013; Delicath, 2000; Farrell & Seifert, 2007; Lichtenberger et al., 2014; Smith, 2007). Several researchers conducted retrospective dual-credit studies with large pre-existing data sets. Lichtenberger et al. (2014) used data from 72,484 students in 629 Illinois public high schools to determine if dual enrollment via post-secondary institutions was related to increased odds of post-secondary enrollment. Lichtenberger et al. found a significant positive relationship between dual enrollment and college-degree enrollment while controlling for selection bias, variation across high schools, and several socio-economic and education covariates using logistic regression. Lichtenberger et al. (2014) wrote:

> After controlling for differences in the previously mentioned precollege and environmental factors, participating in dual enrollment via a community college significantly and positively factored into the odds of enrollment in a two-year institution. The effect size, based on the odds ratio (8.027), related to dual-credit participation was higher than any other factor (p. 972).

Lichtenberger et al. (2014) also found increased odds of enrollment in four-year institutions for dual-credit students (d=6.686, $p < .0001$). Swanson (2008) used a longitudinal, pre-existing data set of 2.3 million American students and found that

students who took college-based dual credits were more likely to enroll in post-secondary institutions immediately after high school and persist into second year than students who did not take college-based dual credits. She also found those dual-enrollment students who obtained dual credits and proceeded immediately to college were more likely to complete bachelor's and other advanced degrees than those who did not. These results held when controlling for student demographic and high school characteristics using logistic analyses. An (2013) analyzed a sample of 8,800 students who participated in the *National Longitudinal Study* of 1998 in the U.S. and also found that dual enrollment via a post-secondary institution was positively correlated with degree attainment. Propensity-score matching models were used to estimate the relationship between dual enrollment and college-degree attainment while controlling for selection bias and confounding influences. Even while controlling for student, family, achievement, school, and socio-economic covariates, the positive relationship between dual enrollment and college-degree attainment held ($p < .001$). Karp et al. (2007) conducted similar research with large pre-existing data sets in New York and Florida with a focus on the impact of dual-credit career and technical education (CTE) programs. Using OLS and logistic regressions, Karp et al. (2007) found that dual enrollment in Florida was positively related to students' likelihood of graduating high school and enrolling in post-secondary education. These findings held for all students including CTE students. Dual-enrollment students in Florida were also more likely to enter the second semester of college and had significantly higher post-secondary grade point averages (GPAs) in first year ($p < .001$) than non-dual-enrollment students (Karp et al., 2007). Similar findings were found in

New York, except the number of dual credits taken had no significant impact on post-secondary enrollment in Florida, but it did in New York. Allen and Dadgar (2012) conducted a study with pre-existing data from 22,962 college freshmen and found through multiple regressions that dual-credit students were more likely to have stronger first-semester college GPAs ($p < .01$) than students who did not participate in dual-enrollment via post-secondary institutions. These results held while controlling for demographic and student achievement characteristics. Thus, there is clear evidence that college, university, and technical dual enrollment contributes positively to cognitive measures of school effectiveness.

Dual enrollment via exam-based IB and AP courses also has positive outcomes for students related to high school achievement, college academic performance, college graduation, and goal attainment. Hoffman's (2003) meta-analysis showed that achievement rises when high schools with large numbers of non-traditional students offer increased numbers of AP courses. Bergeron (2015) found that in a sample of 15,680 U.S. IB Diploma candidates, 92% enrolled in a four-year post-secondary institution between May 2008 and May 2014 compared to the national average of 60% for all students (p. 6). Bergeron also found that the first-year post-secondary retention rate was 98% for IB Diploma graduates; the U.S. average retention rate for all students was 77% in 2010. All IB students (diploma earners and not) had notably higher 6-year post-secondary graduation rates, 83% compared to the national average of 56% in 2009 (p. 7–8). Mattern et al. (2013) used HLM with a national data set (n = 112,108 for sample 1; n = 678,305 for sample 2) to show that higher AP scores were associated with higher four-year post-

secondary graduation rates. These results held even for non-hegemonic subgroups such as first-generation and underrepresented minority females with average standardized entrance exam scores at average public institutions. Using logistic regressions, Mattern et al. (2013) also showed in their study that students who took at least one AP exam had an increased likelihood of graduating college within four years. Shaw, Marini, and Mattern (2013) used HLM in another study with a data set of 250,974 students from 129 colleges and universities in the U.S. to show that students' average AP scores, number of AP exams taken with scores of 3 or greater, and proportion of AP courses taken out of total AP courses offered at their school were good predictors of students' first-year college grades. First-year college GPAs were higher for students who had taken more AP exams, earned AP scores of at least 3, and achieved higher average AP scores. A higher proportion of AP exams taken from a school's total offering was inversely correlated with students' first-year college GPAs. This latter finding needs to be investigated further, but the positive effects of AP dual-enrollment are generally clear. Students who took AP courses benefitted in college with higher post-secondary GPAs.

The relationship between dual enrollment and cognitive measures of student success can be complex. Delicath's (2000) study (n = 2,760) examined differences in persistence in college after first year, college graduation rates, and time-to-degree completion for those with or without AP or Saint Louis University (SLU) dual credit. Delicath's logistic analyses included several independent variables to create a complex model of student persistence and attrition: gender, minority status, financial-aid status, local status (to Saint Louis, Missouri), whether the student commutes, and total family

income. Student performance on the ACT exam was used as a moderator variable in subsequent analyses after the logistic regressions were performed. Delicath was able to show that dual enrollment via SLU significantly increased first-year persistence and college graduation rates. This relationship held after controlling for students' past achievement as measured by their ACT scores. The relationship did *not* hold for AP courses before or after controlling for students' past ACT achievement. While initial linear regressions showed a correlation between students' time-to-degree graduation and SLU dual-credit accumulation, the relationship did not hold after controlling for students' past ACT achievement using logistic regression. Delicath found no differences in time-to-degree completion for those with AP or SLU dual credit after the ACT moderator was introduced. Delicath's research shows that the inclusion and exclusion of independent variables in the statistical analysis can have a major impact on the findings. The study did find that SLU dual enrollment improved persistence in first-year and college graduation rates, so this is taken as a positive result related to dual enrollment.

Thus, there is evidence that dual enrollment via IB, AP, and post-secondary courses improves cognitive measures of student success. Care must be taken to determine whether dual enrollment contributes directly to positive outcomes or whether moderating influences (e.g., student's past achievement, parental expectations, etc.) are responsible for the positive outcomes.

Non-cognitive student outcomes related to dual enrollment. In addition to the studies focusing on cognitive outcomes, a limited number of researchers have conducted quantitative studies on non-cognitive dual-enrollment outcomes. Heath (2008) compared

275 dual-enrolled students to 258 traditional community college transfer students in Florida using an independent test of means and found that dual-enrollment students had higher community college GPAs, higher associate and bachelor degree completion rates, and shorter time periods to associate degree completion than students without dual credit. Heath's research also quantitatively explored dual-enrollment students' social experiences through repeated measures analyses of variance. Heath found that dual-credit students had higher ratings of satisfaction with post-secondary education than traditional non dual-credit students. Open-ended survey questions reinforced these results (Heath, 2008, p. 7). Heath (2008) is one of the few dual-credit researchers to examine non-cognitive outcomes (i.e., the social experiences) of dual-enrollment students. Smith (2007) provided another example of such a study. Smith surveyed 304 students from five rural high schools to measure educational aspirations of dual-enrollment students. Smith used a 12-question survey, based on the psychometrically validated work of Garg, Kauppi, Lewko, and Urajnik (2002) to measure educational ambitions. Smith found through multiple regressions that dual enrollment had a positive and significant relationship with educational aspirations. Those students who took dual credits on the college campus displayed higher educational aspirations ($p = 0.002$) than students who did not. Independent variables included dual-credit delivery location (college or high school), parental education, parental expectations, extracurricular participation, reading-for-pleasure, and achievement. Smith found that 52.9% of the variance in educational aspirations was explained by her model. She found that participation in dual credits was a greater predictor of educational aspirations than student achievement or parents' highest

level of education. Smith (2007) is noteworthy for using dual-credit location as an indicator variable in her analyses. In terms of IB dual-credit courses, Shaunessy et al. (2006) compared the psychosocial outcomes of gifted (n = 122) and high-achieving (n = 33) IB students to general education (n = 179) students. No general education students identified as intellectually gifted volunteered for their study. Using *Multiple Analyses of Variances* (e.g., MANOVAs) and psychometrically validated instruments, Shaunessy et al. (2006) found that gifted and high-achieving IB students had more positive feelings about school climate, higher achievement as measured by their GPAs, stronger academic self-efficacy, fewer problematic behaviours, and less externalizing psychopathy (e.g., less affiliation with negative peers, anti-social behaviours and addictions, etc.) than general-education students. They found no difference between gifted and high-achieving IB students and non-IB students in terms of general overall life satisfaction and internalizing psychopathy (e.g., depression, anxiety disorders, etc.). Thus, there is evidence that all types of dual credits (post-secondary college/university, AP, and IB) improve both cognitive and non-cognitive outcomes for students.

Short overview of qualitative and mixed methods dual-enrollment research. Other researchers have explored non-cognitive aspects of dual-enrollment programs through qualitative research. Kyburg, Hertberg-Davis, and Callahan (2007) used qualitative research in the form of interviews with 9 administrators, 4 counsellors, 43 teachers, and 75 AP and IB students to investigate how teacher and administrators' behaviour and the school environment affect the success of minority students. Kyburg et al. (2007) found that the pervasive belief that students could succeed was integral to the

success of minority students. Farrell and Seifert (2007) conducted qualitative case-study research in Arizona with a community college that began offering dual credits in English and Math in 1997. Forty percent of the college's enrollment was Hispanic or Native American. Farrell and Seifert document issues relating to student experiences, faculty preparation and training, the availability of college services to dual-credit students, transferability of credits, social equity, and accessibility. They explored the impact of a placement test before dual enrollment. Farrell and Seifert's case study found that open dialogue between the community college and partnering high schools in their study was essential for maintaining successful dual-enrollment partnerships. Their research revealed the need for effective program evaluation. Without open dialogue and program evaluation, major issues can arise. For example, college administrators in Farrell and Seifert's study falsely believed their dual-enrollment program was highly successful until they learned that four local post-secondary institutions were not recognizing their dual credits as true college credits, thereby defeating the purpose of dual enrollment. Florida passed a law requiring that all private and post-secondary institutions accept dual credits registered on a state registry (Bouck, Williams, & Page, 2014; Hunt & Carroll, 2006), but Arizona had no similar law at the time. The placement test was meant to ensure rigorous admission standards to dual-credit courses to increase transferability of credits, but Farrell and Seifert noted that some high school administrators balked at the placement test because they feared it would embarrass students who scored poorly and their families. One high school in Farrell and Seifert's case study even found a different dual-credit partnering college to avoid the placement test. Eventually, this high school asked to

rejoin the dual-enrollment partnership with the Arizona community college in Farrell and Seifert's case study. Once distributed leadership structures and strategic plans were successfully established between the community college and local high schools, relationships between dual-enrollment partners and dual-credit transferability improved. Farrell and Seifert's qualitative research champions the benefits of dual enrollment but demonstrates the complexity of forming partnerships between the pre-tertiary and tertiary sectors.

Other qualitative research has explored the benefits and complexities of dual enrollment. Crockett-Bell (2007) conducted a similar mixed-methods study to determine the effectiveness of post-secondary dual-credit programs by exploring credit transferability and college preparedness in a district in Texas. She conducted a case study with surveys, but her survey was not psychometrically validated. The study found positive effects for dual credits in terms of transferability and college preparedness. Thirty-eight percent of former dual-credit students surveyed had matriculated into freshmen-level college studies (Crockett-Bell, 2007, p. 66). Ninety-eight percent of former dual-credit students surveyed said their dual credits transferred to their post-secondary program (Crockett-Bell, 2007, p. 71). Crockett-Bell's interviews with high school dual-credit representatives and faculty were also positive and supported the benefits of dual credits discussed in this literature review. More dual-credit qualitative and mixed method studies at St. Lawrence College (Dennis-Raycroft, 2013), Georgian College (2012), Fanshawe College (Philpott-Skilton, 2013), and Humber College (Borovilos, 2015) support Crockett-Bell's results in an Ontario context. It should be clear

that dual enrollment contributes to positive student outcomes related to post-secondary enrollment, degree attainment, college preparedness, and career aspirations.

Student engagement. None of the aforementioned dual-credit studies examined dual enrollment and student engagement. This section of the literature review defines the student-engagement construct, traces its historical development, and concludes with an overview of instruments used to measure it.

Definition and historical development of the construct. Student engagement is a measure of student success and has been widely described in the literature over the past seventy years (Kuh, 2003). Zhao (2011) states that student engagement is a "broadly defined term that describes the effort, interest, and time that students invest in meaningful education experiences inside and outside the classroom" (p. 1). Kuh (2003) has emphasized that engagement helps students develop habits of the mind and heart that enlarge their capacity for continuous learning and personal development. Research on student engagement began in the 1930s with Ralph Tyler's work on time-on-task (Kuh, 2003). Tyler examined the relationship between secondary school curriculum and later success at college. His college-based studies found the more time students spend on their academic work, the more positive the learning outcomes (McCormick, Kinzie, & Gonyea, 2013, p. 51). Pace (1980) later expanded Tyler's definition of engagement to include quality of the students' efforts. Astin (1984) further developed a student engagement theory that considered students' background characteristics, environments, and outcomes. The outcomes in Astin's model include non-cognitive measures that describe the students' characteristics, knowledge, attitudes, beliefs, and values after

graduation. Astin's student-engagement model is premised on five basic assumptions: 1) Involvement requires both psychosocial and physical energy, 2) Involvement is continuous with the energy invested unique for each student, 3) Involvement may be measured using qualitative or quantitative means, 4) Involvement gains are directly proportional to the level of student involvement, and 5) Better academic achievement is correlated with higher levels of involvement.

Tinto (1975, 1982, 1993), focusing on post-secondary student engagement, broadened previous definitions and models to consider both social and academic integration. Academic integration involves grade performance, enjoyment of the subject, identification with academic norms, and identification with the student role. Social integration involves student-peer relationships, professor-student relationships, and on-campus involvement in extracurricular activities. Tinto's model has been criticized in the literature for its emphasis on social integration (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006). Critics note that some post-secondary students do well academically but are not engaged in on-campus social activities due to time constraints. Since the majority of dual-credit students take only one college class at their local high school or college campus, Tinto's engagement model may not be directly applicable to them.

Current research on student engagement in the last two decades has been built heavily on the work of Finn (1989). Finn developed a seminal model of student engagement that includes both a behavioural component (participation) and a psychological component (identification); together these two factors contribute to positive student outcomes. Finn's identification component can be described using terms

such as affiliation, involvement, attachment, commitment, and bonding. Students who identify with school feel a sense of belonging and are actively part of the school environment. Finn stated that students, who identify with school, value success in terms of both personal and collective school-relevant goals. Students who rank low in identification categories are at risk of displaying problem behaviours such as truancy, acting up in class, and leaving school early. The participation aspect of Finn's model can be measured on four levels (Silins & Mulford, 2002). Level-one participation refers to the most basic behaviours required of all students in school such as attendance, listening, and responding to the classroom teacher. Level-two participation describes initiative-taking behaviour including asking questions in class, dialoguing with the teacher, and participating in co-curricular activities. Level-three participation involves extracurricular activities related to social, sports, and homework activities. Level-four participation entails actively contributing to student government. Identification with school has a positive effect on school participation, especially in the younger grades, that can lead to deeper student engagement in later schooling (Finn, 1989; Silins & Mulford, 2002). Higher levels of student engagement have been correlated with positive student outcomes such as increased persistence, stronger academic performance, and improved graduation rates (Silins & Mulford, 2002).

Overview of instruments used to measure student engagement. There are several psychometrically validated survey tools to measure student engagement based on the above theoretical models. Canadian researchers, Leithwood and Jantzi (1999a), conducted a series of studies in elementary and junior high schools that examined

organizational learning, teacher leadership, and principal leadership and their relationship to student engagement with school. In their (1999a) study, student engagement was measured through the *Student Engagement and Family Culture* survey with 25 questions relating to students' participation in school, 17 questions about students' identification with school, and 10 questions about students' perceptions about their families' educational culture. The engagement survey was directly based on the work of Finn (1989) with the addition of questions related to students' family educational culture, which has been shown as a major factor influencing student engagement (Leithwood & Jantzi, 1999a, 1999b, 2000). Leithwood and Aitken (1992) documented the reliability, validity, and construct validity of the Student Engagement and Family Culture survey, which was piloted in one school district. Construct validity was established through pilot testing with 12 administrators and 37 teachers (Leithwood & Aitken, 1992). Factor loadings were also generated, resulting in additional confirmation of construct validity. In one study with 1,762 teachers and 9,941 students, reliability coefficients ranged from .74 to .95 (Leithwood & Jantzi, 2000, p. 122). A propriety Canadian-based student engagement survey, *Tell Them From Me*, is in widespread use in Canadian elementary and secondary schools and also expands Finn's (1989) engagement model (Willms et al., 2009). It was developed by researchers at the University of New Brunswick, University of Calgary, and the Canadian Education Association. This survey is based on the work of Willms et al. (2009) and measures student engagement in three dimensions: social engagement (a sense of belonging and participation in school life), academic or institutional engagement, and intellectual engagement. This survey is fairly new and has

not been psychometrically validated at the time of writing, so it was not used in this research. It is supported by the Ontario Ministry of Education (Constante, 2011; Willms et al., 2009). The first pilots of Tell Them From Me involved 32,322 grade 5 to 12 students from ten Canadian school boards in five provinces in 2007–2008 (Willms et al., 2009).

There are several American tools for measuring elementary and high school students' engagement. Appleton et al. (2006) from the University of Minnesota developed the *Student Engagement Instrument* (SEI) to measure students' cognitive and psychological engagement with school. The SEI is based on a multidimensional model that postulates that student outcomes (for both high school and post-secondary) are influenced by context (families, schools, peers) and interventions. The SEI measures student engagement in the academic (time-on-task, credit hours towards graduation, homework completion), behavioural (attendance, class participation, extracurricular activities), cognitive (self-regulation, future aspirations, goal-setting, strategizing), and affective (belonging and identification with school) domains. Psychometric properties were validated using a randomly selected sample of 1,931 students in an ethnically and economically diverse school district. Statistical analyses showed that SEI survey questions loaded onto six factors relating to teacher-student relationships, control/relevance, peer support, aspirations, family support, and extrinsic motivation (Appleton et al., 2006; University of Minnesota, 2014). Internal consistency of subscales ranged from 0.72 to 0.88 in the (Appleton et al., 2006) study and 0.77 to 0.92 in a subsequent study with 293 middle and high school students (Reschly, Huebner, Appleton,

& Antaramian, 2008, p. 424). Another standardized student engagement tool is the *Patterns of Adaptive Learning Survey* (PALS) developed by researchers at the University of Michigan for students in grades 3 through 9. Students rate their personal goals, perception of teacher goals, perception of classroom goal structures, academic efficacy, perseverance, and work avoidance on PALS. The PALS also includes questions relating to student perceptions of parents, home life, and neighbourhood. The PALS has been through several psychometric revisions (Midgley et al., 2000). Midgley et al. (1998) documented the reliability of PALS' scales (e.g., Cronbach's alpha was 0.81 for mastery goal orientation when used by 8th grade students) (p. 117). Construct validity was documented using factor analysis in (Midgley et al., 2000).

There are many other general and subject-specific student-engagement instruments available. Fredricks, McColskey, Meli, Mordica, Montrosse, and Mooney (2011) offer a detailed overview and meta-analysis of 21 of the most popular instruments (including the SEI) for measuring upper elementary and high school students' engagement. Scoring, reliability, and construct validity information is provided for each instrument examined. Fredricks and McColskey (2013) provide a comparative analysis of various methods (e.g., observations, interviews, and self-reporting survey instruments) for measuring student engagement. They also give a more recent comparison of the strengths and weaknesses of 11 instruments for measuring student engagement. Fredricks and McColskey (2013) detail the theory behind the student-engagement construct.

Finding a survey to capture the student engagement of those students taking dual credits on both high school and college campuses was difficult. Students taking dual

credits on the college campus may be concurrently enrolled in a high school. In some of the aforementioned surveys, it would be unclear to students whether some questions referred to the high school or post-secondary campuses. The survey also needed to be applicable to students in both New York and Ontario. For this reason, this research used a course-specific version of the National Survey of Student Engagement (NSSE). The NSSE builds on the theoretical models by Finn (1989) and Tinto (1975, 1982, 1993). It was developed in 2000 by the University of Indiana and is one of the most widely used post-secondary surveys in North America. All Ontario universities administer the NSSE in both first and fourth years (Zhao, 2011). In 2014, more than 470,000 students from 713 post-secondary institutions in North America completed it (McCormick, 2014, p. 1). The 2014 Canadian-English version of the NSSE contains 105 survey items that load onto five factors/benchmarks. These benchmarks are a) level of academic challenge, b) active and collaborative learning, c) student-faculty interaction, d) enriching educational experiences, and e) supportive campus environment. Each of these five factors contains subscales (IUCPR, 2015b). For example, level of academic challenge contains subscales of course challenge, writing, and higher-order thinking skills. Enriching educational experiences contains subscales of varied experiences, information technology, and diversity (Zhao, 2011). The psychometric validity of the NSSE in the U.S. has been well documented (Kuh, 2009). Zhao (2011) conducted a detailed report for the *Higher Education Quality Council of Ontario* that explored the psychometric properties of the NSSE in an Ontario context. Zhao found that the NSSE is a valid and reliable measure

for gauging student engagement in Ontario universities, but more research is needed to correlate the NSSE measures with student achievement in Ontario colleges.

A related survey to the NSSE is the *High School Survey of Student Engagement* (HSSSE), which has not been validated in Ontario (Zhao, 2011). The HSSSE was not selected for this study because the questions relate to overall engagement in high school and are therefore not applicable to students taking dual credits in colleges. The NSSE was ultimately not selected for similar reasons; it includes questions about working for pay on campus and student housing which are not applicable to dual-credit students. A common criticism of the NSSE and HSSSE is that they only measure institutional engagement, which fails to capture students who may be engaged in some courses but disengaged in others (Banta, Jones, & Black, 2009). For these reasons, the course-specific version of the NSSE, the CLASSE, is the better tool to measure dual-credit student engagement. The CLASSE detects student engagement at the course level and is not dependent on delivery location. The questions on CLASSE were adapted from those on the NSSE with similar benchmarks (Banta et al., 2009). Psychometric analysis of CLASSE was conducted through pilot studies (Smallwood, 2010), but more psychometric work is needed. The CLASSE has been used in a Canadian context to help redesign a large lecture course for student engagement (Reid, 2012).

Studying student engagement in relation to teacher and principal leadership is important. The next section of this literature review describes transformational leadership and its relationship to student success and engagement.

Transformational leadership. This section of the literature review defines and critiques transformational leadership, provides an overview of instruments used to measure it, and concludes with a discussion of the relationship between student engagement and transformational leadership theory in the context of dual enrollment. Transformational teacher and principal leadership can contribute to positive student outcomes and is worthy of examination in relation to dual-credit programs and student engagement.

Definitions and transformational-leadership theory. Bass and Riggio (2006) describe transformational leaders as those who

- stimulate and inspire followers to reach higher,
- encourage followers to grow and develop by responding to their individual needs,
- set challenging expectations collaboratively,
- nurture followers' sense of self-worth,
- develop followers' leadership capacities through coaching and mentoring, and
- are committed to a shared mission and vision.

Stewart (2006) contended that instructional leadership and transformational leadership are the two most frequently studied leadership styles in respect to education. Stewart (2006) has stated, "Instructional leaders focus on school goals, the curriculum, instruction, and the school environment. Transformational leaders focus on restructuring the school by improving school conditions" (p. 4). Transformational educational leaders drive deep sustainable (second-order) change by sharing knowledge, driving innovation, challenging norms without a guarantee of success, distributing leadership, engaging in

continuous monitoring, and behaving ethically (Marzano, 2005, p. 72). Hallinger (2003) wrote that studying transformational leadership requires careful measurement.

Overview of instruments used to measure transformational leadership. Avolio and Bass (2004) are seminal researchers in the field of transformational leadership and the authors of the Multifactor Leadership Questionnaire (MLQ), the gold standard for measuring transformational leadership. The MLQ measures transformational leadership through four factors: a) idealized influence, b) inspirational motivation, c) intellectual stimulation, and d) individualized consideration (for others). Idealized influence measures the extent followers see their leader as a role model through the leader's behaviours and attributes. Inspirational motivation refers to how the leader motivates and inspires others. Intellectual stimulation measures how the leader stimulates followers to be innovative and creative by questioning assumptions, reframing problems, and looking at problems in new ways. Individualized consideration gauges how leaders provide a supportive climate, pay attention to individual follower's needs, and act as mentors/coaches when necessary. Transformational leadership differs significantly from transactional leadership. Transactional leaders offer and deny subordinates rewards (often financial) for productivity. The MLQ measures a full range of other transactional leadership behaviours including

- **contingent** reward—the leader rewards followers for compliance and for completing tasks;
- **management-by-exception**—the manager *actively* or *passively* monitors for mistakes and deviance, and no action is taken until complaints are received;

and

- non-transactional **laissez-faire**—responsibilities of leadership are avoided or ignored (Bass & Riggio, 2006).

The MLQ 5x is based on the work of Burns (1978) who studied the behaviours of 70 exemplary senior business executives who met the criteria for being transformational leaders. Avolio and Bass (2004) translated these behaviours into 142 descriptive statements. An expert team of 11 judges determined through consensus that 73 of the 142 statements were focused on either transactional or transformational leadership. These 73 statements became the original MLQ. After the release of the original MLQ, there were some concerns that some of the 73 items did not relate to leadership. As a result, the first update of the MLQ reduced the number of survey items to 67 with 37 items related to transformational leadership and nine items related to the leader's effectiveness, followers' satisfaction with the leader, and followers' extra effort. After further psychometric analysis, the first update of the MLQ went through another substantial revision to become the MLQ 5x, the most recent version with 45 items. There are two forms of the MLQ 5x—a leader self-rating form and a follower-rating form. Psychometric validation of the MLQ 5x is extensive (Antonakis et al., 2003; Avolio & Bass, 2004; Bass & Riggio, 2006). Bass and Riggio (2006) piloted the MLQ 5x with 15,000 respondents in several languages. They found internal consistency to be at least 0.80 on all scales with strong rate-rerate consistency and validity (Bass & Riggio, 2006, p. 22–24). Construct validity was determined through extensive factor analyses. Avolio and Bass (2004) found support for nine factors (dimensions) on the MLQ 5x:

- transformational—1) idealized influence (attributed charisma), 2) idealized influence (behaviours), 3) inspirational motivation, 4) intellectual stimulation (4), and 5) individualized consideration;
- transactional—6) contingent reward leadership, 7) management-by-exception (active); and
- passive-avoidant—8) management-by-exception (passive) and 9) laissez-faire.

Thus, the MLQ 5x is designed to measure three major leadership styles—transformational, transactional, and passive-avoidant—on the aforementioned five, two, and two subscales respectively (Avolio & Bass, 2004). There is theoretical support for the MLQ 5x's three meta-factors (leadership styles) and nine subscales (Avolio & Bass, 2004; Bass & Riggio, 2006), but some researchers have found different underlying factor structures. Schedlitzki and Edwards (2014) have outlined ten different factor structures for the MLQ 5x other than the nine-factor model. Avolio et al. (1999) found a seven-factor model with a reduced number of transformational scales better fit MLQ 5x data in one study. Antonakis et al. (2003) reviewed psychometric analyses done by other researchers on various versions of the MLQ from different countries and organization types. Several of these analyses resulted in the generation of fewer than nine factors, but Antonakis et al. have countered that these studies used disparate samplings of leaders from different cultures, organization types, and organizational levels (i.e., combining front-line and upper-level managers). Antonakis et al. (2003) found the nine-factor model held for a homogenous business sample of 2,279 male and 1,089 female raters who evaluated their same-gender leaders in the banking industry using the MLQ 5x. Thus,

there are significant discrepancies in item factor loadings for the MLQ 5x, but all the psychometric analyses support the clear presence of a transformational factor.

Another popular survey measuring transformational leadership is the Leadership Practices Inventory (LPI). Like the MLQ, the LPI includes both self and observer surveys. According to its developers, Kouzes and Posner (2015), the LPI has been used in over 500 academic studies and graduate theses (para. 3). The LPI contains a set of 30 descriptive leadership statements – 6 statements for each of the following five leadership actions and behaviours: modelling, inspiring, challenging, enabling, and encouraging (Kouzes & Posner, 2003). All of these actions and behaviours are key components of transformational leadership. These key constructs were derived from case studies of 2,500 exemplary managers in a variety of fields. Content analyses of these case studies showed that transformational leaders "model the way, inspire a shared vision, challenge the process, enable others to act, and encourage the heart" (Kouzes & Posner, 2006, p. 6). Research supports that the LPI is internally reliable; Cronbach's alpha reliability coefficients range from .75–.87 in the self form and .88–.92 in the observer form (Berry & Woods, 2007, p. 357). Test-retest reliability is also high (Kouzes & Posner, 2014). Kouzes and Posner (2003) have stated that the LPI has high predictive validity which means LPI survey results are significantly correlated with performance measures and "can be used to make predictions about leadership effectiveness" (p. 2). Despite the high predictive validity, Carless (2001) found issues with the LPI's construct validity. Carless examined the LPI results from a group of 1,440 subordinates in the banking industry who

rated their direct manager. Carless found that although a five-factor model and hierarchical model adequately fit the data,

> The evidence that the LPI has weak discriminant validity suggests there is little justification for giving feedback on specific transformational leader behaviours, nor could one defend promoting the development of specific transformational leader behaviours. Without evidence to show that distinct leadership behaviours are in fact measured, feedback may be misleading or detrimental. Caution must be used, however, when interpreting these findings; there is clearly a need for replication of these results (p. 237).

The LPI was not selected for this proposed research because of these construct validity issues. There is more psychometric evidence supporting the transformational leadership constructs on the MLQ than the LPI.

Leslie and Fleenor (1998) provided reviews of twenty-two other leadership feedback instruments such as the *Survey of Leadership Practices*, *The Visionary Leader: Leader Behavior Questionnaire*, and *COMPASS: Managerial Practices Survey*. Several of these tools are no longer being updated or referenced in academic literature, so they were not considered for this research. Bass and Riggio (2006) wrote, "The most widely accepted instrument to measure transformational leadership is the Multifactor Leadership Questionnaire" (p. 19).

Transformational leadership and student engagement. Researchers have studied the relationship between transformational leadership and student engagement. Leithwood, his students, and his colleagues conducted six studies on the effects of leadership and

student outcomes (Anderson, 2002 as cited by Leithwood (2003); Leithwood & Jantzi 1999a, 1999b, 2000; Leithwood, Jantzi & Steinbach, 1999; Ryan, 1999). Five of these six studies reported significant indirect positive effects of transformational leadership on teacher-perceived student outcomes (Stewart, 2006). Leithwood and Jantzi used a version of the MLQ with school and district leaders in some of these studies to draw conclusions about transformational leadership and student engagement (Stewart, 2006). Michael (2003) conducted a correlational study to examine the relationships between the transformational leadership of administrators in America's *middle college high schools* and their feeder institutions (i.e., high schools and middle schools located on college campuses) to cognitive indicators of school effectiveness. Her effectiveness measures were high school attendance, dropout rate, graduation rate, and college-attendance rate. Her sample included 34 middle schools and 465 high schools. A quarter of the principals from these schools were sent the LPI along with a demographic survey to collect the school effectiveness indicators. No association was established between the administrator's leadership style and the measures of school effectiveness for either traditional high schools or schools located on college campuses. All leaders scored in the top 30% on the transformational leadership scale making gauging their true leadership style difficult. Leader self-perception bias may have been an issue. Norton (2012) conducted a similar correlational study to determine if a teachers' leadership style in the middle-school classroom was related to students' willingness to partake in complex cognitive tasks. She surveyed 689 seventh and eighth graders using the MLQ 5x and the Patterns of Adaptive Learning Survey (PALS). Students rated their teacher's leadership

style based on three types on the MLQ 5x: transformational, transactional, and passive-avoidant. Students rated their personal goals, classroom goals, academic efficacy, perseverance, and work avoidance on the PALS. Highly significant correlations were found between transformational leadership and engagement measures (e.g., mastery goal orientation (r=.343, p < .001), mastery goal structures (r=.563, p < .001), academic efficacy (r=.490, p < 0.001), and academic press (r=.736, p < .001)). Negative significant relationships were found between passive-avoidant leadership and student engagement (e.g., mastery goal orientation (r = -.214, p < .001), mastery goal structures (r = -.451, p < .001), academic efficacy (r = -.381, p < .001) and academic press (r = -.473, p < .001)). Norton's findings may not be generalizable as they were conducted in an affluent school with little ethnic diversity. Research on student engagement and transformational leadership, at both the teacher and administrator level, is important for school reform and missing in the dual-credit literature.

Criticisms and critiques of transformational-leadership theory. There are some criticisms of transformational-leadership theory. Some philosophers criticize the morality of transformational leadership; they argue that some transformational leaders appeal to followers' strong emotions and may use charisma, power, and manipulation to persuade subordinates to follow them in immoral pursuits (Hay, 2012). Barnett, McCormick, and Conners (2001) have even argued that teachers can be distracted from instructional pursuits and helping students when they are focused on satisfying the demands of a transformational principal; they reached this conclusion by surveying 124 teachers in twelve high schools in New South Wales, Australia using psychometrically valid tools.

Bass (1997) worried that many transformational leaders lack general accountability—especially to minority groups and countering voices (as cited by Hay (2012)). This research takes the stance of Griffin (2003) that "to bring about change, authentic transformational leadership fosters the modal values of honesty, loyalty, and fairness, as well as end values of justice, equality, and human rights" (para. 22). True transformational leaders are moral, ethical, just, and committed to their followers. They are not inconsiderate of minority and opposing voices, and they do not lead others through coercion and manipulation. The MLQ 5x includes questions related to whether the followers perceive the leader as moral, ethical, considerate of others, and worthy of respect. One MLQ 5x item asks followers whether the leader can rise above his/her own self interests. These items attempt to measure the moral and ethical leadership of transformational leaders.

Review of research on the topic. Dual enrollment offers positive system-level and community-level benefits by creating more educated, productive, and engaged citizens. Dual-enrollment programs have been shown to improve high school graduation rates, college preparedness, educational aspirations, college enrollment, and college degree attainment (Allen & Dadgar, 2012; An, 2013; Delicath, 2000; Lichtenberger et al., 2014; Smith, 2007). Achievement rises when schools serving non-traditional students offer dual credits (Hoffman, 2003). Dual-credit programs offer great promise in the area of improving cognitive student outcomes, but little research has been done surrounding leadership in dual-credit programs or student engagement (Farrell & Seifert, 2007; Michael, 2003). Engagement encompasses non-cognitive measures of school

effectiveness such as school participation, students' sense of self-worth, and students' aspirations (Kuh, 2009). Cognitive measures of school effectiveness, such as degree enrollment and attainment, fail to capture students taking vocational dual credits, who may proceed directly into the workforce after high school. Additionally, cognitive measures, such as school achievement and persistence, do not consider the psychosocial school experiences of students (such as workload, motivation, comfort in class, and enjoyment of the curricula) in post-secondary college/university and exam-based dual credits, especially those of underserved student populations. Student engagement is a non-cognitive construct that captures these psychosocial aspects of the school and dual-credit course experience. A successful dual-enrollment program nurtures deep student engagement, which is fostered by the strong leadership of both teachers and administrators involved in dual-enrollment programs. Transformational leadership is indicated as one of the most positive leadership styles contributing to positive school reform, student outcomes, and sustained change. Hallinger (2003) writes that "transformational leadership focuses on developing the organization's capacity to innovate" (p. 330). Dual-enrollment programs are innovative attempts to give students more opportunities to broaden their high school experience and future life outcomes.

It is essential to study student engagement in the context of leadership. When describing the importance of their fourth study in a series of studies on transformational leadership and student engagement, Leithwood and Jantzi (1999b) wrote, "The study focused on an especially important student outcome, student engagement, for which there is no prior evidence of leadership effects" (p. 454). Large-scale quantitative research on

student engagement has shown principals' transformational leadership only has an indirect impact on students through teachers' leadership (Silins & Mulford, 2002, 2003). This research represents an attempt to investigate whether such relationships exist within dual-credit programs. Research into leadership, student engagement, and dual-enrollment programs is important because it can offer insight into which leadership practices best support positive student outcomes. Other variables shown to potentially impact outcomes for those in dual-enrollment programs such as the student's grade in school (Johnson & Brophy, 2006), number of dual-credit courses taken (Karp et al., 2007), type of dual credit (Karp et al., 2007), and state/province (Karp et al., 2007) are included in the theoretical models in this study. The type of dual-credit teacher (high school or post-secondary) and dual-credit delivery location (high school or college) are also included as possible covariates that may impact student engagement (Smith, 2007). The goal of this empirical study is to build on the existing body of dual-enrollment literature and make it stronger in relation to leadership and student engagement.

Review of methodological literature relevant to the study. Based on the literature review, the central hypothesis of this study was that grade level (e.g., grade 12) and enrollment in multiple dual-credit courses would impact student engagement. It was hypothesized that dual-credit teachers' and administrators' transformational leadership may affect the relationships between grade level (e.g., grade 12) and student engagement *and* between enrollment in multiple dual-credit courses and student engagement, but the exact nature of the teacher and administrator leadership was unknown based on differing results of other more general studies (Leithwood & Jantzi, 1999a, 1999b, 2000; Michael,

2003; Norton, 2012; Silins & Mulford, 2002, 2003). HLM was the preferable statistical technique for studying student-, classroom-, and school- level effects on student engagement (Leithwood & Jantzi, 1999a, 1999b, 2000) because it takes into consideration the shared variance students share in the same classroom and teachers share within the same school. HLM requires larger samples than ordinary least squares (OLS) regression but accounts for the shared variance that OLS regression does not (Woltman, Feldstain, MacKay, & Rocci, 2012). Before employing HLM analysis, care was taken to select the most valid and reliable instruments for measuring student engagement and transformational leadership. These instruments were determined to be the CLASSE and MLQ 5x respectively. The CLASSE is a course-specific version of the NSSE and can measure dual-credit student engagement regardless of whether the dual credit is academic or vocational, delivered on the high school or college campus, or is taught in New York and Ontario. Although extensive psychometric validation has been done on the NSSE, no published validity and reliability information was available on the CLASSE at the time of writing and hence, had to be determined in this study. The literature review has justified that the MLQ 5x is the best tool available for measuring the students' perceptions of their dual-credit instructors' transformational leadership style and instructors' perceptions of their dual-credit administrators' transformational leadership style. The literature review revealed some discrepancies in the published underlying latent structure of the MLQ 5x (e.g., in the number of leadership styles measured), but there is consensus in the literature that the MLQ 5x measures transformational leadership through one or more subscales (Antonakis et al., 2003; Avolio & Bass, 2004; Bass & Riggio, 2006; Schedlitzki &

Edwards, 2014). These discrepancies and use of the MLQ 5x in a new context by high school students warranted psychometric validation in the context of this project. The MLQ 5x was originally designed for use in business, and the CLASSE was designed for use by full-time post-secondary students in universities and colleges as opposed to high school students in secondary schools. No published information about the latent structure of the CLASSE was available at the time of writing. Thus, psychometric validation of the instruments for this study needed to be accomplished using *exploratory* factor analyses (EFAs) as opposed to *confirmatory* factor analyses since both survey instruments were used in a new context by dual-enrollment students (Osborne & Costello, 2005). This literature review has outlined the survey instrument selection process, the strengths and weakness of each tool considered, and justified the choice of statistical tools.

Synthesis of Research Findings

This literature review has synthesized findings from past dual-enrollment studies, traced the development of the theory of student engagement, and argued for the importance of studying transformational leadership in relation to student engagement. It has also identified the strengths and weaknesses of past research and demonstrated the need for research in the area of dual-credit student engagement and leadership.

Dual enrollment can have a positive impact on cognitive measures of student achievement such as degree persistence, graduation rates, and time-to-degree completion (Allen & Dadgar, 2012; An, 2013; Bergeron, 2015; Delicath, 2000; Lichtenberger et al., 2014; Mattern et al., 2013; Shaw et al., 2013; Swanson, 2008). It also has an impact on non-cognitive student outcomes such as mental health and well-being, global life

satisfaction, and career aspirations (Hertberg-David et al., 2006; Shaunessy et al., 2006; Smith, 2007). Student engagement is a non-cognitive student outcome that measures participation and identification with school. Engagement can be measured across academic, social, and personal domains, and it captures students' motivation, aspirations, work ethic, perseverance, and passion (Finn, 1989; Kuh, 2003, 2009). Cognitive measures of school effectiveness such as post-secondary enrollment do not adequately measure the success of vocational students who may proceed directly into the workforce after high school or the life satisfaction of gifted students in the AP or IB programs (Hertberg-David et al., 2006). The success of dual-enrollment programs depends heavily on the distributed leadership of dual-credit teachers and administrators (Spillane, 2005; Stephenson, 2014).

Critique of Previous Research

This literature review has identified several strengths and weaknesses of previous research. First, several dual-enrollment researchers conducted retrospective dual-credit studies with large pre-existing data sets, but they did not distinguish between the types of dual credit (e.g., academic or vocational), type of dual-credit teacher (e.g., college/university, high school, or team-taught), or dual-credit delivery location (high school or post-secondary institution) (Allen & Dadgar, 2012; An, 2013; Swanson, 2008). Although this study does not distinguish between the nature of the dual credit (e.g., AP, IB, or post-secondary college/university), the type of dual credit, type of dual-credit teacher, and dual-credit delivery location are distinguished within the hierarchical models (see Figures 2 and 3). Second, at the time of writing, only one study (Michael, 2003)

attempted to link dual enrollment to school leadership. School leadership is a school climate variable that plays an essential role in predicting cognitive and non-cognitive student outcomes (Leithwood & Jantzi, 1999a, 1999b, 2000; Silins & Mulford, 2002, 2003). This study considers the impact of teacher and principal transformational leadership on student engagement for those in dual-enrollment programs. Third, some studies were unable to use the desired statistical technique of HLM to explore the impact of teacher and principal leadership on student engagement. HLM can account for the shared variance students share in the same classroom and teachers and students share in the same school. Leithwood and Jantzi (1999a, 1999b, 2000) were unable to link student responses to teacher responses because of practical reasons, so they could not use HLM in their series of student-engagement studies. In her study on student engagement and teacher leadership in the middle school classroom, Norton (2012) faced a similar issue. As the principal of the middle school in her study, Norton (2012) was not allowed to link student responses to individual teachers. For this reason, she was unable to use HLM and instead used correlational analyses which do not allow for multiple potentially confounding variables (influences) in the same model. This study was able to use HLM because student responses were linked through anonymous bar codes to teacher responses. Fourth, some studies (Delicath, 2000; Norton, 2012) used data from only one school so the results may not be generalizable to other schools with different student populations. This study uses data from 16 schools in seven communities in two countries. Karp et al. (2007) have noted that few studies consider the efficacy of vocational dual credits across states. This research includes vocational dual credits in two countries.

Fifth, some dual-credit studies did not use psychometrically validated survey instruments (Crockett-Bell, 2007). This research takes care to establish the reliability and validity of survey instruments before proceeding with the hierarchical analysis. There is a strong case for this research study.

Summary

Dual-credit programs motivate students to reach higher curricula standards, ease the transition to post-secondary colleges and universities, and increase college retention and completion rates (An, 2013; Delicath, 2000; Farrell & Seifert, 2007; Hoffman, 2003; Lichtenberger et al., 2014; Smith, 2007; Wathington & Pretlow, 2014). Several studies in this literature review help form the foundation for this study (Leithwood & Jantzi, 1999a, 2000; Lichtenberger et al., 2014; Michael, 2003; Norton, 2012; Silins & Mulford, 2002, 2003). These studies assisted in designing a methodology and identifying potential confounding variables for this research. The literature review confirmed that the MLQ 5x was the best tool for measuring transformational leadership (Bass & Riggio, 2006) and the CLASSE was the best survey for measuring dual-credit students' engagement. HLM is the desired statistical technique for studying whether teacher and administrator leadership affects (i.e., moderates) the relationship between enrollment in multiple dual-credit courses and student engagement *and* between grade level (e.g., grade 12) and student engagement. While this research does not consider all leadership styles or all potentially confounding variables such as socio-economic, ethnicity, or at-risk status, it does consider the students' perceptions of their teachers' transformational leadership and teachers' perceptions of their administrators' transformational leadership. In a large-scale

Canadian study, teachers' transformational leadership was shown to have a positive impact on students indirectly through school climate and organizational learning, and principals' transformational leadership was shown to directly influence students (Leithwood & Jantzi, 1999a, 1999b, 2000).

In other international research, principals' transformational leadership was shown to have a more indirect impact on students through teachers' leadership (Silins & Mulford, 2002, 2003). This research hopes to explore relationships between teacher and administrator leadership in a dual-credit context. The next chapter outlines the methodology for doing this.

Chapter 3. Methodology

The purpose of this study is to examine relationships between dual-credit program leadership, related dual-enrollment variables (e.g., whether the dual credit is delivered in a high school or post-secondary institution, type of dual-credit teacher, etc.), and student engagement using rigorous quantitative methods such as exploratory factor analysis (EFA), reliability analysis, and hierarchical linear modelling (HLM). Covariates in the 2-level and 3-level hierarchical linear models include student-, classroom-, and school-level variables that have been shown to impact dual-credit student outcomes in other research (see Figures 2 and 3). This chapter provides an overview of the study and addresses questions of research design, research questions and hypotheses, population and participant selection, procedures, instruments, data collection, data analyses, and expected findings (see Figure 1 for study overview).

Research Method and Design Appropriateness

In this study, dual-credit students (n = 676) in New York and Ontario completed the Classroom Survey of Student Engagement (CLASSE), a course-specific version of the National Survey of Student Engagement (NSSE), regarding their dual-credit courses. They also completed the revised Multifactor Leadership Questionnaire (MLQ 5x) to rate their dual-credit instructors' transformational leadership. The dual-credit instructors (n = 43) completed the MLQ 5x to rate their principals' or college deans' transformational leadership. EFAs were used to establish the construct validity of both the MLQ 5x and CLASSE with dual-enrollment students—a new context for both instruments. The MLQ 5x was designed for use in business, and there are discrepancies in the authors' proposed

underlying factor structure for the instrument (i.e., number of subscales and leadership dimensions measured) (Antonakis et al., 2003; Avolio et al., 1999; Schedlitzki & Edwards, 2014). The CLASSE was designed to measure post-secondary students' engagement in courses delivered in colleges and universities as opposed to dual-credit students' engagement in courses taught in high schools. At the time of writing, no published psychometric work (e.g., factor analyses, reliability analyses such as Cronbach's alpha or average inter-item correlations) or scoring manual exists for the CLASSE. Thus, it was necessary to conduct EFAs (as opposed to confirmatory factor analyses) on both the MLQ 5x and CLASSE student data to examine each instrument's respective construct validity before proceeding with the 2-level and 3-level hierarchical models that attempt to relate leadership within dual-credit programs to student engagement.

The construct validity analyses and reliability tests (Cronbach's alpha and average inter-item correlations) revealed that the MLQ 5x was a suitable tool for measuring students' perceptions of their dual-credit instructors' transformational leadership, but further psychometric work was needed on the CLASSE to determine a subset of engagement items for use in the hierarchical linear models. The reduced item subset from the CLASSE was found by performing several EFAs and adding and removing survey items until the reduced subset met the following criteria as recommended by the literature ("Exploratory Factor Analysis," 2015; Osborne & Costello, 2005): all selected survey items had high-rotated primary factor loadings greater than .40, minimal cross loadings of *no* more than .30 on secondary factors, and a spread of at least .30 between rotated

primary and cross loadings. Once the reliability of the subset of CLASSE items was deemed satisfactory by examining Cronbach's alpha and the average inter-item correlation for the student-engagement scale, the reduced subset was then used to generate average student-engagement scores for use in 2-level and 3-level hierarchical linear models that attempt to relate elements of transformational teacher and administrator leadership to student engagement in the context of other variables shown in past research to influence dual-credit student engagement (see Figures 2 and 3). The next paragraph provides an overview of the other variables at each level of the hierarchical models.

The dependent variable in both the 2-level and 3-level hierarchical linear model was dual-credit student engagement (a level-1 variable). Independent variables at level 1 of the 2-level model included student's grade in school (e.g., grade 12 or other) and whether the student had taken multiple dual credits (yes or no). These categorical variables were dummy-coded as contrast variables for the hierarchical analyses. Grade in school was coded as "1" for grade 12 and "0" for any other grade. Post-graduation students were considered grade 12. The "enrollment in multiple dual credits" indicator variable was coded as "1" to represent a student who had taken multiple Advanced Placement (AP), International Baccalaureate (IB), or college/university dual credits and "0" if they had not. Independent variables (moderators) at level 2 of the 2-level hierarchical model included students' perceptions of their teachers' transformational leadership (as measured by their responses on the MLQ 5x), the type of dual credit (academic or vocational), and the type of dual-credit teacher (high school or post-

secondary). The type of dual credit was coded as "1" for academic and "0" for vocational, and the type of dual-credit teacher was coded as "1" for high school, "-1" for post-secondary, and "0" for team-taught. Team-taught dual-credit courses were not considered in the hierarchical model at level 2 because only 3.7% of the sample in this research involved dual-enrollment courses team-taught by both secondary and college teachers, compared to 79.3% taught by secondary teachers and 17.0% taught by post-secondary professors (see Table 2 for student-participant characteristics). In the 3-level hierarchical model, the level-1 independent variable was the same contrast variable representing whether the student had taken multiple dual credits (as explained above for the 2-level hierarchical model), the level-2 independent variable was the students' perception of their teachers' transformational leadership (as measured by their responses on the MLQ 5x), and the level 3 independent variables (moderators) were the state/province the student resides in (New York or Ontario), the dual-credit delivery location (post-secondary institution versus high school), and the dual-credit instructors' perceptions of their administrators' transformational leadership (as measured by their responses on the MLQ 5x). The state/province was coded as "0" for New York and "1" for Ontario, and the delivery location was coded as "0" for college and "1" for high school. Due to the large sample sizes required of HLM, it was not possible to put all level- 1, 2, and 3 variables in the same model. This chapter will outline how the data was collected, organized, screened, and analyzed in detail.

Research Questions and Hypotheses

The central research question was, "Does grade in school (e.g., grade 12) or

enrollment in multiple dual credits impact student engagement before and after moderation by leadership and dual-enrollment related variables at the classroom and school level?" Classroom-level leaders refer to dual-credit instructors (i.e., high school teachers or post-secondary professors) and school-level leaders refer to the administrators (i.e., college deans or high school principals) who directly oversee dual-credit instructors. The supporting research questions and hypotheses were as follows:

1. Using EFAs and reliability analyses, is the MLQ 5x a suitable instrument for measuring students' perceptions of their teachers' transformational leadership so teachers' leadership scores could be used in HLM? If not, is there a combination (subset) of questions from the MLQ 5x that can measure students' perceptions of their dual-credit instructors' transformational leadership with acceptable validity and reliability? The MLQ 5x was hypothesized to be a valid and reliable tool for measuring dual-credit students' perceptions of their teachers' transformational leadership as specified by its scoring manual and other research (Norton, 2012; Stewart, 2006); however, due to discrepancies in factor loadings proposed (e.g., actual leadership dimensions measured and number of subscales representing each dimension) by the MLQ 5x's authors and by other researchers, it was unknown whether one or multiple transformational leadership scales (factors) would emerge from the student data. The MLQ 5x was also used in a new context by high school dual-enrollment students, so it was unknown if the survey would measure the same leadership styles as in a business setting.

2. Using EFAs and reliability analyses, is the CLASSE a suitable instrument for measuring students' engagement in their dual-credit courses so students' engagement scores could be used in HLM? If not, is there a combination (subset) of questions from the CLASSE that could measure student engagement with acceptable validity and reliability? A combination of questions on the CLASSE was hypothesized to be a valid and reliable measure for determining dual-credit student engagement because the items on the CLASSE are derived from the NSSE which has undergone extensive and on-going psychometric analysis. Since the CLASSE has not undergone any psychometric analysis in the literature at the time of writing, it was unexpected that the full set of CLASSE questions would adequately capture all underlying facets of student engagement without high cross loading of survey items across latent factors. Due to parsimony, it was pertinent to have a measure of student engagement that uses the fewest number of items from the CLASSE as possible (to reduce possible inflation of Cronbach's alpha).
3. Does the student's grade in school (grade 12 or other) or enrollment in multiple dual-credit courses impact student engagement before and after moderating for the following classroom-level variables: students' perceptions of their teachers' transformational leadership style (as measured by the MLQ 5x), type of dual credit (academic or vocational), and type of dual-credit teacher (high school or post-secondary); and before and after moderating for the following school-level variables: dual-credit delivery location (i.e., high

school or post-secondary institution), school location (New York or Ontario), and teachers' perceptions of their administrators' transformational leadership style (as measured by the MLQ 5x)? It was hypothesized that the student's grade in school and enrollment in multiple dual-credit courses would impact student engagement based on the findings of other researchers (Karp et al., 2007). It was postulated that the state/province may impact the relationship between enrollment in multiple dual-credit courses and student engagement. The relative impact of teacher transformational leadership on the relationship between grade level and student engagement was unknown and the relative impact of teacher and administrator leadership on the relationship between enrollment in multiple dual-credit courses and student engagement was also unknown. Some large-scale peer-reviewed quantitative research found no *direct* impact of teachers' transformational leadership on student engagement (Leithwood & Jantzi, 1999a), but other research did (Norton, 2012). Thus, the impact of teacher and principal transformational leadership needed to be determined in the context of this study.

Population

In total, data was collected from 676 student participants (332 Ontario, 344 New York) from 54 congregated dual-credit classes in 16 different educational institutions (high schools and colleges) in seven communities between April–June 2015. Data was collected from 43 teachers in these same educational institutions during this time period. Some teachers taught multiple dual-credit courses. Research sites in New York State and

Ontario were included because each locale has different dual-credit delivery models (see Chapter 1 for explanation). Dual credits in this study were granted by two external agencies (i.e., the College Board and the IB Organization) and 10 post-secondary institutions in New York and Ontario. Seven of these post-secondary institutions were campuses of larger post-secondary institutions. The sample in this study was derived from the population of all congregated (dedicated) dual-credit classes in North America. Due to the logistical, ethical, and sample-size constraints, high school students enrolled in dual-credit courses on post-secondary campuses with college peers were excluded in this research. The next section outlines the sampling techniques and participant selection criteria.

Sampling Design/Participant Selection

Sampling strategy. This research employed forms of convenience, cluster, and quota sampling. Compensation was not given to the participants.

Convenience sampling. After ethics approval was granted from Western University's Research Ethics Board, the researcher pseudo-randomly selected schools in New York and Ontario by convenience using a geographical information system (GIS). The college locations were selected for convenience because they were within a three-hour (one-way) drive of the researcher. All colleges in Ontario offer dual-credit programs, so all colleges within three-hours driving distance were considered by the GIS. The high school locations were also chosen for convenience after the researcher conducted an Internet search of dual-credit programs within three-hour (one-way) driving distance of her home. The search revealed several high schools in both New York and

Ontario with active dual-enrollment programs. A GIS then identified a pseudo-random selection of these sites to be contacted. In New York, the superintendents of four selected school districts containing these high schools were informally contacted. Three of the four superintendents expressed formal interest in participation and assisted with introductions to the schools' principals, guidance offices and dual-enrollment coordinators. The fourth New York superintendent declined citing that their dual-enrollment students had already been surveyed several times in the current calendar year. This school indicated that they would have preferred to take part in qualitative interview research. An ethics application was submitted to the State University of New York (SUNY), which had oversight for dual credits (from several different SUNY campuses) at all three New York high schools in this study. SUNY approved the study (see Appendix B). In Ontario, ethics applications were submitted to five school boards and three colleges selected by convenience using the GIS. These ethics applications were followed up with phone calls and emails to ensure they were received and give the school boards and colleges more information about the study. All three Ontario colleges approved the study (see Appendix B). Three of the five school boards approved the study (see Appendix B), and all participating boards assisted with introducing the researcher to schools offering dual-enrollment courses. One Ontario school board declined due to impeding labour disruptions, and another Ontario board was only able to accommodate research studies related to literacy during the current calendar year.

Convenience sampling is a type of non-probabilistic (non-random) sampling and contains some limitations. There is inherent bias in convenience sampling because non-

volunteering participants (schools) may differ from volunteering participants (schools). Gay, Mills, and Airasian (2011) state, "Because the total population is composed of both volunteers and nonvolunteers, the results of a study based solely on volunteers are not likely generalizable to the entire population" (p. 141). This means the results of this study may not be generalizable to all dual-enrollment programs. Despite this limitation, MacMillan and Schumacher (2006) write:

> This does not mean that the findings are not useful; it simply means that caution is needed in generalizing. Often researchers will describe convenient samples carefully to show that although they were not able to employ random selection, the characteristics of the subjects matched those of the population or a substantial portion of the population (p. 125).

In this study, care was taken to survey a large sample of dual-enrollment classes, both academic and vocational, in a wide-variety of subjects, in seven communities in two countries. Schools selected for the study represented diversity in terms of ethnicity, urbanity, achievement, and socio-economic status. The geographical location section of this methodology chapter outlines characteristics of each college and school in the study that reflect this diversity (see sections to follow).

In participating schools, all students and instructors from congregated (dedicated) dual-credit classes were invited to participate. The response rate was 88.5% for classes approached, 84.3% for instructors, and 94.3% for students approached in participating classes (see Figure 4 for more detail about the flow of survey participants in the study). Two classes declined because the regular classroom teacher was on sick leave, and two

declined citing lack of time to participate in the study due to dual-credit examinations.

Cluster and quota sampling. Sampling all students from congregated classes is a form of cluster sampling. This type of sampling is used when the population is naturally divided into relatively homogenous groups, and a simple random sample of groups is obtained. In this research, the groups are the congregated dual-credit courses. These classes can be considered pseudo-randomly selected from the population of all congregated dual-credit classes. A maximum of 25 classes from New York and 25 classes from Ontario were included in this research due to requiring at least 30 classes to conduct HLM analysis (Kreft & De Leeuw, 1998). A class was defined as having five or more students—also a requirement of HLM (Maax & Hox, 2005). In this research, at least 30 but no more than 50 classes were scheduled for recruitment and surveying to ensure at least 30 classes were ultimately included. Once the quota was reached (of 30 congregated classes), no new recruitment/survey appointments were booked. Scheduled appointments, beyond the 30 classes but below the 50-class limit, were allowed to proceed. This strategy can be considered quota sampling. Quota sampling is a non-probabilistic method in which the researcher continues collecting data until a fixed number of participants have been reached. The method is not random because classes excluded after the quota do not have an equal probability of selection. All research sites offer both vocational and academic dual credits, so no quota was set regarding the nature of the dual-credit course. Quota sampling made logistical sense for this study.

Participant selection. The research had strict inclusion and exclusion criteria. Teacher participants needed to be currently teaching a congregated dual-credit course,

have provided written consent (all were assumed to be over the age of 18), and have school board and principal permission to participate. School boards and principals granted approval for their schools and were not aware of what specific teachers and students were participating. This level of risk was acceptable because once the data was aggregated (into a sample of nearly 700 students and 50 instructors), it was impossible to identify a student or instructor from the survey data. For a student to be included in the research, he/she needed to be between the ages of 16 and 21, be currently enrolled in a congregated dual-credit course, have provided written consent and/or parent assent (if under age 18), and have both school board and teacher permission to participate in the research. No students younger than age 16 were surveyed, because the age at which children can give their own informed legal consent to participate in research in Ontario is 16 (Health Canada, 2014). College students between the ages of 16 and 18 can give their own informed consent in New York if the ethics review board deems the research no more than minimal risk (Cornell University, 2010). Dual-credit students enrolled in post-secondary institutions are registered as part-time college or university students. Parental consent was still used for those students under 18 years of age because most school boards require it. New York and Ontario high schools only register dual-credit students who are 21 years old or younger (Mombourquette, McEwan, & McBridge, 1999, p. 2; Youth Communication, 2012, para. 2). Thus, all surveyed students were aged 16 to 21.

Dual-credit students and instructors comprised all genders and multiple ethnicities. Gender, age, ethnicity, and socio-economic variables were not collected in this study. Gender was not included because several similar student-engagement studies

did not collect students' gender as an indicator variable (Johnson & Brophy, 2006; Leithwood & Jantzi, 1999a, 1999b, 2000; Smith, 2007). Some dual-enrollment studies found that gender influenced student outcomes (Delicath, 2000; Karp et al., 2007; Lichtenberger et al., 2014), and some did not after other variables were controlled for in the analysis (Swanson, 2008, p. 308). Students' ages were not gathered because student's grade in school (i.e., grade 9, grade 10, etc.) was a similar variable shown to influence dual-credit student outcomes in other related quantitative research (Johnson & Brophy, 2006). Ethnicity and socio-economic status were not collected due to project scope and ethical issues with their collection. Various researchers have shown that outcomes related to dual enrollment and student engagement are influenced by ethnicity and socio-economic status (Delicath, 2000; Karp et al., 2007; Leithwood & Jantzi, 1999a, 1999b, 2000; Silins & Mulford, 2002, 2003), but several school boards indicated that ethnicity and socio-economic variables were not to be collected under any circumstances.

Sample-size determination. HLM requires large sample sizes to achieve appropriate power (Garson, 2013). It is better to have more groups (classes) with fewer students in each group than fewer classes with more students in each group. Acceptable level-1 group (classroom) sizes range from 5 students to 22 students or more (Maas & Hox, 2005). Maas and Hox (2005) wrote, "[Our] results show that only a small sample size at level two (meaning a sample of 50 or less) leads to bias estimates of the second-level errors" (p. 86). A sample-size calculator for a 2-level hierarchical linear model (i.e., student engagement and teacher leadership) with a 0.15 effect size, 80% power, and p = 0.05 demands a level-2 sample size of 55 (Soper, 2014). This calculation confirms Maas

and Hox's (2005) suggestions. Adding another layer to the hierarchical linear model (principal leadership) still requires at least 50 data points at level two (i.e., the teacher leadership level). Kreft and De Leeuw (1998) have written that 30 is the smallest acceptable group size at level two in educational and organizational research using HLM. Thus, this research attempted to obtain a sample of at least 30 distinct dual-credit classes, but no more than 50 classes due to logistical concerns to satisfy these level-2 requirements specified by Kreft and De Leeuw (1998) and Maas and Hox (2005). This research attempted to have at least five dual-credit students in each class (a requirement of HLM (Mass & Hox, 2005). This translated into having at least 30 teacher participants to a maximum of 50 teacher participants, and having at least 150 student participants to a maximum of 800 student participants (i.e., 30 classes × 5 students per class = 150 students minimum to 50 classes × 15 students per class on average = 750 students maximum = 800 rounded to the nearest hundred). A maximum of 25 classes from New York and 25 classes from Ontario (with five students in each class) were therefore to be included in this research. In this research, classroom sizes depended on student enrollment and study participation, and therefore were not directly controllable (a possible limitation of this research). In total, 54 classes were surveyed but four classes had fewer than five students. Some classes were taught by the same dual-credit instructor.

Informed consent. Written consent was used for all participating groups including parental assent for students under age 18. This consent could be revoked at any time before data analysis. Each survey contained an anonymous randomly-generated bar code. The sole purpose of the bar code was to link the student surveys to the instructor surveys

for correlational purposes and allow participants to withdraw at a later date by anonymously contacting the researcher with their bar code (see Letters of Information in Appendix F for more detail). No participants contacted the researcher to be removed from the study.

Confidentiality. Privacy concerns were closely adhered to throughout all stages of the research. All surveys were anonymous. No identifying school names, course codes, teacher names, student names, or other personal identifiers were recorded. Once data was aggregated into the final sample of nearly 700 students and 50 instructors, identification of individual participants was impossible. During the survey administration, dual-credit instructors were not present in the classroom, so they did not know which of their students had chosen to participate. Participating principals and college deans were informed that the study was taking place in their school (through the Letters of Information; see Appendix F), but they did not know which students or teachers were participating. All consents and assents were kept sealed and separate from the data to maintain anonymity of participants. Completed surveys were kept in a locked cabinet except during data entry. Data from paper-based surveys was initially entered into Qualtrics, an online survey platform on a secure Western University server. Survey responses were then downloaded from Qualtrics and coded into the *IBM Statistical Program for the Social Sciences* 23.0 (SPSS), *Mplus* 7.31, and *HLM* 7.0 software programs where the files were stored on the researcher's work computer, which was password protected. The Qualtrics data was deleted after being transferred to the

researcher's computer. All surveys and the corresponding digital files will be destroyed and/or deleted five years after project completion.

Ethical issues. Written ethics approval was obtained from Western University, State University of New York (SUNY), the college sites (where data was collected onsite), all school boards, school principals, teachers, and student participants (and parents where necessary). See Appendices A and B for the written ethical approvals obtained for this project. There were no issues of power or coercion between the researcher and participants or between the dual-credit instructors and students. The researcher was not connected to any of the dual-credit programs. Participation was completely voluntary, and participants could withdraw at any time before data analysis. If participants wished to withdraw their records, they were instructed to record their survey bar code and contact the researcher anonymously by phone or email. The Letter of Information (see Appendix F) directed participants to use call blocking (Bell Canada, 2015) or an anonymous email address of their choice (Griffith, 2015) if they wished to withdraw. Dual-credit instructors and principals/deans knew, through the Letter of Information (see Appendix F), that their students and teachers (respectively) would be asked to rate their leadership style. They were free to decline participation if they did not agree with any of the study's protocols.

Geographical location. The study was conducted in New York State and Ontario. This section of the methodology provides school and community profiles. Community data was taken from federal, provincial, and municipal government websites. School data was derived from school websites. Citations for school and community data are not

provided because it would directly identify school sites.

Ontario community, school, and college profiles. The main campus of the Ontario community college in this study was located in a city of approximately 150,000 residents. Approximately 16% lived below the poverty line, and there was some ethnic diversity (10%). The second campus of this college was located in a town of approximately 46,000 residents where approximately 16% lived below the poverty line, and there was little ethnic diversity (<6%). One dual-credit course, offered in a high school in this community, had oversight from another community college, which granted ethical permission for this study. Geographical regions for community colleges in Ontario can overlap. The third campus of the Ontario college was located in a town of approximately 22,000 residents with approximately 25% living below the poverty line. There was almost no ethnic diversity (<3%) in this community. The three regionally diverse campuses of this Ontario college had over 700 dual-credit students enrolled annually in regular college classes alongside college freshmen, in dedicated classes on the college campuses for secondary school students, and in local high schools through team-taught classes. Both vocational (apprenticeship) and academic dual credits were offered. Eleven congregated dual-credit courses were offered in the Winter 2015 semester. The Ontario AP, IB, and college dual-credit courses in this study were offered in high schools in the communities surrounding these three college campuses. Dual-enrollment students at the third Ontario college were not surveyed due to the late response of that college's research ethics board and rejection of one of their partnering school boards.

New York community, school, and college profiles. The first New York high

school in this study has typically enrolled 750 students in grades 7 to 12 annually for the past several years. This high school was the only secondary school in a community of approximately 12,500 residents. Approximately 20% lived below the state poverty line, and there was some ethnic diversity (15%). The high school boasted dual-credit partnerships with five post-secondary institutions, both public and private, in nearby areas. Both vocational and academic dual credits (college/university and AP) were offered. Secondary school teachers in the high school taught the majority of these dual credits.

The second New York high school was located in a rural area with approximately 180 students in grades 9 to 12. This high school was the only secondary school in a village with approximately 1100 residents. Approximately 13% lived below the state poverty line, and there was almost no ethnic diversity (<1%). The high school offered twelve onsite dual-credit courses from a nearby community college; the majority of these courses were academic in nature. Several AP courses were offered to students beginning in grade 10. Eighty-eight percent of this high school's graduates enrolled in further post-secondary studies annually. Secondary school teachers in the high school taught the majority of their dual credits, but some were college delivered through distance education (video-conferencing) with the partnering post-secondary institution.

The third New York high school of nearly 1,000 students was located in a town of approximately 13,000 residents. There was less than 5% ethnic diversity and nearly 20% lived below the state poverty line. Most students were bused to the school from surrounding outlying rural areas. This high school boasted high student achievement and

offered 19 IB courses and 10 post-secondary-based college/university dual-credit courses per year. Their sports teams have won several state-wide championships.

All sites were pseudo-randomly selected for convenience using a GIS. The sites reflect a population of dual-credit students from cities, towns, and villages (as compared to urban metropolitan areas) in New York State and Ontario. The sites display a predominantly rural and suburban geography, but some Ontario high schools were located in the downtown core of their respective cities and towns. The sites did not reflect a great deal of ethnic diversity (a possible limitation of the study), but one high school in Ontario, which offered at least 10 dual-credit courses annually, had a large population of international exchange students taking dual-credit courses at the time of surveying.

Data Collection

Appropriate ethical approvals were obtained from Western University, all participating school boards, high schools, and partnering post-secondary institutions (where data was collected on-site) before recruitment and data collection commenced (see Appendix B for site ethics approvals). With ethical approval, the researcher approached school principals or college deans in person. Once the study was approved for their specific school or college, the principal or dean introduced the researcher to the guidance office staff or college dual-credit office staff. The researcher then booked a time for recruitment at least one week prior to anticipated survey administration to recruit students and instructors. During recruitment sessions, guidance counsellors introduced the researcher to dual-credit classes and assisted with the collection of consent and assent forms (see Appendix F). Parental assent was used for all students younger than 18 years

of age in addition to participant-informed written consent. The researcher and guidance counsellors then administered paper-based copies of the MLQ 5x and CLASSE at least one week after recruitment for students and instructors with appropriate consent/assent. Each participating student with appropriate consent/assent was given two surveys (MLQ 5x and CLASSE) to complete *in* the classroom, and each participating instructor (with appropriate written consent) was given one survey (MLQ 5x) to complete *outside* the classroom. Assisting teachers/counsellors were in the classroom during survey completion. This ensured that the researcher was never alone or supervising students without a school board teacher present. All participants completed the MLQ 5x and CLASSE towards the end of their dual-credit course between April–June 2015. Students were asked to fill out only one CLASSE and MLQ 5x if they were approached for recruitment in multiple classes. For team-taught dual-credit courses, students were asked to rate the instructor who was presently instructing them on the day of surveying. If both the high school teacher and post-secondary professor were present, students were asked to rate the college professor on the MLQ 5x. Participant Letters of Information contained details about how final study results can be anonymously obtained (see Appendix F). All participating schools and colleges will be provided with the final research report.

The remaining sections of this chapter explain the structure of the instruments in depth, and describe the data cleaning, coding, scoring, screening, handling of missing data, and assumption testing.

Instrumentation

MLQ 5x. Dual-enrollment students completed the follower-rating form of the

MLQ 5x to evaluate their dual-credit instructors' leadership based on nine leadership dimensions that comprised three leadership styles: transformational, transactional, and passive-avoidant. These three leadership styles were measured on five, two, and two subscales respectively (Avolio & Bass, 2004). Dual-credit instructors completed the follower-rating form of the MLQ 5x to evaluate their principals' or deans' leadership based on the same dimensions and subscales (see Appendix C for survey license for all student and teacher participants). The MLQ 5x was selected for use in this study because it is considered to be the "gold standard" for measuring transformational leadership (Bass & Riggio, 2006), and it had been psychometrically validated and used successfully in other educational research (Stewart, 2006).

The MLQ 5x includes 45 standardized survey items—four items for each of the nine leadership dimensions listed in Table 1 and nine additional items related to the outcomes of leadership. Responses were coded on a 5–point Likert scale to represent students' and teachers' perceptions of how frequently their teachers and administrators (respectively) demonstrated particular leadership behaviours (0 = *Not at all;* 1 = *once in a while;* 2 = *sometimes;* 3 = *fairly often;* 4 = *frequently, if not always*). The MLQ 5x has undergone extensive psychometric analyses to establish its construct validity by the survey's authors and other researchers (Antonakis et al., 2003; Avolio & Bass, 2004). Although some researchers do not agree on the number of MLQ 5x subscales, there is consensus in the literature that the instrument measures transformational, transactional, and passive-avoidant leadership (Avolio & Bass, 2004; Schedlitzki & Edwards, 2014). Bass and Riggio (2006) found internal consistency (Cronbach's alpha) to be at least 0.80

on all MLQ 5x scales with strong rate-rerate consistency (reliability) (p. 22–24).

Table 1 also provides sample items for each of the three leadership styles (transformational, transactional, and passive-avoidant). For this study, 39 of the 45 items from the MLQ 5x followers-rater form were selected. Six questions related to organizational outcomes, leader effectiveness, and leader satisfaction were excluded because they were not applicable to teacher leadership. For example, a student may have experienced difficulty rating their teacher on this item: "[The person I am rating] is effective in meeting organizational requirements" (Avolio & Bass, 2004, p. 115). The exclusion of these items does not influence the evaluation of transformational leadership (the focus of the larger study) (Avolio & Bass, 2004). The exploratory factor analysis (EFA) on the MLQ 5x included all 39 items administered to students.

CLASSE. Participating dual-enrollment students completed the Classroom Survey of Student Engagement (CLASSE), a course-level version of the National Survey of Student Engagement (NSSE). The NSSE measures the time and effort students put into their education-related studies on an institutional level (IUCPR, 2014c), whereas the CLASSE measures engagement on a per course basis. There are two versions of the NSSE and CLASSE—one for students and one for faculty. The student self-rating version of the CLASSE was used in this study as opposed to the faculty version (which measures faculty members' perceptions of student engagement) because the unit-of-analysis was the student not the teachers' perceptions of their classes' engagement.

Although the NSSE has more extensive published psychometric validation than the CLASSE, the NSSE was not selected for this study because it measures student

engagement across a student's entire post-secondary experience (i.e., across multiple courses and/or departments) and would therefore not be appropriate for dual-credit students who may take only one post-secondary course on-site in their high school. Additionally, the NSSE also draws heavily on Tinto's (1975, 1982, 1993) post-secondary theories of student engagement (which are not applicable to high school students who are not full-time college or university students). Moreover, several NSSE survey questions relate to the post-secondary campus only and do not apply to high schools. For example, one 2014 NSSE question reads, " Indicate the quality of your interactions with the following people at your institution…Student services staff (career services, student activities, housing, etc.)" (IUCPR, 2014a, p. 4). Another 2014 NSSE question reads, "About how many hours do you spend in a typical 7-day week doing the following…Working for pay on campus" (IUCPR, 2014a, p. 5). These questions would not be applicable to high school students taking their post-secondary (college/university) dual-credit courses in their high schools or students taking a single dual-credit course one day a week on the post-secondary campus. For other NSSE questions, it would have been unclear whether the questions referred to the high school or college campus—some dual-credit students simultaneously take courses on both types of campuses. For these reasons, this research required the course-specific version of the NSSE, the CLASSE, which asks questions that apply to students in dual-credit courses such as "How often do you ask questions during your dual-credit class?" and "How frequently do you take notes in your dual-credit class?" (See Appendix E for the CLASSE used in this study).

The CLASSE allows for the inclusion of eight additional survey items regarding the

dual-credit course. Four optional items were included for this study. The first question asked the student where the majority of the dual-credit course was delivered (i.e., high school, college, or distance education). The second question asked if the dual-credit instructor was a high school teacher, college/university professor (employed in a post-secondary institution), or both (i.e., team-taught). The third question asked whether the dual credit was academic or vocational in nature. The fourth question asked whether the student's career aspirations had changed since enrolling in the dual-credit program. These questions were necessary to help answer the proposed research question and for sub-analyses that were often overlooked in retrospective dual-credit studies with existing datasets.

The three demographic questions on the original CLASSE do not apply to dual-credit students because they refer specifically to post-secondary campuses. For example, one demographic question on the original CLASSE asks the student whether he/she is a college freshman, sophomore, junior, or senior. This question is not applicable to dual-credit students who are in high school, so it was replaced with a question about the student's current grade level (i.e., grade 9, 10, 11, 12, or other). The other original demographic questions on the CLASSE refer to total college-semester credit hours and college major (also not applicable to dual-credit students who are typically enrolled part-time in the college). These questions were therefore replaced with one asking whether the student was enrolled in or had taken multiple dual-credit courses. For statistical modelling purposes, an additional demographic question relating to the state or province where the student resides (i.e., New York or Ontario) was also included. No information

related to students' age, gender, ethnicity, first language, at-risk status, financial status, previous academic performance, or parents' academic achievement was collected because this analysis was beyond the scope of this proposed research project. The full 2014 NSSE does not collect data on students in several of these aforementioned categories, and none are standard questions on the CLASSE (IUPRC, 2004; see Appendix E for survey). The University of Indiana approved all changes and additions to the CLASSE survey (see Appendix D for survey license).

All dependent questions (variables) on the CLASSE were coded on nine similar 4–point Likert scales to represent students' perceptions of their engagement in their dual-credit courses (see the CLASSE in Appendix E). Sample 4-point Likert scales include 1 = *never/rarely;* 2 = *sometimes;* 3 = *often;* 4 = *very often* and 1 = *difficult;* 2 = *somewhat easy;* 3 = *easy;* 4 = *very easy.* Some scales were coded in reverse (see Appendix E for CLASSE survey). While extensive reliability and validity analyses have been conducted on the institutional NSSE and its subscales (Kuh, 2009), at the time of writing, there was very little published information about the validity of the CLASSE and no published reliability information. Smallwood (2010), CLASSE co-author, has written that the CLASSE will help localize variation in student engagement. Ouimet, one of the CLASSE's coauthors, stated that psychometric work on the CLASSE is ongoing by Dr. Francis Strydom at the University of the Free State in South Africa (J. A. Ouimet, personal communication, November 14, 2014).

Since no published reliability information was currently available for the CLASSE, the closest reliability information comes from identical questions on the NSSE designed

to measure student engagement. Kuh et al. (2008) found the Cronbach's alpha to be .818 in a study with 6,193 post-secondary students using "a summative scale of 19 NSSE items measuring student interaction with faculty, their experiences with diverse others, and their involvement in opportunities for active and collaborative learning" (p. 558). Kuh et al. (2008) used this student-engagement scale to predict students' first-year college grades and persistence. Fifteen of the 19 NSSE items on this "Scale of Educationally Purposeful Activities" appear on the CLASSE. One item on the Educationally Purposeful Activities engagement scale, "Asked questions or contributed to a class discussion," is broken into two separate questions on the CLASSE (see Appendix E for the CLASSE). The reliability of the 15 items from the Educationally Purposeful Activities scale of the NSSE was found to be .786 in this study. While a Cronbach's alpha of .786 can be considered acceptable, EFAs on these items revealed several items with significant cross loading (see Table 13 for factor loadings for the Educationally Purposeful Activities scale). In addition, the Educationally Purpose Activities scale only contained survey items from Part I (Engagement Activities) of the CLASSE and excluded items from Part II (Cognitive Skills), Part III (Other Educational Practices), and Part IV (Class Atmosphere). It was desirable to have an engagement scale that contained as *few* items as necessary from as *many* different parts of the CLASSE as possible. The Educationally Purposeful Activities scale ignored survey items from three of the four parts (sections) of the CLASSE. For these reasons, a different set of items from the CLASSE was ultimately selected for use in this study after extensive psychometric analysis (see Table 14 for the final items selected and their underlying

factor structure). The reliability (Cronbach's alpha) of the final 18 items selected to generate the average student-engagement scores in this study was an acceptable .816. Thus, this research attempted to make up for the missing psychometric work on the CLASSE through EFAs and reliability analyses. The initial EFAs on the CLASSE included all 38 items administered to students in Parts I–IV. Covariate questions about the dual-credit courses (in Part V of the CLASSE) were not included in the EFAs because the goal of the EFAs on the CLASSE were to explore the latent factors underlying student engagement. The covariate data was used in the HLM analyses.

Validity and Reliability

Overview of validity and reliability. This study takes care with respect to validity and reliability as outlined above. Validity refers to extent in which findings accurately reflect the real world, and reliability refers to whether the findings of the study can be replicated. Construct validity refers specifically to the validity of the instruments used in the research. In this study, construct validity was established and confirmed through the literature, pilot testing, and EFAs. The literature review in Chapter 2 and the introduction of this chapter outline the reliability and validity of the MLQ 5x and CLASSE (NSSE) in other studies. Extensive reliability information has been published on the MLQ 5x (Avolio & Bass, 2004; Bass & Riggio, 2006). While no published reliability figures were available for the CLASSE at the time of writing, over half of the questions on the CLASSE were derived from the NSSE, which has extensive reliability information available by the NSSE's authors and in peer-reviewed literature (Kuh, 2009). The NSSE has high reliability on its subscales (Kuh, 2009). Cronbach's alpha and

average inter-item correlations were used to establish the reliability of all scales on the MLQ 5x and CLASSE rated by students and instructors in this study, and they showed results in acceptable ranges (see paragraphs to follow). The discussion of construct validity for this research begins with the pilot study.

Pilot study. In this study, a pilot test was conducted in the Winter of 2015 with former dual-credit students (*n = 40*) and instructors (*n =9*) at one of the post-secondary college sites in Ontario to help establish the construct validity of the MLQ 5x and CLASSE in the context of this study. Ethical permission was granted from the college site. Ethical approval was not needed from the school boards because all piloting students were over the age of 18 and no longer high school students. Pilot dual-credit students and instructors were recruited by word-of-mouth from all disciplines (trades, arts, business, technology, etc.) and included those involved in both academic and vocational dual credits. The former dual-enrollment students came from several post-secondary institutions and from dual-credit courses with different delivery models (e.g., college-delivered, high school-delivered, team-taught, etc.) and types of instructors (e.g., college and/or high school). Pilot participants were asked to comment on the wording of the questions on each survey, and they were asked to identify any unclear or ambiguous questions. No such questions were identified. One former dual-credit cooking student and one former carpentry dual-credit student said that the CLASSE was somewhat more geared towards academic courses rather than vocational (trades) courses, but they still felt that most of the questions were applicable to them and that the study should proceed. One instructor struggled with interpreting the scales on the MLQ 5x to rate his dean. After

reading the questions to the instructor aloud, the instructor was able to read them to himself and answer the questions without assistance. Another eight former dual-enrollment instructors piloted the MLQ 5x to rate their dean or principal, and they had no issues with the survey. Thus, the pilot was therefore deemed a success with evidence that MLQ 5x and CLASSE had sufficient construct validity to proceed with further reliability and validity analysis in the full study.

Internal validity. Internal validity refers to the extent that a causal conclusion in a study is warranted. Care was taken in this study to ensure that major variables were carefully chosen and computed according to instrument scoring manuals and established psychometric principles (e.g., parsimony, guidelines for EFAs such as maximizing high-rotated primary factor loadings for items and minimizing item cross loadings, etc.). Reliability (Cronbach's alpha and average inter-item correlations) and validity analyses were performed to ensure all major study variables were in acceptable ranges for research. Data was screened for univariate and multivariate outliers and normality.

Scoring of the MLQ 5x. Scoring on each of the five transformational leadership subscales followed the MLQ 5x-scoring manual after EFAs revealed that 19 of the 20 transformational items from the MLQ 5x loaded onto the same factor (see final factor loadings in Table 7). Each transformational subscale (Idealized Influence Attributed Charisma, Idealized Influence Behaviours, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration) contained four items. To generate a score on the subscale, the respondent had to provide answers to at least three of the four items. These answers were then averaged over the three or four questions answered. Avolio

(MLQ co-author) has stated, “There are lots of opinions on how to deal with [missing data on the MLQ 5x]. I would generally say if you have 3 items for a scale, keep that data and plug in the mean [of those 3 for the 4th item], as that won’t change your results” (Mind Garden Inc., 2015). Avolio’s suggestion is mathematically equivalent to averaging over three items instead of four items if one item on a scale is missing. If more than one item was missing from a subscale in this research, the entire subscale was treated as missing. After possible scores on each of the five transformational subscales was computed for each student and teacher respondent, subscale scores were aggregated to the classroom and school level by averaging all responses for a particular instructor and administrator respectively. Thus, each teacher and principal/dean received average subscale scores on each of the five transformational subscales based on the responses of their students and teachers respectively. This scoring method maximized respondent input on transformational measures for their leaders. For example, a respondent could contribute scores for inspirational motivation and idealized consideration for their leader even if there was not enough scorable data on the other three transformational subscales. The five transformational subscales on the MLQ 5x (as specified by the MLQ 5x scoring manual) were then summed to generate overall transformational leadership scores for each teacher and each administrator in the study (see Tables 19 and 20). Cronbach’s alpha was computed to be .919 for the items used to compute the summative score for the students’ perceptions of their teachers’ transformational leadership style and .968 for the items used to compute the summative scores for the instructors’ perceptions of their

administrators' transformational leadership style (see Tables 19 and 20 for more information about major study variables)—both in the acceptable range for research.

Scoring of the CLASSE. In terms of the CLASSE, extensive psychometric work through EFAs was conducted to determine a subset of questions that adequately measured student engagement with high-rotated primary factor loadings across latent engagement factors and low cross loadings. This is standard practice in psychometrics when validating a tool ("Exploratory Factor Analysis," 2015; Osborne & Costello, 2005). Parsimony requires that the engagement scale uses the fewest number of items to generate a combined score—otherwise the Cronbach's alpha can be falsely inflated. The final student-engagement scale for each student in the 2-level and 3-level HLM analyses consisted of 18 items taken from the CLASSE (See Table 14 for these items and their final factor loadings). Average student-engagement scores for participants were generated as long as the student participants had answered at least 15 (approximately 83%) of the 18 engagement items. The scoring policy in this research is stricter than the National Survey of Student Engagement (NSSE)'s scoring guidelines for computing benchmarks (subscales). The NSSE scoring guidelines for the student-engagement benchmark state, "A mean was calculated for each student so long as they had answered three-fifths of the items in any particular benchmark" (IUCPR, 2015b). If more than three items were missing, the average student-engagement score for that particular student was treated as missing data. The strict scoring policies help reinforce the internal and external validity of this study. The Results Chapter further details the psychometric work to establish the validity of the student engagement score in the hierarchical linear models in more depth.

Cronbach's alpha was computed to be .816 for the final subscale of 18 items selected to measure student engagement in the 2-level and 3-level hierarchical linear models (see Tables 19 and 20 for more information about major study variables).

External validity. External validity refers to the extent to which research can be generalized to the entire population. As mentioned in the sampling description in this chapter, this research uses convenience, cluster, and quota sampling, which may affect generalizability of results. Despite the use of convenience sampling, care was taken to select research sites that reflect socio-economic, ethic, urbanity, and achievement diversity. Sites were pseudo-randomly selected by convenience using a GIS. This should help improve the extent to which results can be applied to other dual-credit programs.

Reliability. As mentioned in the overview of this section, all instruments used in this study displayed acceptable reliability. Cronbach's alphas and average inter-item correlations were computed for the students' perceptions of their teachers' leadership styles on each of the nine dimensions of the MLQ 5x and for the teachers' perceptions of their administrators' leadership styles on each of the nine dimensions of the MLQ 5x with acceptable results (see Tables 17–18 and the section to follow). Cronbach's alphas were also computed for the summative transformational teacher scores, the summative transformational principal/dean scores, and for the 18 items chosen to generate the average student-engagement scores for use in the hierarchical linear models. All reliability measures were within acceptable ranges for research. Specific details of all reliability measures and major study variables are given in the paragraphs below and in Tables 17–20.

MLQ 5x reliability when used by students. For the students' perceptions of teacher leadership, Cronbach's alpha for the MLQ 5x was found to be .76, .60, .78, .75, and .63 for the five transformational subscales (Idealized Influence Attributed Charisma, Idealized Influence Behaviours, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration), .74 and .73 for the two transactional subscales (Contingent Reward and Active Management-by-Exception), and .64 and .73 for the two passive-avoidant subscales (Passive Management-by-Exception and Laissez-faire), respectively (Table 17 for reliability information). Cronbach's alphas in the range .60 – .70 are generally considered acceptable (Gliem & Gliem, 2003). Average inter-item correlations were found to be .53, .33, .56, .49, and .40 for the five transformational subscales, .50 and .44 for the two transactional subscales, and .37 and .51 for the two passive-avoidant subscales for the students' perceptions of teacher leadership respectively. Average inter-item correlations in the range .30 – .60 are acceptable (G. Tohver, personal communication, July 29, 2015). Thus, all of these internal consistency measures show reasonable reliability for the MLQ 5x's survey scales when used by students to rate their dual-credit instructors' leadership in this study.

MLQ 5x reliability when used by teachers. For the teachers' perceptions of administrator leadership, Cronbach's alpha was found to be .82, .82, .90, .92, and .83 for the five transformational subscales, .88 and .74 for the two transactional subscales, and .82 and .81 for the two passive-avoidant subscales respectively (see Table 18 for reliability information). Average inter-item correlations were found to be .64, .60, .74, .74, and .64 for the five transformational subscales, .67 and .52 for the two transactional

subscales, and .57 and .58 for the two passive-avoidant subscales for the teachers' perceptions of administrator leadership respectively. Thus, Cronbach's internal consistency measures and the average inter-item correlations also showed acceptable reliability for the MLQ 5x's survey scales when used by dual-credit instructors to rate their administrators' leadership.

CLASSE reliability when used by students. For the student-engagement survey, Cronbach's alpha was computed to be .816 for the 18 items selected to generate the average student-engagement scores in this study. The average inter-item correlation was found to be .246 for the 18 items (see Tables 19 and 20 for reliability information). Reliability measures were not generated for the four subscales (factors) comprising the final student-engagement scores because only the overall average student-engagement scores were used in level 1 of the 2-level and 3-level hierarchical linear models. While the average inter-item correlation was slightly below the desirable .30, Cronbach's alpha (.816) indicated reasonable reliability for this measure, so it was used in the 2-level and 3-level hierarchical linear models.

Data Analysis

Data cleaning. Once data collection was complete, student and instructor survey responses were transferred from paper-based surveys into Qualtrics, a secure online survey platform. Data went through three verifications–once, at the time of data entry and then two subsequent verifications. Administrative data entry errors were corrected. Unidentifiable responses were coded as missing data. After verification was completed, the data set was exported as an SPSS data file for additional verification and cleaning.

To prepare for the HLM analyses, students' perceptions of their teachers' transformational leadership on each of the five transformational subscales was aggregated to the classroom level by averaging the data from all students within each classroom on each of the five subscales. Teachers' perceptions of their administrators' transformational leadership style on each of the five transformational subscales was aggregated to the school-level by averaging all data from all teachers within each school or college department on each of the five subscales. Once data on each of the five transformational subscales was averaged over classes and schools respectively, the five subscales were then summed to generate a total transformational leadership score for each teacher and administrator respectively. Missing or incorrect responses for covariates in the HLM analyses (e.g., the student's state/province, type of dual-credit teacher, location of dual-credit course, etc.) were imputed or corrected by hand if possible. Missing data on the transformational subscales and student-engagement scale was handled as previously described. Once the final verification and cleaning was completed in SPSS, the data files were exported to a format readable by the Mplus 7.31 and HLM 7.0 statistical software.

Handling of missing data for the MLQ 5x student data set. Approximately 93% of all datum were present in the overall student leadership data set (e.g., students' perceptions of their teachers' leadership styles). All of the leadership variables had at least one missing value, and approximately 34% of cases had at least one missing datum. Eight students submitted the MLQ 5x completely blank. Listwise deletion was used to remove the eight blank surveys from the data set before performing the EFA by the Mplus 7.31 statistical software, resulting in 94% of the entire data set present with only

five variables containing more than 10% missing data. No variables contained more than 12.4% missing data when the eight surveys were removed. Weighted Least Squares Estimation with Missing Values (WLSMV) was used by Mplus 7.31 to handle the remaining missing data in the EFA on the student leadership data set.

Handling of missing data for the CLASSE student data set. Approximately 99% of all datum were present in the CLASSE data set in the Part I (Engagement Activities), Part II (Cognitive Skills), Part III (Other Educational Practices), and Part IV (Class Atmosphere) sections of the survey. All of the engagement variables from Parts I–IV had at least one missing value, and approximately 20% of cases had at least one missing datum. No variables contained more than 5.3% missing data, and most contained only 1–2% missing data. WLSMV was used by Mplus 7.31 to handle the remaining missing data in the EFAs on the student-engagement data. Covariate data from Part V will be addressed in the paragraph below because it was used in the HLM analyses and not in the EFAs on the student engagement data set.

Handling of missing data for the HLM analyses (including teacher leadership data). When conducting the 2-level HLM analysis with student and classroom indicators, the level-1 data file had 99.21% of data present. At level 1 (the student level), 99.41% of covariate data (e.g., data measuring whether the student was in grade 12 and whether the student had taken multiple dual credits) was present, and only 1.2% of average student-engagement scores were missing. Over 98% of cases had complete data at level 1 for the 2-level HLM analysis. When conducting the 3-level HLM analysis with student, classroom, and school indicators, the level-1 data file had 98.96% of the data present. At

level 1 (the student level), 99.1% of the covariate data (e.g., data measuring whether the student had taken multiple dual credits) was present. The grade-level (e.g., grade 12 or not) indicator was not used in the 3-level HLM model (see Tables 21 and 22 for theoretical 2-level and 3-level hierarchical models). The number of missing student-engagement scores remained the same in the 3-level HLM model as the 2-level HLM model. In the level-2 data file, there was no missing data for either the 2-level or 3-level HLM analyses. All data was present for all cases for the type of dual credit (academic or vocational), the contrast variable representing the type of dual-credit teacher (high school or post-secondary), and students' perceptions of their dual-credit teachers' transformational leadership. In the level 3 file, only one case was missing an administrators' transformational leadership score. This case was linked to ten students at level 2. The HLM 7.0 software used restricted maximum likelihood to handle missing data at level 1 of both the 2-level and 3-level HLM analyses and listwise deletion to handle missing data at levels 2 and 3. Thus, the case with missing data at level 3 caused a deletion of 10 attached records at level 2 in the 3-level hierarchical model. As a result, the 2-level hierarchical model was conducted on a total of 663 complete records (98.1% of total student sample) and the 3-level hierarchical model was performed on 653 complete records (96.6% of total student sample).

Data screening for the MLQ 5x student data set. Assumptions for the EFA were checked for the students' perceptions of their teachers' leadership styles. All variables on the MLQ 5x rated by students were measured on the same metric ordinal scale (of 0, 1, 2, 3, or 4) from a homogenous sample of dual-credit students. Skewness

and kurtosis values were between –2.0 and +2.0 for all variables except one that displayed kurtosis of approximately 2.52 (see item IC15 in Table 3). These results indicate that these categorical variables generally follow a normal distribution (Bachman, 2004). Categorical variables are more likely to display some skewness and kurtosis compared to continuous or functionally continuous variables (G. Tohver, personal communication, August 19, 2015). For this reason, the variable displaying slight kurtosis was left in the analysis for theoretical reasons because it referred to the coaching and teaching role of the leader—fundamental in an educational leadership context.

The student leadership data was screened for univariate and multivariate outliers. Using Tukey's (1977) outer-fence univariate outlier rule ($Q_1 - 3\times(Q_3-Q_1)$; $Q_3 + 3\times(Q_3-Q_1)$), *none* of the variables contained high or low univariate outliers. Tukey's outer-fence rule was chosen to be conservative in making decisions about outliers, since the items on the MLQ 5x rated by students were measured on a 4-point ordinal scale and followed the normal distribution. Ordinal variables are more likely to display some skewness and kurtosis as compared to continuous or functionally continuous variables which could potentially yield more univariate outliers. Using Tukey's outer-fence outlier rule, there were *no* extreme upper or lower univariate outliers in the student-leadership data. Thirty-eight of the 39 items (categorical variables) on the MLQ 5x rated by students followed the normal distribution, so use of Tukey's outer-fence rule is justifiable.

The full MLQ 5x data rated by students was screened for multivariate outliers using Mahalanobis's distance test at the $\alpha = .001$ level. Mahalanobis's distance "measures the distance of a case from the centroid (multidimensional mean) of a

distribution, given the covariance (multidimensional variance) of the distribution" (Schwab, 2002). Thirty-two cases, which represented less than 5% of the data set, were identified as being possible multivariate outliers using Mahalanobis's distance. The majority of these cases just exceeded the critical $\chi^2(39)$ value of 72.055 at the $\alpha = .001$ level for a significant result on Mahalanobis's distance test (see Figure 9). Further analysis using Cook's Distance, which measures the effect of deleting a particular case, revealed only one distinct potential multivariate outlier (see Figure 10). This case represented less than 0.15% of the entire data set. These potential multivariate outlier cases were not the result of data-entry errors, and they represented cases sampled from the same homogenous population of dual-credit students. Additionally, MLQ 5x data was captured on a 5-point ordinal scale, so multivariate outliers were far less extreme than what might be found with continuous data. The factor analysis on the MLQ 5x student data was ultimately performed with and without the 32 potential multivariate outliers, and there was no change in the overall factor structure in either model (see Tables 6 and 23 for comparison). For these reasons, all cases were ultimately retained for consideration in the factor analysis discussed in this research (i.e., all discussions related to student MLQ 5x data refer to the full data set). When the subset of 20 items measuring teachers' transformational leadership (as rated by students on the MLQ 5x) for use in HLM was scanned for multivariate outliers using Mahalanobis's distance test at the $\alpha = .001$ level, 29 cases slightly exceeded the critical $\chi^2(20)$ value of 45.315 at the $\alpha = .001$ level for a significant result on Mahalanobis's distance test. Further analysis using Cook's Distance revealed only two potential multivariate outliers. Moreover, when the 20 items were

aggregated to generate each teachers' transformational leadership score for use in HLM, there were *no* multivariate outliers identified using Mahalanobis's distance test (see the section entitled "Assumption testing for HLM analyses" to follow for more detail). Thus, these potential multivariate outlier cases were retained for HLM. EFAs and HLM demand large sample sizes, so it was pertinent to retain as many cases as possible as long as it could be theoretically justified.

Data screening for the CLASSE student data set. Assumptions for the EFA on the student engagement data set were checked. All variables on the CLASSE were measured on metric ordinal scales with four options (1, 2, 3, or 4) from a homogenous sample of dual-credit students. Skewness and kurtosis values were between –2.0 and +2.0 for all variables except for item #16 which displayed normal kurtosis but slight positive skewness at 2.69 (See Table 9). Categorical variables are more likely to display some skewness and kurtosis compared to continuous or functionally continuous variables (G. Tohver, personal communication, August 19, 2015). Question #16 asked students whether they had participated in a community-based project in their dual-credit course. Participation in such community-based projects is an essential part of deeper or higher-order engagement in school (Finn, 1989), so the item was therefore left in the analysis for theoretical reasons. Nearly 30% of students participated in at least one community-based project (see Table 9), showing the importance of this variable. Item #16 was not ultimately used in the final scale to generate average student-engagement scores in the 2-level and 3-level HLM analyses, but it was left in the EFA analysis for theoretical purposes.

The full CLASSE data was screened for univariate and multivariate outliers. Using Tukey's (1977) outer-fence univariate outlier rule ($Q_1 - 3\times(Q_3-Q_1)$; $Q_3 + 3\times(Q_3-Q_1)$), *no* variables contained high or low univariate outliers. Tukey's outer-fence outlier rule was chosen to be conservative in outlier detection since the student-engagement data was measured on a 4-point ordinal scale, and the items on the CLASSE rated by students followed the normal distribution. Thirty-seven of the 38 items (categorical variables) on the CLASSE rated by students followed the normal distribution, so Tukey's outer-fence rule was justifiable.

The full CLASSE data rated by students was screened for multivariate outliers using Mahalanobis's distance test at the $\alpha = .001$ level. Four cases were identified as being possible multivariate outliers. The four cases were close to the critical $\chi^2(38)$ value of 70.703 at the $\alpha = .001$ level for a significant result on Mahalanobis's distance test with distance values of 72.3, 73.2, 87.2, and 87.3. These cases (4 of 676) represented less than 1% of the entire CLASSE data set. Furthermore, a visual inspection of a scatterplot comparing Cook's distance to centred leverage values revealed only one potential multivariate outlier. For these reasons, all cases were therefore retained for consideration in the CLASSE factor analysis. When the final 18 items chosen to measure student engagement (as rated by students on the CLASSE) for use in HLM were scanned for multivariate outliers using Mahalanobis's distance test at the $\alpha = .001$ level, only *one* case exceeded the critical $\chi^2(18)$ value of 42.312 at the $\alpha = .001$ level for a significant result on Mahalanobis's distance test with a distance value of 47.433. This case (1 of 676) represented less than 0.15% of the entire data set. Further analysis Cook's Distance

revealed only two potential multivariate outliers. Moreover, when the 18 items were averaged to generate each students' engagement score for use in HLM, there were *no* multivariate outliers identified using Mahalanobis's distance test (see the section on "Assumption testing for HLM analyses" to follow for more detail). Therefore all cases were retained for use the in the HLM analyses.

Data screening for the MLQ 5x teacher data set. Although an EFA was not performed on the teacher leadership data set due to a small instructor sample size (n = 43), teachers' perceptions of their administrators' leadership was screened for collinearity, normality, and univariate and multivariate outliers for completeness.

All of the 39 items rated by teachers correlated at least .3 with at least one other item (see Table 16), suggesting reasonable factorability if a larger sample size had been available. One pairs of items (i.e., EE42 and EE44) displayed collinearity with a correlation greater than 0.90 (see Table 16), but these MLQ 5x items were *not* used in any EFA or the HLM analyses, so this was not an issue.

All variables on the MLQ 5x rated by teachers were measured on the same metric ordinal scale (of 0, 1, 2, 3, or 4) from a homogenous sample of dual-credit instructors. Skewness and kurtosis values were between –2.0 and +2.0 for all variables except one that displayed slight kurtosis of approximately 2.06 (see item LF7 in Table 15). These results indicate that these categorical variables generally follow a normal distribution (Bachman, 2004). Categorical variables measured on likert scales tend to display more skewness and kurtosis than continuous or functionally-continuous variables.

The teacher leadership data was screened for univariate and multivariate outliers. Using Tukey's (1977) outer-fence univariate outlier rule ($Q_1 - 3\times(Q_3-Q_1)$; $Q_3 + 3\times(Q_3-Q_1)$), *none* of the items rated by teachers on the MLQ 5x contained high or low univariate outliers. Tukey's outer-fence outlier rule was chosen to be conservative in outlier detection since the items on the MLQ 5x rated by teachers were measured on a 4-point ordinal scale and all items followed the normal distribution.

The full MLQ 5x data rated by teachers was screened for multivariate outliers using Mahalanobis's distance test at the $\alpha = .001$ level. No cases exceeded the critical value of $\chi^2(39)$ value of 72.055 at the $\alpha = .001$ level for a significant result on Mahalanobis's distance test. When the subset of 20 items measuring administrators' transformational leadership (as rated by teachers on the MLQ 5x) for use in HLM was scanned for multivariate outliers using Mahalanobis's distance test at the $\alpha = .001$ level, no cases exceeded the critical $\chi^2(20)$ value of 45.315 at the $\alpha = .001$ level for a significant result on Mahalanobis's distance test. Thus, all teacher cases were therefore retained for consideration in the HLM analyses.

EFA assumption testing for MLQ 5x student data set. The minimum amount of data for the factor analysis on the student leadership data set was present with a final sample size of 668 students. Comrey and Lee (1992) have stated that a sample size of 500 or more is very good for factor analysis, and they have urged researchers to use at least 500 sample participants. The data nearly satisfies the 20 : 1 subjects-to-variables ratio specified by Hair, Anderson, Tatham, and Black (1995) for factor analysis, with a ratio of 17 : 1. All of the 39 items correlated at least .3 with at least one other item (see Table 4),

suggesting reasonable factorability. In addition, no pairs of items had collinearity with correlations greater than 0.90 (see Table 4). The factorability of all 39 MLQ 5x items was therefore considered.

EFA assumption testing for CLASSE student data set. The minimum amount of data for the factor analysis was present with a final sample size of 676 students. All of the 38 items correlated at least .3 with at least one other item (see Table 10), suggesting reasonable factorability. In addition, no pairs of items had collinearity with correlations greater than .90 (see Tables 10). The factorability of all 38 CLASSE items from Parts I–IV of the survey was therefore considered.

Assumption testing for HLM analyses. HLM is the preferred statistical technique to answer the research question for the data. HLM is "a complex form of ordinary least squares (OLS) regression that is used to analyze variance in the outcome variables when the predictor variables are at varying hierarchical levels; for example, students in a classroom share variance according to their common teacher and common classroom" (Woltman et al., 2012, p. 52). In this research, two linear hierarchical models were created—a 2-level model and 3-level model (sees Tables 21–22 for theoretical model structures and Figures 1–2 for visual representation). Due to the large sample sizes required of HLM, it was not possible to run all independent variables (covariates) in one HLM model. HLM remains the most suitable statistical tool for studying the relationship between student engagement and teacher and principal transformational leadership. Leithwood and Jantzi (2000) conducted studies that examined the impact of teacher and principal leadership on student engagement and wrote:

> Hierarchical linear modelling is the analytic technique of choice for some researchers exploring databases such as this one. For a variety of practical reasons, however, we were unable to collect our data in a way that allowed us to link the responses of individual students with their teachers, a prerequisite for HLM (p. 122).

Alternatives to HLM can introduce serious errors. Disaggregating the data (i.e., treating all data as level-1) produces errors because shared variance is no longer accounted for, assumption of independence of errors is violated, and dependencies in data remain uncorrected. Aggregating data (i.e., treating all data as level-3) means individualized variation is lost (Woltman et al., 2012). This means the researcher can only look at average classroom student engagement not individual student engagement. Woltman et al. (2012) warn that up to 80%–90% of variability due to individual differences vanishes when data is aggregated (p. 55).

HLM is "ideally suited for the analysis of nested data because it identifies the relationship between predictor and outcome variables by taking both level-1 and level-2 regression relationships into account" (Woltman et al., 2012, p. 56). HLM requires fewer statistical assumptions than other statistical methods. It can handle non-independence of observations, a lack of sphericity, missing data, small and/or discrepant group sample sizes, and heterogeneity of variance across repeated measures (Woltman et al., 2012). Effect sizes remain undistorted and the problems of disaggregating and aggregating to a single level (e.g., classroom or school) discussed above are avoided. HLM is robust enough to accommodate multiple continuous or discrete outcome variables in the same

analysis (Raudenbush & Bryk, 2002). Most importantly, the 2-level and 3-level HLM analyses in this study account for the shared variance that students in the same classroom share with each other because they have the same teacher. The 3-level HLM model also accounts for the shared variance that teachers in the same school share under the same principal or dean. Accounting for this shared variance would not be possible in a regular ordinary least squares (OLS) multiple regression model.

Thus, HLM analysis was conducted because it was the most suitable statistical technique for dealing with the student, classroom, and school effects on student engagement. The final sample size indicated adequate power for the HLM analyses ($\omega^2 \geq$ .80 for both the 2-level and 3-level hierarchical models). Screening for univariate outliers using Tukey's outer-fence rule ($Q_1 - 3\times(Q_3-Q_1)$; $Q_3 + 3\times(Q_3-Q_1)$) revealed no univariate outliers for continuous variables at levels 1, 2, or 3 (e.g., student engagement, students' perceptions of their teachers' transformational leadership, and teachers' perceptions of their administrators' transformational leadership). The level-2 binary variable, type of dual credit (academic or vocational), and the level-3 binary variable, dual-credit delivery location (high school or post-secondary institution) contained univariate outliers by Tukey's outer-fence rule due to the small number of students taking vocational (n = 82; 12.1% of total student sample) and college-delivered (n = 129; 19.1% of total student sample) dual-credit students surveyed respectively (see Table 2 for student-participant characteristics). The type of dual-credit variable was left in the 2-level hierarchical model for theoretical purposes but was removed from the 3-level model. Approximately 1 in every 8 students in this study took a vocational dual credit. The dual-credit delivery-

location variable was left in the 3-level model because of its theoretical importance. Nearly 20% of students took dual credits delivered at post-secondary institutions as opposed to high schools, and 6 of the 16 schools in the study were post-secondary institutions or departments (see Tables 2 and Tables 19–20 for student and school participant information).

Data at levels 1, 2, and 3 used in the 2-level and 3-level hierarchical models was also screened for multivariate outliers using Mahalanobis's distance test at the $\alpha = .001$ level using a critical value of $\chi^2(3) = 16.266$ for each level, and no multivariate outliers were identified. The level-1 file contained indicators of each student's grade in school (e.g., grade 12 or other), enrollment in multiple dual-credit courses, and student engagement. The level-2 file contained the type of dual credit (academic or vocational), type of dual-credit teacher (high school or post-secondary), and students' perceptions of their teachers' transformational leadership variables. The level 3 file contained the delivery location, state/province, and teachers' perceptions of their principals' or college deans' transformational-leadership variables. Skewness and kurtosis values were between -2 to +2 for all these variables except the binary type of dual-credit variable at level 2 which displayed slight skewness of -2.11 and slight kurtosis of 2.53 (see Table 19). Binary and categorical variables naturally display more skewness and kurtosis than continuous or functionally continuous variables, so these results are acceptable and reveal the data generally followed a normal distribution. Hence, the HLM analyses were conducted after performing extensive validity and reliability analyses, screening, and assumption checking on the data used.

Level of significance selected for HLM analyses. The .05 level of significance was selected to determine whether variables impacted student engagement in the 2-level and 3-level HLM analyses. Aron, Coups, and Aron (2012) write

> In general, psychology researchers use a cutoff on the comparison distribution with a probability of 5% that a score will be at least that extreme if the null hypothesis were true. That is, researchers reject the null hypothesis if the probability of getting a sample score this extreme (if the null hypothesis were true) is less than 5% . . . However, in some areas of research, or when researchers want to be especially cautious, they use a cutoff of 1% ($p < 01$). (p. 113).

Gravetter and Wallnau (2009) describe commonly used alpha levels in behavioural science research as $\alpha = .05$ (5%), $\alpha = .01$ (1%), and $\alpha = .001$ (0.1%) (p. 206). HLM demands large sample sizes when two or more levels are used (Garson, 2013, p. 37). Mattern et al. (2013) and Shaw et al. (2013) performed HLM on data sets with *hundreds* of thousands of dual-credit students. Since the sample size ($n = 676$) in this study was under 1000 students, the conservative level of $\alpha = .05$ was chosen. All data tables and numerical results present exact *p*-values when possible, so readers can draw their own conclusions if necessary.

Expected Findings

This correlational study had several expected findings. It was expected that the MLQ 5x could be used to measure students' perceptions of their dual-credit instructors' transformational leadership as confirmed through EFAs, reliability analyses, and other researchers. It was also expected that the MLQ 5x could be used to measure teachers'

perceptions of their dual-credit administrators' transformational leadership. The relative influence of principals' and teachers' transformational leadership on the relationship between grade level and student engagement *and* between enrollment in multiple dual-credit courses and student engagement was unknown before running the hierarchical models. The impact of covariate/moderators of the type of dual-credit teacher (high school or post-secondary) and dual-credit delivery location (high school or college/university) was unknown. It was theorized that the type of dual credit (academic or vocational) may not impact relationships between enrollment in multiple dual-credit courses and student engagement (Karp et al., 2007). The state/province moderator was hypothesized to impact dual-credit engagement in the HLM analyses as indicated by statistically significant slopes on student engagement across classrooms and schools (Karp et al., 2007).

Summary

This study consisted of three major components: EFAs on the student MLQ 5x leadership data set, EFAs on the student CLASSE, and 2-level and 3-level HLM analyses on the student, classroom, and school factors affecting dual-credit student engagement (see Figure 1). All analyses were supported by appropriate reliability analyses (Cronbach's alpha and average inter-item correlations). This chapter has detailed the study and addressed questions of research design, research questions and hypotheses, population and participant selection, procedures, instruments, data collection, data analyses, and expected findings. While this research used convenience sampling, it may still be applicable to other dual-enrollment programs in schools and communities with

similar urbanity, socio-economic, and ethnic profiles. School and community profiles were included to help other researchers judge whether results would be generalizable to their jurisdictions. This chapter has provided sufficient detail so that this study could be replicated with other dual-credit student and teacher populations.

Chapter 4. Results

This chapter presents study results and provides answers to all hypotheses and research questions. The main purpose of this study was to assess whether grade in school (e.g., grade 12) or enrollment in multiple dual-credit courses impacted student engagement before and after moderation by classroom- and school- level transformational leadership and dual-enrollment related variables. In this study, dual-credit students (n = 676) from 54 classes in 16 different schools in Ontario (n = 332) and New York (n = 344) completed the Classroom Survey of Student Engagement (CLASSE), a course-specific version of the National Survey of Student Engagement (NSSE), regarding their dual-credit courses. They also completed the revised Multifactor Leadership Questionnaire (MLQ 5x) to rate their dual-credit instructors' transformational leadership. The dual-credit instructors (n = 43) completed the MLQ 5x to rate their principals' or college deans' transformational leadership. Schools were selected by convenience, cluster, and quota sampling. Exploratory Factor Analyses (EFAs) were used to establish the construct validity of both the MLQ 5x and CLASSE with dual-enrollment students—a new context for both instruments. The MLQ 5x was designed for use in business, and there are discrepancies in the authors' proposed underlying factor structure for the instrument (i.e., number of subscales and leadership dimensions measured) (Antonakis et al., 2003; Avolio et al., 1999; Schedlitzki & Edwards, 2014). The CLASSE was designed to measure post-secondary students' engagement in courses delivered in colleges and universities as opposed to dual-credit students' engagement in courses taught in high schools. At the time of writing, no published psychometric work (e.g.,

factor analyses, reliability analyses such as Cronbach's alpha) or scoring manual existed for the CLASSE. Thus, it was necessary to conduct EFAs, as opposed to confirmatory factor analyses, on both the MLQ 5x and CLASSE student data to examine each instrument's respective construct validity before proceeding with the 2-level and 3-level hierarchical models that relate leadership within dual-credit programs to student engagement in the context of covariates (see Figures 1–3 for study overview).

This chapter is organized into three major sections that address the study's three main research questions and hypotheses. The first major research question was, "Using EFAs and reliability analyses, is the MLQ 5x a suitable tool for measuring students' perceptions of their teachers' transformational leadership so teachers' scores could be used in hierarchical linear modelling (HLM)? If not, is there a combination (subset) of questions from the MLQ 5x that can measure students' perceptions of their dual-credit instructors' transformational leadership with acceptable validity and reliability?" The MLQ 5x was determined through EFAs to be a suitable and reliable tool for measuring students' perceptions of their teachers' transformational leadership. The second major research question was, "Using EFAs and reliability analyses, is the CLASSE a suitable instrument for measuring students' engagement in their dual-credit courses so students' engagement scores could be used in HLM? If not, is there a combination (subset) of questions from the CLASSE that could measure student engagement with acceptable validity and reliability?" A subset of 18 items from the CLASSE was determined through EFAs to be a valid and reliable tool for measuring dual-enrollment students' engagement in their dual-credit classes. The final research question was, "Does the student's grade in

school (grade 12 or other) or enrollment in multiple dual-credit courses impact student engagement before and after moderating for the following classroom-level variables: students' perceptions of their teachers' transformational leadership style (as measured by the MLQ 5x), type of dual credit (academic or vocational), and type of dual-credit teacher (high school or post-secondary); and before and after moderating for the following school-level variables: dual-credit delivery location (i.e., high school or post-secondary institution), school location (New York or Ontario), and teachers' perceptions of their administrators' transformational leadership style (as measured by the MLQ 5x)?" In the 2-level HLM analysis, being a senior twelfth-grade student did not significantly impact student engagement (initially $p = .391$) before or after moderation by the type of dual credit ($p = .055$), type of dual-credit teacher ($p = .094$), and students' perceptions of their teachers' transformational leadership ($p = .241$). Enrollment in multiple dual-credit courses did not have a significant impact on engagement (initially $p = .080$) before moderation by type of dual-credit teacher and teachers' transformational leadership, but it had a significant impact after moderation by these variables ($p = .012$ and $p = .018$ respectively). The type of dual credit had no impact on the relationship between enrollment in multiple dual-credit courses and student engagement in the 2-level model ($p = .398$). In the 3-level HLM analysis, no school-level moderators (e.g., principals'/deans' transformational leadership, dual-credit delivery location, etc.) impacted the relationship between enrollment in multiple dual-credit courses and student engagement; these findings held before or after additional moderation by teachers' transformational leadership. This chapter describes these results with full statistical

terminology and presents significant and non-significant results in full. Together these results answer the central research question and sub-questions.

Findings

Participant characteristics. Participants in this study included 676 students (332 Ontario, 344 New York) and 43 teachers from 54 classrooms in 16 schools in 7 communities (see Table 2 for student-participant characteristics and Tables 19–20 for teacher, classroom, and school characteristics). Nearly 16% of students were enrolled in Advanced Placement (AP) courses, 38% in International Baccalaureate (IB) courses, and 46% in post-secondary-based (college/university) dual-credit courses. The majority of these dual credits were delivered in high schools (80.9%) as opposed to post-secondary institutions (19.1%). High school teachers (79.3%) delivered the majority of these dual credits, and the remainder were taught by post-secondary instructors (17.0%) or team-taught by high school and post-secondary instructors (3.7%). Approximately 88% of the dual credits were academic in nature and 12% were vocational (trades). The students and instructors in these dual-credit courses comprised all genders. All dual-credit students surveyed were between the ages of 16 and 21 in both New York and Ontario. Gender was not collected as an explicit variable because it was not collected in similar quantitative student-engagement research (Leithwood & Jantzi, 1999). The student's grade in school (e.g., grade 9, grade 10, etc.) was a similar variable to age so it was not collected in this study.

EFA results on student responses on the MLQ 5x. An EFA (1 to 4 factors) was performed using Mplus 7.31 (WLSMV estimation, oblique geomin rotation) on the full

data set to determine how many factors underlie the indicators on the MLQ 5x (see Table 3 for specific item frequencies) when used by students to rate their teachers' leadership styles. An oblique factor rotation was chosen as opposed to an orthogonal solution due to predicted correlations between leadership styles (factors). Results from the EFA indicate a 3-factor structure best represented the shared variance structure of the 39 chosen indicators from the MLQ 5x in this study ($\chi^2(627) = 1740.675$, $p <. 001$, RMSEA = .052 (90% CI .049;.054), $p(<.05) = .183$, SRMR = .042, CFI/TLI = .962/.955; see Table 5 for 1-factor to 4-factor model fit information). Fit indices for the 3-factor model were acceptable. Root Mean Square Error of Approximation (RMSEA) is an absolute fit measure that bases model goodness-of-fit on the ‘‘discrepancy between the model and the data per degree of freedom for the model’’ (Fabrigar, Wegener, MacCallum, & Strahan, 1999, p. 280). Acceptable maximum RMSEA values range from .05 to .08 with smaller RMSEA values indicating better fit (Kenny, 2014), so .052 was satisfactory. The Standardized Root Mean Square Residual (SRMR) measures the mean absolute value of covariance residuals and was below the acceptable .10 for the 3-factor model (University of Massachusetts Department of Psychology, 2013). Smaller SRMR values are preferable, so .042 for the 3-factor model indicates good model fit on this index. The Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) were both in the acceptable range over .90 for the 3-factor model—showing substantially better fit than the lower-order models (Kenny, 2014; see Table 5). CFI/TLI fit indices above .95 indicate very good model fit, so the 3-factor CFI/TLI indices of .962/.955 can be considered excellent. The lower-order 1-factor solution had unacceptable model fit indices ($\chi^2(702) =$

6555.343, p <. 001, RMSEA = .112 (90% CI .109; .114), p(<5%) < .001, SRMR = .117, CFI/TLI = .798/.787; see Table 5), so it was not considered. While the 2-factor solution had acceptable model fit indices (χ^2(664) =2369.027, p <. 001, RMSEA = .062 (90% CI .059; .065), p(<5%) < .001, SRMR = .052, CFI/TLI = .941/.934; see Table 5) and some theoretical support (Schedlitzki & Edwards, 2014), six items had primary loadings below .50 (items II(B)6 (B/β = .379, p < .001), IC29 (B/β = .454, p < .001), MBEA22 (B/β = .493, p < .001), MBEA24 (B/β = .497, p < .001), MBEP17 (B/β = .372, p < .001), and LF7 (B/β = .492, p < .001); see Table 8 for loading patterns for all items across the two factors). In general, rotated factor loadings below .50 are considered weak and should be avoided if possible ("Exploratory Factor Analysis," 2015; Osborne & Costello, 2005). In the 3-factor solution with improved model fit indices, only three items had primary loadings below .50 (items II(B)6 (B/β = .362, p < .001), MBEA4 (B/β = .490, p < .001), and MBEA17 (B/β = .334, p < .001); see Table 6 for item loading patterns onto the three factors). Thus, the 3-factor solution has more items with loadings greater than .50 than the 2-factor solution. Both the 2-factor and 3-factor models displayed some cross-loading items, but the 3-factor solution generally showed larger gaps between primary and cross loadings (see Tables 6 and 8). The 4-factor solution had better fit indices (χ^2(591) = 1400.565, p <. 001, RMSEA = .045 (90% CI .042; .048), p(<5%) = .995, SRMR = .036, CFI/TLI = .972/.965; see Table 5) than both the 2-factor and 3-factor models, but no items had strong primary loadings on the fourth factor (see Table 7 for summary of 4-factor loadings), so the 4-factor model was discarded. Since the goal of EFA is to determine the smallest number of factors that adequately explain the maximum amount of

variability in the data, no higher-order factor solutions were therefore considered. Thus, the 3-factor solution was preferred because of its acceptable fit indices, strong primary item loadings over .50 with minimal cross loadings across factors for most items (see Table 6), and previous theoretical support (see discussion to follow). The scree plot also showed the levelling off of eigenvalues after three factors, indicating a 3-factor solution (see Figure 5).

It is clear from Table 6 that three factors emerge from the EFA: transformational + transactional contingent reward (T/CR; Factor 1), passive-avoidant (PA; Factor 2), and transactional active-management-by-exception (MBEA; Factor 3) leadership. Using the loading cutoff of .5, Factor 1 was indicated by all items related to transformational leadership except item II(B)6. All items related to transactional contingent reward leadership and followers' extra effort also had their strongest primary loadings (all above .50) on Factor 1. Factor 2 was indicated by all items related to transactional passive-management-by-exception and non-transactional laissez-faire leadership. These two leadership styles comprise PA leadership (Avolio & Bass, 2004). All items indicating Factor 2 had primary loadings of .50 or greater, except items II(B)6 ($B/\beta = .362$, $p < .001$) and MBEP17 ($B/\beta = .334$, $p < .001$) which had significant weak (rotated) primary loadings on this factor. Factor 3 was represented by all items related to transactional active-management-by-exception. Primary loadings were above .50 for all items on this factor except item MBEA4, which was very close to the .50 primary loading threshold ($B/\beta = .490$, $p < .001$).

A significant moderate positive correlation between T/CR and MBEA was observed ($r(666) = .434$, $p < .001$). There was a significant moderate negative correlation between T/CR and PA leadership ($r(666) = -.315$, $p < .001$). There was a negative correlation between MBEA and PA leadership, but it was not significant ($r(666) = -.080$, $p = .502$). These results indicate that the more optimistic leadership styles, T/CR and MBEA leadership, are positively related to each other. The most optimistic leadership styles (T/CR) are inversely correlated with the more negative PA leadership style.

EFA results on student responses on the CLASSE. An EFA (1 to 4 factors) was performed using Mplus 7.31 (WLSMV estimation, oblique geomin rotation) on the full data set to determine how many factors underlie the indicators on Parts I–IV of the CLASSE (see Table 9 for specific item frequencies) and their factor structure. An oblique factor rotation was chosen as opposed to an orthogonal solution due to predicted correlations between facets of student engagement (factors). Results from the EFA indicate a 6-factor structure best represented the shared variance structure of the 38 indicators from the CLASSE in this study ($\chi^2(490) = 1199.852$, $p <. 001$, RMSEA = .046 (90% CI .043;.050), $p(<.05) = .967$, SRMR = .041, CFI/TLI = .939/.913; see Table 11 for 1-factor to 6-factor model fit information). Despite the acceptable model fit indices, primary item loadings were well below the desired .50 for several items (e.g., items facgrad (B/β = .280, $p < .001$), oocideas (B/β = .307, $p = .001$), memorize (B/β = -.258, $p < .001$), etc.; see Table 12 for item loading patterns across all six factors). As mentioned previously, rotated factor loadings below .50 are considered weak and should be avoided if possible ("Exploratory Factor Analysis," 2015; Osborne & Costello, 2005). For this

reason, further psychometric work was completed to determine a subset of CLASSE items with low cross loadings, higher primary loadings, and acceptability reliability. The primary item loading cut-off for each factor was eventually relaxed to .40 (as compared to the .50 used for the MLQ 5x data rated by students), because the CLASSE has undergone much less psychometric validation than the MLQ 5x. Rotated loadings *below* .40 are very weak and were avoided; some rotated factor loadings between .40 – .50 were unavoidable and all attempts were made to minimize them.

As a first attempt to find an acceptable subset of CLASSE items with acceptable psychometric properties, an EFA (1 to 4 factors) was performed on the items from Kuh et al.'s (2008) Educationally Purposeful Activities scale that appear on the CLASSE. Results from the EFA performed by Mplus 7.31 (WLSMV estimation, oblique geomin rotation) indicate a 4-factor structure best represented the shared variance structure of the educationally purposeful activities indicators from the CLASSE in this study ($\chi^2(62) = 209.442$, $p <$. 001, RMSEA = .059 (90% CI .051;.068), $p(<.05) = .040$, SRMR = .042, CFI/TLI = .959/.921; see Table 11 for 1-factor to 6-factor model fit information). Again, despite the acceptable fit indices, several items had primary loadings below the desired .40 cut-off (items tutor ($B/\beta = .344$, $p < .001$), clunprep ($B/\beta = -.294$, $p < .001$, and commproj ($B/\beta = .278$, $p = .002$); see Table 13 for item loading patterns across the four factors). Due to the low primary loadings for items from the Educationally Purposeful Activities scale, it was not selected to generate average student-engagement scores in the 2-level and 3-level hierarchical models.

Thus, the researcher started with the full set of 38 items from Parts I–IV of the CLASSE and performed many EFAs by choosing different combinations of items from the survey. Items were added and removed manually from the EFA analysis until the following criteria was met as suggested by literature ("Exploratory Factor Analysis," 2015; Osborne & Costello, 2005): all selected CLASSE items had high-rotated primary factor loadings greater than .40, minimal cross loadings of no more than .30 on secondary factors, and a spread of at least .30 between rotated primary and cross factor loadings. Additionally, a factor had to be indicated by at least two items. The final EFA performed by Mplus 7.31 (WLSMV estimation, oblique geomin rotation) as part of this analysis revealed a 4-factor solution ($\chi^2(87) = 285.420$, $p <$. 001, RMSEA = .058 (90% CI .051;.066), $p(<.05) = .037$, SRMR = .036, CFI/TLI = .964/.937; see Table 11 for 1-factor to 4-factor model fit information) for the final subset of 18 items from all sections of the CLASSE. In the 4-factor solution for these 18 items, all items had primary loadings greater than .40, and only three of the 18 items had primary loadings slightly below .50 (items classgrp (B/β = .401, $p < .001$), initideas (B/β = .491, $p < .001$), and email (B/β = .468, $p < .001$); see Table 14 for item loading patterns across the four factors). None of the 18 items displayed cross loadings above .30 or gaps of *less* than .30 between primary and cross loadings (see Table 14). Since the subset of 18 items from the CLASSE met the desired criteria for the EFA, its reliability was then checked. Cronbach's alpha was .816 for the scale, and the average inter-item correlation was .246. While the average inter-item correlation was slightly below the desired .30, Cronbach's alpha was acceptable for this scale. The scale was also acceptable for theoretical reasons. The literature reinforces

the four facets of student engagement which emerged, and the scale used items from Parts I–IV of the CLASSE (e.g., all sections of the CLASSE containing dependent variables). Recall items from Kuh et al.'s (2008) Educationally Purposefully Activities scale only used items from Part I of the CLASSE (see Table 13). Thus, the 4-factor solution using the 18 items was preferred because of its acceptable fit indices, strong primary item loadings over .40 with minimal cross loadings across factors for most items (see Table 14), and theoretical support (see discussion to follow in Chapter 5). The scree plot also showed the levelling off of eigenvalues after four factors, indicating a 4-factor solution (see Figure 8).

It is clear from Table 14 that four factors emerge from the final EFA: participation in school (PART; Factor 1), academic challenge (ACAD; Factor 2), cognitive-thinking skills (COG; Factor 3), and non-cognitive skills (NCOG; Factor 4). Using the loading cut-off of .4, Factor 1 was indicated by all items related to basic participation in school such as asking questions (clquest; B/β = .970, $p < .001$) and contributing to class discussions (clqdiscuss; B/β = .646, $p < .001$). Factor 2 was represented by all items related to basic academic behaviours such as preparing two or more drafts of a paper (rewropap; B/β = .603, $p < .001$), integrating ideas from various sources into academic papers and projects (integrat; B/β = .666, $p < .001$), working with others in class (classgrp; B/β = .401, $p < .001$), integrating ideas from different courses (intideas; B/β = .491, $p < .001$), emailing the dual-credit instructor (email; B/β = .468, $p < .001$), and making class presentations (clpresen; B/β = .663, $p < .001$). Factor 3 was comprised of all the cognitive skills related to success in school: analyzing (analyze; B/β = .712, $p < .001$),

synthesizing (synthesz; B/β = .861, $p < .001$), making judgments (evaluate; B/β = .781, $p < .001$), and applying theories (applying; B/β = .690, $p < .001$). The fourth and final factor was comprised of non-cognitive aspects of student engagement such as whether the student found the exams in their dual-credit course challenging (exams; B/β = .512, $p < .001$), spent at least one hour per week completing each course assignment (probseta; B/β = .525, $p < .001$), took notes in their dual-credit class (takenote; B/β = .675, $p < .001$), reviewed their notes (lsnotes; B/β = .588, $p < .001$), formed a study partnership with another student (studyprt; B/β = .571, $p < .001$), and found the course material difficult (diffmate; B/β = .604, $p < .001$).

A strong positive correlation was found between ACAD and COG ($r(674) = .556$, $p < .001$). Significant moderate positive correlations were found between PART and ACAD ($r(674) = .319$, $p < .001$), PART and COG ($r(674) = .347$, $p < .001$), and COG and NCOG ($r(674) = .293$, $p < .001$). Significant weak positive correlations were found between NCOG and PART ($r(674) = .152$, $p = .005$) and NCOG and ACAD ($r(674) = .179$, $p = .001$). These results indicate that academic behaviours and cognitive skills are positively related to each other. Basic participation in school and academic behaviours, basic participation in school and cognitive thinking skills, and cognitive and non-cognitive aspects of student engagement are also positively correlated but these relationships are not as strong as the relationship between academic behaviours and cognitive skills. Non-cognitive skills and basic participation in school and non-cognitive skills and academic behaviours are weakly, but significantly, related.

HLM results with level-2 predictor variables. Hierarchical linear modelling (intercepts-and-slopes-as-outcomes, restricted maximum likelihood, multiple regression method) of the relation between dual-credit student engagement (SE; M = 2.71, SD = .48) and two level-1 predictors was performed using the HLM 7.0 statistical software. Students' data was modelled as clustering randomly based on school classroom. The level-1 predictors consisted of indicators of whether the dual-credit student was a senior in the twelfth grade or post-graduation (SENIORSTU; 55.9% senior students, 44.1% non-senior students) and whether the student had taken or was enrolled in multiple dual-credit courses (MULT; 67.0% took multiple dual credits, 33.0% did not). The moderation effect of three cross-classroom (level 2) variables – mean classroom (teacher) transformational leadership as perceived by students (TLEAD; M =14.14, SD = 1.47), an indicator of whether the dual credit was academic or vocational in nature (TYPE; 85.7% academic courses, 14.3% vocational courses), and an indicator of whether the dual credit was delivered by a high school teacher (TEACH; 77.6% high school teacher-delivered courses, 22.4% post-secondary teacher-delivered or team-taught courses) were included to judge moderation of level-1 predictor effects. Variables at level 1 were grand mean centred for model development. All variables were left uncentred at level 2 because the concern at this level is groups rather than individuals; TLEAD, TYPE, and TEACH are shared amongst all students in a class (group). The generated model was as follows:

Level 1: $$SE_{ij} = \beta_{0j} + \beta_{1j}(SENIORSTU_{ij}) + \beta_{2j}(MULT_{ij}) + r_{ij}$$

Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}(TYPE_j) + \gamma_{02}(TEACH_j) + \gamma_{03}(TLEAD_j) + u_{0j}$

$\beta_{1j} = \gamma_{10} + \gamma_{11}(TYPE_j) + \gamma_{12}(TEACH_j) + \gamma_{13}(TLEAD_j) + u_{1j}$

$\beta_{2j} = \gamma_{20} + \gamma_{21}(TYPE_j) + \gamma_{22}(TEACH_j) + \gamma_{23}(TLEAD_j) + u_{2j}$

Fixed effects results showed that the mean class intercept differed significantly from 0 (initially 1.43, $t(45) = 6.09$, $p < .001$) both before and after the moderating effect of TLEAD (.08, $t(45) = 4.47$, $p < .001$) was included in the model. Thus, the overall mean SE score across all classes and individuals was significantly different from 0—both before and after TLEAD moderation was introduced. The mean intercept did not differ significantly from 0 after the moderating effect of TYPE (.07, $t(45) = .80$, $p = .427$) was introduced into the model. Thus, the overall mean SE score across all classes and individuals was significantly different from 0 before TYPE moderation was introduced, but not after. The mean intercept was not statistically different from 0 after the introduction of TEACH (.06, $t(45) = 1.72$, $p = .093$). Hence, the overall mean SE score across all classes and individuals was statistically different from 0 before moderation by TEACH, but was not statistically different from 0 after moderating for TEACH.

The mean slopes against SENIORSTU (initially -.48, $t(45) = -.87$, $p = .391$) did not differ from 0 after introducing TLEAD (.05, $t(45) = 1.19$, $p = .241$) moderation. Hence, SENIORSTU did not affect SE scores across classes overall before or after TLEAD moderation was introduced into the model. The mean slopes against SENIORSTU did not differ 0 after introducing TYPE (-.36, $t(45) = -1.97$, $p = .055$) and TEACH (-.08, $t(45) = -1.71$, $p = .094$) moderation. Thus, SENIORSTU did not affect SE

scores across classes overall after TYPE and TEACH moderation were introduced into the model.

The mean slopes against MULT (initially -.65, $t(45) = -1.79$, $p = .080$) differed from 0 after introducing TEACH (-.09, $t(45) = -2.61$, $p = .012$) and TLEAD (.07, $t(45) = 2.45$, $p = .018$) moderation. Hence, MULT did not affect SE across classes before introducing TEACH and TLEAD moderation and *did* affect SE across classes after introducing TEACH and TLEAD moderation into the model. The mean slope against MULT did not differ from 0 after introducing TYPE (-.06, $t(45) = -.85$, $p = .398$) moderation into the model. Therefore, MULT did not affect SE across classes overall before or after introducing TYPE moderation into the model. In summary, MULT affected SE across classes overall after introducing TEACH and TLEAD moderation, but not after introducing moderation by TYPE.

Results of random effects indicated that the variance of the intercepts (.02) was significantly greater than 0, $\chi^2(10) = 29.24$, $p = .001$. The variances against the slope of SENIORSTU (.03) were also significantly greater than 0, $\chi^2(10) = 21.69$, $p = .017$, but the variances against the slope of MULT (.01) were not significantly greater than 0, $\chi^2(10) = 9.91$, $p > .500$. These results indicate that mean SE scores varied across classes and the effect of SENIORSTU on SE varied significantly across classes overall, but the effect of MULT on SE did not vary significantly across classes overall. Also, the level-1 error variance (r) was estimated to be approximately .1656.

Therefore, in this model, being a twelfth-grade or post high-school graduation student did not significantly impact dual-credit student engagement at the .05 level —

(initially $p = .391$) both before and after moderation by teachers' transformational leadership ($p = .241$) was accounted for in the model. Being in grade 12 did not have a statistically significant impact on student engagement after moderation by the type of dual credit (academic or vocational; $p = .055$) and type of dual-credit instructor (high school or post-secondary; $p = .094$). Enrollment in multiple dual-credit courses did not have a significant impact on engagement at the .05 level (initially $p = .080$) before introducing moderation by type of dual-credit teacher and teacher transformational leadership in the model, but it *did* impact engagement at the .05 level after type of dual-credit teacher ($p = .012$) and teacher transformational leadership ($p = .018$) moderation. In terms of variance, the class mean intercepts ($p = .001$) and the effect of being a senior twelfth grade student on student engagement significantly varied across classes ($p = .017$), but the effect of enrollment in multiple dual-credit courses on student engagement did not vary across classes ($p > .500$).

HLM results with level-3 predictor variables. Hierarchical linear modelling (intercepts-and-slopes-as-outcomes, restricted maximum likelihood, multiple regression method) of the relation between dual-credit student engagement (SE; $M = 2.70$, $SD = .48$) and one level-1 predictor, one level-2 predictor, and three level-3 predictors was performed using the HLM 7.0 statistical software. Students' data was modelled as clustering randomly based on school classroom. Teachers' data was modelled as clustering randomly based on school or department within a post-secondary institution. The level-1 predictor consisted of an indicator of whether the student had taken or was enrolled in multiple dual-credit courses (MULT; 66.8% took multiple dual credits, 33.2%

did not). The moderation effect of one cross-classroom (level 2) variable – mean classroom (teacher) transformational leadership as perceived by students (TLEAD; *M* =14.09, *SD* = 1.45) was included to judge moderation of level-1 predictor effects. The moderation effect of three cross-school (level 3) variables – a state/province indicator (STATE; 20.0% New York schools, 80.0% Ontario schools), an indicator of whether the dual credit was delivered in a high school or post-secondary institution (SCHTYPE; 60.0% high schools, 40.0% post-secondary institutions), and mean school (principal/dean) transformational leadership as perceived by teachers (PLEAD; *M* =11.35, *SD* = 4.50) was included to judge moderation of level 1- and level 2- predictor effects. Variables at level 1 were grand mean centred for model development. All variables were left uncentred at levels 2 and 3 because the concern at this level is groups rather than individuals. TLEAD is shared amongst all students in a class (group) and PLEAD, SCHTYPE, and STATE are shared amongst all classes in a school. The generated model was as follows:

Level 1: $SE_{ijk} = \pi_{0jk} + \pi_{1jk}(MULT_{ijk}) + e_{ijk}$

Level 2: $\pi_{0jk} = \beta_{00k} + \beta_{01k}(TLEAD_{jk}) + r_{0jk}$

$\pi_{1jk} = \beta_{10k} + \beta_{11k}(TLEAD_{jk}) + r_{1jk}$

Level 3: $\beta_{00k} = \gamma_{000} + \gamma_{001}(STATE_k) + \gamma_{002}(SCHTYPE_k) + \gamma_{003}(PLEAD_k) + u_{00k}$

$\beta_{01k} = \gamma_{010} + \gamma_{011}(STATE_k) + \gamma_{012}(SCHTYPE_k) + \gamma_{013}(PLEAD_k) + u_{01k}$

$\beta_{10k} = \gamma_{100} + \gamma_{101}(STATE_k) + \gamma_{102}(SCHTYPE_k) + \gamma_{103}(PLEAD_k) + u_{10k}$

$\beta_{11k} = \gamma_{110} + \gamma_{111}(STATE_k) + \gamma_{112}(SCHTYPE_k) + \gamma_{113}(PLEAD_k) + u_{11k}$

Fixed effects results showed that the mean school intercept did not differ significantly from 0 (initially 1.02, $t(11) = .51$, $p = .620$) both before and after the moderating effects of STATE (-.30, $t(11) = -.35$, $p = .731$), SCHTYPE (1.26, $t(11) = 1.17$, $p = .267$), or PLEAD (-.05, $t(11) = -.40$, $p = .701$) were included in the model. Thus, the overall mean SE score across all schools, classes, and individuals was not significantly different from 0—both before and after STATE, SCHTYPE, or PLEAD moderation were introduced.

Fixed effects results showed that the mean school intercept did not differ significantly from 0 after moderation by TLEAD (.11, $t(11) = .80$, $p = .440$) and after introducing STATE (.03, $t(11) = .44$, $p = .669$), SCHTYPE (-.08, $t(11) = -1.03$, $p = .323$), or PLEAD (.00, $t(11) = .392$, $p = .703$) moderation. Hence, the overall mean SE score across all classes and individuals was not significantly different from 0 before or after introducing STATE, SCHTYPE, or PLEAD moderation into the model while also moderating for TLEAD.

The mean slopes against MULT (initially 3.42, $t(11) = 1.15$, $p = .276$) also did not differ significantly from 0 after introducing STATE (-2.91, $t(11) = -2.07$, $p = .063$), SCHTYPE (-.82, $t(11) = -.56$, $p = .589$) or PLEAD (-.19, $t(11) = -.93$, $p = .372$) moderation. Hence, MULT did not affect SE across classes overall before or after introducing STATE, SCHTYPE, or PLEAD moderation into the model.

The mean slopes against MULT while moderating for TLEAD (-.19, $t(11) = -.92$, $p = .377$) also did not differ significantly from 0 after introducing STATE (.19, $t(11) = 1.97$, $p = .074$), SCHTYPE (.04, $t(11) = .37$, $p = .717$) or PLEAD (.01, $t(11) = .85$, $p =$

.411) moderation. Hence, MULT did not affect SE across classes overall before or after introducing STATE, SCHTYPE, or PLEAD moderation into the model while also moderating for TLEAD.

Results of random effects for the level-1 and level-2 variance components indicated that the variances of the intercepts (.016) was significantly greater than 0, $\chi^2(11) = 52.82$, $p < .001$, but the variances against the slope of MULT (.05) were not significantly greater than 0, $\chi^2(11) = 7.65$, $p > .500$. These results indicate that mean SE scores varied across classes, but the effect of MULT on SE did not vary significantly across classes overall. Also, the level-1 error variance (r) was estimated to be approximately .1675.

Results of random effects for the level-3 variance components indicated that the variance of the level-1 and level-2 intercepts (.00137) was not significantly greater than 0, $\chi^2(4) = 7.129$, $p = .128$. The variances against the level-1 intercept and slope of TLEAD (.00001), the slope of MULT and the level-2 intercept (.00144), and the slopes of MULT and TLEAD (.00001) were also not significantly greater than 0, $\chi^2(4) = 6.97$, $p = .136$, $\chi^2(4) = 6.82$, $p = .145$, and $\chi^2(4) = 6.84$, $p = .143$ respectively. These results indicate that mean SE scores did not vary across classes or schools, and the effect of MULT and TLEAD on SE did not vary significantly across schools overall.

Therefore, in the 3-level model, enrollment in multiple dual-credit courses did not significantly impact students' engagement in dual-credit courses — (initially $p = .267$) both before and after moderation by teachers' transformational leadership ($p = .377$). Moderation by state/province ($p = .063$), dual-credit delivery location (e.g., high school

or post-secondary institution; $p = .589$), and administrators' transformational leadership ($p = .372$) had no impact on the relationship between enrollment in multiple dual-credits and student engagement. Moderation teachers' transformational leadership *and* by state/province ($p = .074$), dual-credit delivery location, (e.g., high school or post-secondary institution; $p = .717$), and administrators' transformational leadership ($p = .411$) had no impact on the relationship between enrollment in multiple dual-credits and student engagement. Average student engagement did not differ across schools ($p > .10$). The effect of enrollment in multiple dual-credit courses and teachers' transformational leadership on student engagement also did not vary across schools ($p > .10$).

Conclusion

This chapter has provided full results to the study's three main research questions. The MLQ 5x was determined through EFAs to be a suitable and reliable tool for measuring students' perceptions of their teachers' transformational leadership. A subset of 18 items from the CLASSE was determined through EFAs to be a valid and reliable tool for measuring dual-enrollment students' engagement in their dual-credit classes. In the 2-level HLM analysis, being a senior twelfth grade student did not impact student engagement (initially $p = .391$) before or after accounting for moderation by the type of dual credit (academic or vocational; $p = .055$), type of dual-credit teacher (high school or post-secondary; $p = .094$), and students' perceptions of their teachers' transformational leadership ($p = .241$) in the model. Enrollment in multiple dual-credit courses was not significant at the .05 level for impacting student engagement (initially $p = .080$) before moderation by type of dual-credit teacher and teachers' transformational leadership, but it

was after moderation by both of these classroom-level predictors (p = .012 and p = .018 respectively). In the 3-level HLM analysis, no classroom- or school- level moderators were found to impact the relationship between enrollment in multiple dual-credit courses and student engagement. The next chapter discusses the implications of these results with a particular focus on the impact for leaders involved in administering dual-enrollment programs.

Chapter 5. Discussion

The purpose of this chapter is to relate the results of the three phases of this research to the broader literature, highlight implications, and provide recommendations for further research in this area. The chapter provides a discussion of the results obtained from the exploratory factor analyses on the revised Multifactor Leadership Questionnaire (MLQ 5x) and the Classroom Survey of Student Engagement (CLASSE) student data. Exploratory factor analyses on the CLASSE included all items administered to students, items from Kuh et al.'s (2008) Educationally Purposeful Activities scale, and the final 18 items used to generate the average student-engagement scores for use in the mixed linear models. The chapter concludes with a discussion of the results from the 2-level and 3-level hierarchical linear models that relate student, classroom, and school effects on dual-enrollment students' engagement. This chapter highlights limitations of the current study and makes possible recommendations for improvement in future research.

The central research question was, "Does grade in school (e.g., grade 12) or enrollment in multiple dual-credit courses impact student engagement before and after moderation by leadership and dual-enrollment related variables at the classroom and school level?" The purpose of the study was to explore the relationship between student-level variables and student engagement using hierarchical linear modelling in the context of other variables shown to potentially impact dual-credit student outcomes.

The student-level variables included whether the student was a senior student in grade 12 and whether he or she had taken multiple dual credits. The type of dual credit (academic or vocational), type of dual-credit teacher (high school teacher or post-

secondary professor), and/or students' perceptions of their teachers' transformational leadership were used as classroom-level moderators in the 2-level and 3-level hierarchical linear modelling analyses. The dual-credit delivery location (high school or post-secondary institution), state/province (New York or Ontario), and teachers' perceptions of their administrators' transformational leadership were used as school-level moderators in the 3-level hierarchical theoretical model (see Tables 21 and 22 for the theoretical hierarchical models and Figures 1 and 2 for visual representation). Due to the large sample sizes of hierarchical linear modelling, it was not possible to run all variables and moderators in the same model. For this reason, 2-level and 3-level hierarchical linear models were created. In these models, the level-1 outcome variable was student engagement. Average student-engagement scores were generated from a subset of questions on the CLASSE determined through exploratory factor analyses and reliability analyses to be valid and reliable for measuring student engagement. Exploratory factor analyses and reliability analyses were also performed on student responses on the MLQ 5x. These analyses revealed that the MLQ 5x was a valid and reliable tool for measuring students' perceptions of their teachers' transformational leadership. While the student sample size (n = 676) was sufficiently large in this study to perform the necessary exploratory factor analyses, the teacher sample size (n = 43) was too small to perform such exploratory factor analyses—a possible limitation of this research. Based on past research (Norton, 2012; Stewart, 2006) and reliability analyses conducted in this study, the MLQ 5x was accepted to be a valid and reliable tool for measuring teachers' perceptions of their principals' or deans' transformational leadership.

Once the construct validity and reliability of the instruments was determined to be acceptable, scores were aggregated to the appropriate level for use in the hierarchical linear modelling analyses. Averaging student responses from the MLQ 5x in each classroom generated teachers' transformational leadership scores for use at level 2, and averaging teacher responses from the MLQ 5x in each school generated principals' or deans' transformational leadership scores at level 3.

Results from the 2-level hierarchical linear modelling analysis revealed that enrollment in multiple dual-credit courses impacted student engagement after moderating for the instructors' transformational leadership (p = .018) and the type of dual-credit teacher (e.g., high school teacher or post-secondary professor; p = .012). Results from the 2-level hierarchical linear modelling analysis also revealed that grade level (e.g., grade 12) did not have an impact on student engagement after moderating for the type of dual credit (academic or vocational; p = .055) and the type of dual-credit teacher (high school teacher or post-secondary professor; p = .094). Results from the 3-level hierarchical linear modelling analysis revealed that enrollment in multiple dual-credit courses did not have a significant impact on student engagement after moderating for geography (e.g., state/province, p = .063), dual-credit delivery location (high school or post-secondary institution; p = .589), and for teachers' perceptions of their principals' or deans' transformational leadership (p = .372); additional moderation by the students' perceptions of their teachers' transformational leadership did not alter these findings (p = .074, p = .717, and p = .411 respectively). The commonly used alpha level of .05 was employed as

a conservative cutoff for determining whether results from the hierarchical linear modelling analyses were significant.

Discussion of Results

Discussion of exploratory factor analysis results on student responses on the MLQ 5x. The exploratory factor analyses on the student responses to the MLQ 5x has revealed that the relationship between transactional and transformational leadership in an educational environment is complex. Schedlitzki and Edwards (2014) describe the 3-factor transformational/contingent reward, active management-by-exception, and passive-avoidant model found in this research as one of the ten possible factor structures for the MLQ 5x for which psychometric and theoretical support exists. All the items relating to transactional contingent reward leadership load strongly onto the same factor as the five dimensions of transformational leadership in this model, which is not unexpected due to the high correlation between both leadership styles. Avolio and Bass (2004) wrote, "Transactional contingent reward leadership may be the basis for structuring developmental expectations, as well as building trust due to a consistent honoring of contracts over time. Thus, it is not surprising to find that transactional contingent reward leadership correlates with transformational leadership" (p. 66). There is support in the literature that transformational school leadership includes transactional elements. Leithwood and Jantzi (2000) have stated that the transformational models by Avolio and Bass (2004) neglect to include important transactional leadership elements fundamental to a school's stability such as staffing, instructional support, monitoring, and climate. The items relating to followers' willingness to put forth extra effort on the MLQ 5x may

capture some of the interdependent relationship between transformational and transactional leadership in schools. The three items measuring followers' extra effort (e.g., EE39, EE42, EE44) loaded most heavily onto the transformational/contingent-reward factor with some cross loading on the active-management-by-exception factor (see Table 6). These items are characteristic of both transformational and transactional leadership, and they were not designed to measure a specific leadership style by the MLQ 5x's authors (Avolio & Bass, 2004). Followers (students) appear more willing to put forth extra effort when their leaders (teachers) display more positive leadership styles.

Of the 20 items indicated for measuring transformational leadership from the MLQ 5x, 19 of these items loaded onto the first factor (transformational/contingent reward leadership). The one item not loading onto Factor 1, item II(B)6, asked whether the leader (teacher) shares his/her personal views with followers. Since teachers are required to take a neutral stance in the classroom, it was not unexpected that this item loaded most heavily onto the passive-avoidant leadership factor (Factor 2). This analysis has revealed that nearly all of the specified transformational items cluster heavily together on Factor 1 (the transformational/contingent-reward factor; see Table 6). This provides evidence that transformational leadership can be distinguished from transactional active management-by-exception and passive-avoidant leadership. Since 19 of the 20 transformational leadership items loaded as expected (with reasonable reliability on the five transformational subscales), there is evidence that the MLQ 5x can be used to generate aggregate transformational leadership scores for use in multi-level linear models to predict student engagement.

In summary, the exploratory factor analyses on the students' MLQ 5x responses helped to establish the construct validity of the MLQ 5x in an educational setting. All leadership subscales had acceptable reliability (Cronbach's alpha and average inter-item correlations; please see Methodology chapter). The findings from the exploratory factor analyses on the student MLQ 5x responses have support of previous literature (Schedlitzki & Edwards, 2014) and helped strengthen the larger hierarchical linear modelling analyses in this research project.

Discussion of exploratory factor analysis results on student responses to all items on the CLASSE. The exploratory factor analyses on the full CLASSE student data revealed clear facets of student engagement, as supported by theoretical literature on engagement, with some cross loading of specific survey items. Fit indices and the levelling off of eigenvalues on the scree plot indicated a 6-factor structure for the CLASSE: basic, academic, non-cognitive, collaboration, emotional, and cognitive engagement (see Tables 11–12 and Figure 6). Items with primary factor loadings greater than .40 indicated all factors. This discussion will outline the composition of the factors, and their support and relevance in relation to the literature.

Factor 1, basic engagement, was indicated by CLASSE items related to whether the student asked questions in class (clquest; $B/\beta = .750$, $p < .001$) and contributed to classroom discussions (clqdiscuss; $B/\beta = .755$, $p < .001$). This basic-engagement factor can be considered equivalent to the first two levels of Finn's (1989) four-level model of student participation in school. In Finn's model, level-one participation consists of the most basic behaviours required of all students in school such as attendance, listening, and responding to the classroom teacher. Level-two participation encompasses student initiative-

taking behaviours such as asking questions in class and dialoguing with the teacher (Silins & Mulford, 2002). Finn's participation model was part of his seminal identification-participation model of student engagement. Deeper levels of student engagement (e.g., higher levels of student participation in school) are not truly achievable unless students actively identify with school and participate in the most basic student behaviours required of them in the classroom.

Items related to deeper student engagement indicated Factor 2, academic engagement. The academic-engagement factor was indicated by items from the CLASSE related to whether the dual-credit student prepared multiple drafts of assignments (rewropap; B/β = .621, $p < .001$), integrated ideas from other sources into his or her school work (integrat; B/β = .760, $p < .001$), included diverse perspectives in written work or class discussions (divclass; B/β = .743, $p < .001$), used concepts from other courses to complete work in the dual-credit course (intideas; B/β = .521, $p < .001$), emailed his or her dual-credit instructor (email; B/β = .560, $p < .001$), made class presentations (clpresen; B/β = .712, $p < .001$), received prompt feedback (facfeed; B/β = .448, $p < .001$), and wrote assignments longer than 5 pages (writemid; B/β = .573, $p < .001$). The item measuring whether the student used an electronic medium to discuss or complete an assignment (itacdem; B/β = .393, $p < .001$) came very close to meeting the .40 factor loading criteria. All of these items loaded onto the academic engagement factor without significant cross loading across other factors (see Table 12). All models of student engagement include an academic component (Appleton et al., 2006; Astin, 1984; Finn, 1989; Kuh, 2003; Leithwood & Jantzi, 1999a, 1999b, 2000; Midgley et al., 2000; Silins & Mulford, 2002, 2003; Tinto,

1975, 1982, 1993; Willms et al., 2009). Factor 2 describes the core behaviours required for students to achieve academic success in their dual-credit courses.

The third factor, non-cognitive engagement, was indicated by CLASSE items related to whether the dual-credit student found the exams challenging (exams; B/β = .507, $p < .001$), spent at least one hour per week completing each course assignment (probseta; B/β = .557, $p < .001$), spent more than three hours preparing for his or her dual-credit class (acadpr01; B/β = .646, $p < .001$), took notes in class (takenote; B/β = .577, $p < .001$), reviewed his or her notes before class (lsnotes; B/β = .546, $p < .001$), formed a study partnership with another student (studyprt; B/β = .453, $p < .001$), and found the dual-credit course material difficult (diffmate; B/β = .673, $p < .001$). The item measuring whether the student worked harder than they thought they could to meet his or her instructor's expectations (workhard; B/β = .398, $p < .001$) almost met the .40 loading criteria for indicating Factor 3. These items describe non-cognitive engagement in school. Non-cognitive student outcomes include participation in school, academic self-concept (i.e., pride and diligence, work ethic, and positive feelings about school, academics, and the future), and engagement (overall involvement). This discussion will expand on the importance of non-cognitive outcomes since student engagement, a non-cognitive outcome, was the centerpiece of this research project.

The importance of non-cognitive learning outcomes. Researchers have championed the critical role non-cognitive learning outcomes play in predicting student achievement and future personal and social success. The *Successful School Principal's Project* (SSPP) in the United Kingdom, which consisted of nine in-depth case studies,

131 principal surveys, and 494 teacher surveys, reaffirmed that non-cognitive measures can predict student success in other domains such as academic success and future outcomes (Mulford, Kendall, Edmunds, Kendall, Ewington, & Silins, 2007). As part of the SSPP project surveys, Mulford et al. (2007) developed a *Social Success Index* which contained student questionnaire items such as "has developed self-confidence", "[dares] to try new things", and "[does] not accept discrimination" (p. 234). All of these individual survey items combined into a single factor (social success) that explained 50% of the variance in differences between student outcomes. This is strong evidence to suggest that non-cognitive factors explain differences in achievement in high schools. Silins and Mulford (2002) have emphasized that "non-academic outcomes such as student participation in and engagement with school can be important factors in school success, academic and social, at *all* levels of schooling (O'Brien & Rollefson, 1996)" (p. 579). Sedlacek (2004) echoed this view at the post-secondary level through his analysis of thirty years of legal challenges and research literature surrounding high-stakes testing in the U.S. and the resulting influence of non-cognitive variables related to adjustment, motivation, and student perception in college. Sedlacek (2004) wrote:

> Test results should be useful to educators, student service workers, and administrators, by constituting the basis to help students learn better and analyze their needs. As currently designed, tests do not accomplish these goals. . . . The goal of using non-cognitive variables is not to *substitute* [the non-cognitive] approach for the cognitive focus more commonly employed in assessments, but to

add to the range of attributes we consider in making judgments required of [all involved in education] (p. 6–7).

Sedlacek (2004) described eight non-cognitive variables important to success in the post-secondary environment: positive self-concept, realistic self-appraisal, successfully handling the system, long-term goal planning, and availability of a support person, leadership, community involvement, and knowledge acquired in a field. Astin and Antonio (2012) have also stressed the importance of non-cognitive variables in their seminal book, *Assessment for Excellence: The Philosophy and Practice of Assessment and Evaluation in Higher Education*, based (again) on thirty years of research. After thoroughly reviewing college mission statements, Astin and Antonio (2012) found that almost all the statements describe affective student qualities such as good judgment, citizenship, social responsibility, and character. Astin and Antonio (2012) stated that "no program of student outcomes assessment would seem complete without due consideration for assessment of relevant affective outcomes" (p. 47). Astin and Antonio described a taxonomy with psychological or affective non-cognitive variables (i.e., values, interests, self-concept, attitudes, beliefs, and satisfaction with college) and sociological or behavioural non-cognitive variables (i.e., leadership, citizenship, interpersonal relationships, and hobbies and avocations). The student-engagement models described the literature review and this research provides additional support for the presence of a non-cognitive component of student engagement (Appleton et al., 2006; Astin, 1984; Kuh, 2003; Kuh et al., 2008; Leithwood & Jantzi, 1999a, 1999b, 2000; Midgley et al., 2000; Tinto, 1975, 1982, 1993; Willms et al., 2009).

Student engagement also involves a collaborative component. Factor 4, collaborative engagement, was indicated by all items related to collaboration—both inside and outside of the dual-credit classroom. Items such as whether the dual-credit student tutored others (tutor; B/β = .413, $p < .001$, undertook a community-based project (commproj; B/β = .451, $p < .001$), attended review sessions for their dual-credit course (revsess; B/β = .489, $p < .001$), and enjoyed the group work (enjoygrp; B/β = .429, $p < .001$) loaded onto the fourth factor. Items such as whether the dual-credit student worked with others in class (classgrp; B/β = .386, $p < .001$, worked with others outside class (occgrp; B/β = .358, $p < .001$), and talked with faculty outside class (facideas; B/β = .365, $p < .001$) almost met the .40 loading criteria for indicating Factor 4. Appleton, Christenson, and Furlong (2008) have described the importance of peers in the student-engagement models in their meta-analysis of the student-engagement construct. The student-engagement models by Appleton et al. (2006), Finn (1989), Midgley et al. (2000), and Tinto (1975, 1982, 1993) also have emphasized the importance of positive interactions and collaboration with peers.

Items related to an emotional component of student engagement indicated Factor 5, emotional engagement. Items such as whether the student came to class prepared (clunprep (item scored in reverse); B/β = .498, $p < .001$), attended class (absent (item scored in reverse); B/β = .473, $p < .001$), was interested in learning the dual-credit curricula (interest; B/β = .565, $p < .001$), and was comfortable with the instructor (comfort; B/β = .408), $p < .001$) comprised Factor 5. The item measuring whether the student found the dual-credit course lectures easy to follow (difflect; B/β = .391, $p <$

.001) almost met the .40 loading criteria for indicating Factor 5. Appleton et al. (2008) provide an overview of several student-engagement models that include an emotional aspect (Russell, Ainley, & Frydenberg, 2005; Fredericks, Blumenfeld, & Paris, 2004; Skinner, Wellborn, & Connell, 1990; Yazzie-Mintz, 2007 as cited by Appleton et al., 2008). All the items on Factor 5 relate to Finn's (1989) identification component of student engagement. Students who identify with school feel emotionally invested and find their courses enjoyable. They are comfortable talking to their teacher, and they are interested in learning the course material. They come to class prepared and ready-to-learn. Kuh (2003, 2009), author of the National Survey of Student Engagement (the most widely used engagement survey in North American colleges and universities), has strongly supported the presence of an emotional aspect of student engagement.

The final factor, Factor 6 (cognitive engagement), was represented by CLASSE items related to higher-order cognitive thinking skills: analyzing ideas, experiences, and theories (analyze; $B/\beta = .568$, $p < .001$), synthesizing ideas (synthesz; $B/\beta = .655$, $p < .001$), making judgments (evaluate; $B/\beta = .579$, $p < .001$), and applying theories in new ways (applying; $B/\beta = .510$, $p < .001$). Most student-engagement models include an intellectual component (Appleton et al., 2008; Willms et al., 2009).

Thus, this study found that student engagement was represented on the CLASSE by six latent constructs related to basic, academic, non-cognitive, collaboration, emotional, and cognitive engagement. Some items on the CLASSE significantly cross loaded across more than one factor at the .05 level (see Table 12 for factor loadings). For example, the item measuring whether the student formed a study partnership (studyprt)

loaded almost equally onto the non-cognitive engagement factor (B/β = .453, $p < .001$) and the collaboration factor (B/β = .443, $p < .001$). The item measuring whether the student enjoyed the group work (enjoygrp) loaded onto the collaborative-engagement factor (B/β = .429, $p < .001$) and the emotional factor (B/β = .336, $p < .001$). The CLASSE question measuring whether the student worked harder than they thought they could to meet his or her instructor's expectations (workhard) loaded onto the non-cognitive (B/β = .398, $p < .001$), academic (B/β = .266, $p = .002$), and emotional factors (B/β = .277, $p < .001$). The findings of this study support those of Bryan, Eagle, Wright, and Icenogle (2013) who have argued that some of the NSSE's benchmarks/subscales, particularly level of academic challenge, require revision due to cross loading of items across benchmarks (subscales). Many items from the NSSE's level of academic challenge benchmark are found on the CLASSE; these items include the time a student spends preparing for class by studying, reading, writing, rehearsing, and performing other similar activities (items probseta and acadpro01). Working harder than one thought he/she could to reach expectations (item workhard), writing papers more than 5 pages long (item writemid), and using cognitive-thinking skills (items analyze, synthesz, evaluate, and applying) are also found on both the NSSE's and CLASSE's academic benchmarks (IUCPR, 2014a). For this reason, it was not unexpected that the CLASSE required further psychometric work before use in the mixed 2-level and 3-level hierarchical linear models.

Discussion of exploratory factor analysis results on student responses on items from the Educationally Purposeful Activities scale. It was essential to this research to have a psychometrically valid measure of student engagement from the

CLASSE. This average student-engagement measure needed to consist of the fewest number of items from the CLASSE with the highest-rotated primary factor loadings and minimal cross loadings. It was desirable that this scale make use of items from as many different sections of the CLASSE as possible. A first attempt at using items from Kuh et al.'s (2008) Educationally Purposeful Activities scale to generate an average (aggregate) measure of student engagement revealed four facets of student engagement: basic participation, academic, cognitive, and non-cognitive (See Table 13). Fit indices and the levelling off of eigenvalues on the scree plot indicated this 4-factor structure for the Educationally Purposeful Activities scale (See Table 11 and Figure 7). Several items had weak (rotated) primary loadings on their respective factors: tutored other students (tutor; B/β = .344, $p < .001$) on the collaboration factor, undertook a community project (commproj; B/β = .278, $p = .002$) on the academic factor, and came unprepared for class (clunprep (item scored in reverse); B/β = -.294, $p < .001$) on the active-learning factor. These items and other items on the scale displayed significant cross loadings (e.g., less than a .30 spread between an item's primary and secondary rotated factor loadings). For example, the item measuring whether the dual-credit student tutored classmates (tutor) loaded onto the collaboration (B/β = .344, $p < .001$) and academic factor (B/β = .254, $p = .005$). The item measuring whether the student took part in community-based projects in his or her dual-credit course (commproj) cross loaded onto the collaboration (B/β = .249, $p = .005$) and academic (B/β = .278, $p = .002$) factors. For these reasons, the Educationally Purposeful Activities scale was ultimately rejected to generate average student-engagement scores for use in the mixed 2-level and 3-level hierarchical models.

Discussion of exploratory factor analysis results final set of items selected for hierarchical linear modelling analyses on the CLASSE. It took many attempts through exploratory factor analyses to find a suitable subset of items from the CLASSE that had theoretical support, high-rotated primary factor loadings, minimal cross loadings, and reasonable reliability. This research was successful in finding such a subset of items (see Table 14 for final items chosen and their factor loadings). Fit indices and the levelling off of eigenvalues on the scree plot indicated a 4-factor structure for the final 18 CLASSE items selected to generate the average student-engagement scores for use in the 2-level and 3-level hierarchical linear models (see Table 11 and Figure 8).

Factor 1, basic participation, again emerged as the first factor and was represented by items related to whether the student asked questions in class (clquest; B/β = .970, $p < .001$) and contributed to class discussions (clqdiscuss; B/β = .646, $p < .001$). Factor 2, academic engagement, was represented by questions related to whether the dual-credit student prepared multiple drafts of assignments (rewropap; B/β = .603, $p < .001$), integrated ideas from other sources into his or her school work (integrat; B/β = .666, $p < .001$), worked with others in class (classgrp; B/β = .401, $p < .001$), used concepts from other courses to complete work in the dual-credit course (intideas; B/β = .491, $p < .001$), emailed his or her dual-credit instructor (email; B/β = .468, $p < .001$), and made class presentations (clpresen; B/β = .663, $p < .001$). Items related to higher-order cognitive thinking skills represented Factor 3: analyzing ideas, experiences, and theories (analyze; B/β = .712, $p < .001$); synthesizing ideas (synthesz; B/β = .861, $p < .001$); making judgments (evaluate; B/β = .781, $p < .001$); and applying theories in new ways (applying;

B/β = .690, $p < .001$). A cognitive thinking-skills factor has emerged in each exploratory factor analysis thus far (e.g., for the full set of items from the CLASSE and for the Educationally Purposeful Activities scale). The final factor, Factor 4 (non-cognitive engagement), was represented by items relating to whether the dual-credit student found the exams challenging (exams; B/β = .512, $p < .001$), spent at least one hour per week completing each course assignment (probseta; B/β = .525, $p < .001$), took notes in class (takenote; B/β = .675, $p < .001$), reviewed his or her notes before class (lsnotes; B/β = .588, $p < .001$), formed a study partnership with another student (studyprt; B/β = .571, $p < .001$), and found the dual-credit course material difficult (diffmate; B/β = .604, $p < .001$).

In the final model consisting of 18 items, the emotional and collaborative factors found in the first exploratory factor anlaysis on the full CLASSE data set collapsed into academic and non-cognitive factors in the final exploratory factor analysis. The final exploratory factor analysis revealed four clear facets of student engagement when the CLASSE was used with dual-credit students: participation, academic (active learning), cognitive, and non-cognitive (see Table 14). The results from all the exploratory factor analyses on the CLASSE show that core facets of student engagement emerge across subject areas and school settings. New York and Ontario students in this research took academic and vocational dual-credit courses in a variety of high school and post-secondary settings. High school and post-secondary teachers delivered these dual-credit courses. Thus, the aforementioned findings yield credence to the theory that student engagement is based on underlying psychological theory and is not course or location

specific. This finding also helps establish the internal and external validity of the methodology used in this project.

Discussion of 2-level and 3-level hierarchical linear modelling results. Results from the 2-level hierarchical linear modelling analysis revealed that being a senior twelfth grade student did not significantly affect dual-credit students' engagement on its own (initially -.48, $t(45) = -.87$, $p = .391$) before and after moderation by the type of dual credit (academic or vocational; -.36, $t(45) = -1.97$, $p = .055$) and type of dual-credit teacher (high school teacher or post-secondary professor; -.08, $t(45) = -1.71$, $p = .094$). A replication of this study with a larger student population is needed to determine if the type of dual credit and type of dual-credit teacher impact senior students' engagement.

The finding that grade level (e.g., grade 12) was not significant at the .05 level for having an impact on student engagement after moderation by the type of dual credit (academic or vocational; -.36, $t(45) = -1.97$, $p = .055$) is interesting and requires further research. Johnson and Brophy (2006) found that dual credits have a positive impact on older students. Karp et al. (2007) found positive dual-credit outcomes held for vocational students, but emphasized that more research is needed on the efficacy of vocational dual credits. This study had a credible number of students ($n = 82$, 12.1%) enrolled in vocationally based dual credits, but a replication of this study with a larger number of vocational dual-credit students would definitely be worthwhile to investigate this outcome in more depth. The Ontario government has worked hard to create a dual-enrollment program with community colleges that provide vocational learning opportunities for at-risk and underserved student populations. This study included dual-

enrollment students in the vocational "Tech Prep" program in the U.S., which has a similar focus. More research is necessary to determine if and why student engagement may differ for senior and non-senior students in academic and vocational dual-credit courses.

More research is also needed to determine if the type of dual-credit teacher (high school or post-secondary) is important—especially with senior students. Many retrospective dual-credit studies (Allen & Dadgar, 2012; An, 2013; Swanson, 2008) did not specify the type of dual-credit teacher. The type of dual-credit teacher should strongly be considered as a covariate in dual-credit student-outcomes-based research—especially with senior students and with those enrolled in multiple dual credits. Dual credits can be delivered by high school teachers, post-secondary instructors, or can be team-taught in high schools or post-secondary institutions. More research is needed to actively compare these different dual-enrollment models. Due to the small number of team-taught dual-credit courses surveyed in this research, this work does not comment on student engagement for those in team-taught courses.

Results from the 2-level hierarchical linear modelling analysis also revealed enrollment in multiple dual-credit courses did not have an impact on student engagement on its own (initially -.65, $t(45) = -1.79$, $p = .080$) but did impact student engagement after moderation by type of dual-credit teacher (-.09, $t(45) = -2.61$, $p = .012$) and teachers' transformational leadership (.07, $t(45) = 2.45$, $p = .018$). This is evidence to suggest that the type of dual-credit teacher and his/her transformational leadership affects student engagement for those enrolled in multiple dual credits (over half of the student sample in

this research). This finding complements the empirical work of Silins and Mulford (2002, 2003) who have demonstrated through rigorous quantitative research that teachers' transformational leadership impacts student engagement through the organizational learning of schools. Teachers can play a life-changing role in the lives of many students whom they have the opportunity to instruct. The positive characteristics of teacher transformational leadership—idealized behaviours, the ability to inspire students, intellectually stimulate them, adhere to a shared mission/vision, and consider students as individuals impact student outcomes. This research helps support this claim.

The 2-level hierarchical linear modelling analysis also revealed some complex relationships. Moderating variables at level-2 had varying impacts on different student populations at level-1. Although being a senior twelfth grade student *no* impact on student engagement after moderation by the type of dual-credit teacher (-.08, $t(45) = -1.71$, $p = .094$), enrollment in multiple dual-credit courses had an impact on student engagement after moderation by type of dual-credit teacher (-.09, $t(45) = -2.61$, $p = .012$). Although enrollment in multiple dual credits impacted student engagement after moderation by the students' perceptions of their teachers' transformational leadership (.07, $t(45) = 2.45$, $p = .018$), being a senior student did *not* impact student engagement after moderation by the students' perceptions of their teachers transformational leadership (.05, $t(45) = 1.19$, $p = .241$). The latter result may result from the large percentage of International Baccalaureate students in the final sample ($n = 256$; 37.8% of the sample). Senior International Baccalaureate students are required to take a variety of courses in Mathematics, Science, and foreign languages to meet the rigorous graduation

requirements. To graduate with the full International Baccalaureate diploma (as opposed to a single-subject certificate), International Baccalaureate students must take all required courses regardless of their teachers' leadership style. In many schools in this study, only one section of each International Baccalaureate course was offered each year, so student engagement may be motivated more by the necessity of credit achievement rather than teachers' transformational leadership for graduating high school students.

Results from the 3-level hierarchical linear modelling analysis revealed that no school-level moderators (e.g., principals' transformational leadership, state/province, or dual-credit delivery location) were found to impact the relationship between enrollment in multiple dual-credit courses and student engagement at the 0.05 level in this study (before and after moderating for teachers' transformational leadership). More research with a larger sample at the school level is necessary to further investigate the impact of school-level variables on student engagement.

The findings of this study are still positive—teachers' transformational leadership was found to impact the relationship between enrollment in multiple dual-credit courses and student engagement in the 2-level hierarchical model. Many researchers have championed the efficacy of dual-credit programs on student achievement and outcomes. Norton (2012)'s empirical work showed that teachers' transformational leadership impacted middle-school students' engagement; she used the Patterns of Adaptive Learning Survey to measure student engagement and MLQ 5x to measure teachers' leadership. Karp et al. (2007) found that enrollment in multiple dual credits positively impacted student outcomes for those in New York State. Therefore, it was expected that

the teachers' transformational leadership would inspire engagement amongst those taking multiple dual credits.

Discussion Chapter Conclusion

This conclusion will focus on summarizing the 2-level and 3-level hierarchical linear modelling results, since this was the main focus of the study. The methodology, results, and earlier discussion justify why the MLQ 5x and CLASSE were valid and reliable instruments for generating scores for use in the hierarchical linear modelling analyses.

Two-level hierarchical linear modelling conclusions. This study revealed that enrollment in multiple dual-credit courses did not have a significant impact on student engagement (initially $p = .080$) before moderation by students' perceptions of their dual-credit instructors' transformational leadership and type of dual-credit teacher, but it *did* impact student engagement after considering these classroom-level moderators ($p = .018$ and $p = .012$ respectively). In other words, the type of dual-enrollment instructor (pre-tertiary or tertiary) and teachers' transformational leadership style altered the relationship between enrollment in multiple dual-credit courses and student engagement. The teachers' transformational leadership made a difference and so did the type of dual-credit teacher on student engagement. The introduction and literature review in this research has argued that transformational leadership is important for positive school outcomes, and this research has demonstrated that teachers' transformational leadership may act upon on student engagement. More research is needed to compare student engagement in different dual-credit delivery models (e.g., team-taught dual-credit courses) in the context of other

potentially confounding variables. Replication studies and studies with additional moderating student, classroom, and school variables are suggested.

The 2-level hierarchical linear model showed that there was a positive effect on engagement for students who have taken multiple dual credits with transformational teachers. Dual-credit students in this study rated their teachers as transformational leaders—giving them an average transformational leadership score of 14.14 out of 20 on the MLQ 5x. For this reason, students should be encouraged to take advantage of as many dual-credit opportunities as they can while they are still in high school—regardless of whether the dual credits are offered by high school teachers or post-secondary professors. Two New York high schools in this research offered dual-credit opportunities to students beginning in the tenth-grade. Both the International Baccalaureate and Advanced Placement organizations, beginning in the 2015–2016 school year, will offer certificate and diploma credentials to recognize students who take multiple dual credits. These credentials are in addition to the "regular" high school graduation diploma. The International Baccalaureate program currently offers single-subject credentials and a full diploma, and Advanced Placement offers single-subject credentials and will begin offering a full diploma in the 2015–2016 school year. The results in this study regarding multiple dual credits help support the conclusions of Karp et al. (2007) who found that enrollment in multiple dual-credit courses impacted student outcomes. Enrollment in multiple dual credits has a positive impact on student outcomes—both cognitive (as shown in Karp et al.'s study) and non-cognitive (as shown in this study).

Another of the study's 2-level HLM findings showed that being a senior (twelfth-grade) student did not have significant impact at the .05 level on student engagement after moderating for the type of dual credit (academic or vocational; $p = .055$) and the type of dual-credit teacher (high school or post-secondary; $p = .094$). Moreover, being a senior student did *not* have an impact on student engagement (initially $p = .391$) before or after moderation by teachers' transformational leadership ($p = .241$). In other words, teachers' transformational leadership did not impact the relationship between grade level and student engagement. Many senior students require credits for graduation (especially IB students) and post-secondary admission, so they require the credit regardless of the dual-credit teachers' transformational leadership style. Therefore, this finding can be explained. More research relating dual-credit student outcomes to grade in school is necessary.

Three-level hierarchical linear modelling conclusions. Finally, this project showed that enrollment in multiple dual-credit courses did not have a significant impact at the .05 level on student engagement (initially $p = .276$) before and after moderation by students' perceptions of their teachers' transformational leadership while also moderating for state/province ($p = .074$). More research is needed to determine whether teachers' transformational leadership and the state/province impacts student engagement for those in dual-enrollment programs. Silins and Mulford (2002, 2003) determined through path analysis that teachers' transformational leadership impacts student engagement through organizational learning in schools. Leithwood and Jantzi (1999a) showed that principals' transformational leadership impacts students' identification and participation with school

directly, but teachers' transformational leadership does not. Karp et al. (2007) showed through their analyses that dual-credit student outcomes can vary by state. This project has revealed many possible avenues of further research. A larger sample size (particularly at the school level) is recommended. Researchers such as Mattern et al. (2013) and Shaw et al. (2013) performed hierarchical linear modelling analyses on retrospective data sets of hundreds of thousands of dual-enrollment students before drawing conclusions about the efficacy of dual credits.

Implications

This correlational study has several implications for professional practice in dual-enrollment settings. The study has provided evidence that teachers' transformational leadership and type of dual-credit teacher (high school or post-secondary) impacts the relationship between enrollment in multiple dual credits and student engagement. Thus, more research should be done to determine whether these findings hold in more diverse ethnic, achievement, and urbanity settings. Additional student, classroom, and school moderating variables should be used in statistical models. More research is needed to explore different dual-enrollment delivery models; this study has revealed possible student-engagement differences for those in dual-credit courses taught by high school and post-secondary teachers. Finally, more research should be conducted on the impact of the state/province moderator on student engagement. New York and Ontario use different grade 12 curricula, and this should be explored further. Therefore, this correlational study provides several opportunities for further research by educators, policy makers, and dual-

enrollment leaders to conduct more research. The following section outlines these implications in more detail.

Recommendations

This study makes several recommendations with regards to further study and suggestions for action. The following paragraphs outline these recommendations and suggestions.

First, further dual-enrollment studies relating student, classroom, and school effects on student engagement should be conducted with larger sample sizes to investigate whether the findings in this study hold. Many schools in this study represented rural and suburban landscapes—it would be meaningful to replicate this study in schools in more urban geographies with varied ethnic and achievement profiles. These replication studies should be conducted in diverse environments in additional school districts, states, provinces, and countries. This larger sample-size should include more dual-enrollment students and instructors. In this study, the number of instructors was small (n = 43). The instructors in each school and college department were asked to rate their principals' or deans' transformational leadership. Replicating this study with a larger number of instructors at each school may give more accurate indications of each administrator's true transformational leadership style. To reduce bias, follower and self-ratings forms of the MLQ 5x could be used with participants. This study found that administrators' transformational leadership had *no* impact at the .05 level on the relationship between enrollment in multiple dual credits and student engagement before or after classroom-level moderator variables were included. A larger sample of

instructors may change this conclusion to support the findings of Leithwood and Jantzi (1999a). Leithwood and Jantzi (1999a) showed that principals' leadership directly impacted student engagement. Furthermore, replicating the exploratory factor analyses on the MLQ 5x and CLASSE would add to the psychometric validity of the usage of these instruments by dual-enrollment students and instructors. It was not possible to perform an exploratory factor analysis on the dual-credit instructors' perceptions of their administrators' leadership on the MLQ 5x in this study, but it would be possible if a larger number of instructors from each school were sampled in a replication study. Researchers such as Mattern et al. (2013) and Shaw et al. (2013) performed hierarchical linear modelling analyses on retrospective data sets of hundreds of thousands of students. This was not possible in this study as data was collected by a single researcher in real time with only one data-collection assistant (e.g., school guidance counsellor) at each research site.

Secondly, a larger sample size could also accommodate consideration of additional leadership styles at the classroom and school level such as instructional leadership, moral leadership, ethical leadership, and so on. Leithwood and Jantzi (1999a, 1999b, 2000) conducted a series of studies on student engagement and teacher and principal leadership in the context of school organizational values. Leadership styles considered in these studies included instructional, transformational, moral, participative, managerial, and contingent. These leadership styles were measured by Leithwood and Jantzi's (1999a, 1999b, 2000) *Organizational Conditions and School Leadership Survey*. There is not a particular leadership style that single-handedly captures the full leadership

profile of an individual teacher or principal. Transformational leadership was selected for this study because of its potential positive effect on student outcomes in other studies (Leithwood & Jantzi, 1999a, 1999b, 2000; Norton, 2012; Silins & Mulford, 2002, 2003). Norton (2012) found that teachers' transformational leadership directly impacted middle school students' engagement in a positive way. Silins & Mulford (2002, 2003) found that principals' transformational leadership positively impacted students through teachers and school organizational learning. Their path-analysis study also showed that teachers' leadership impacted students through the organizational learning. Leithwood and Jantzi (1999a) showed that principals' transformational leadership had a weak but significant direct positive impact on student engagement. There are other positive leadership styles that could be considered in similar studies. Moral leaders develop the capacities of others. Ethical leaders are just, show respect for followers' values, and approach ethical dilemmas with integrity, honesty, and compassion. Instructional leaders drive curriculum change to better enhance the learning experience for students and teachers. Transformational leaders inspire and lead positive school reform, consider followers as individuals, intellectually stimulate those around them, and lead according to shared values. All these positive characteristics of educators are worth investigating in the context of dual enrollment. The additional leadership styles could be used as classroom- and school- level moderators in the 2-level and 3-level hierarchical linear modelling analyses.

Third, it would be useful to replicate this study using separate populations of post-secondary college/university, Advanced Placement, and International Baccalaureate dual-

enrollment students or to use the nature of the dual-credit (e.g., post-secondary college/university, Advanced Placement, or International Baccalaureate) as a classroom-level covariate in the hierarchical linear models. Delicath (2000) found significant differences in outcomes for Advanced Placement and post-secondary dual-enrollment students. For example, Delicath showed that dual enrollment via a university significantly increased first-year persistence and college graduation rates. This relationship held for university dual-credit students after controlling for their past achievement on the American College Test, but the relationship did *not* hold for Advanced Placement students after moderation by American College Test scores. Thus, it would be advantageous to replicate this study with separate populations of post-secondary college/university, Advanced Placement, and International Baccalaureate dual-credit students to see if conclusions differ based on the nature of the dual credit. Students in the International Baccalaureate diploma program and dual-credit focus programs, such as Tech Prep, are required to take "packages" of dual credits. Students in these courses may take some courses out of graduation-requirement necessity rather than personal choice, so the nature of the dual credit (Advanced Placement, International Baccalaureate, post-secondary college/university, and/or packaged in a focus program) may be another important classroom-level independent variable. The sample sizes were too small in this study to accommodate additional classroom-level moderators in the hierarchical linear modelling analyses.

Fourth, it would be worthwhile for replication studies to include student-level variables not considered in this study such as students' socio-economic status, ethnicity,

gender, past achievement, current achievement, home-educational culture, and students' parental achievement; many of these variables have been shown to influence student engagement in other studies (Leithwood & Jantzi, 1999a, 1999b, 2000; Silins & Mulford, 2002, 2003). Due to compressed time frames and research ethics board's requirements, it was not possible to collect these variables during the course of this study. Moreover, with proper ethical clearance, this study could be replicated with two outcome variables in the hierarchical linear modelling analyses: student engagement and current student achievement (as measured by high school grade point average). Hierarchical linear modelling analyses are robust enough to handle multiple outcome (dependent) variables in the same analyses (Raudenbush & Bryk, 2002). All of aforementioned variables are important and would build a richer conceptual framework. Path analysis and structural equation modelling may offer a more advanced method of analysis to determine the relationships between dual enrollment, teacher and administrator leadership, and student engagement.

Finally, an expansion of this study's methodological protocol to include a mixed-methods approach may yield additional knowledge on the nature of the complex relationships uncovered in this study. Qualitative research can unearth the deep and rich tapestries that underlie human phenomena that cannot be captured through quantitative research alone. A mixed-methods approach could support and complement the findings of this study.

This study represents a call-to-action for dual-credit researchers and policy makers to consider the importance of student-, classroom-, and school- level variables,

especially teacher and principal leadership, in the context of dual enrollment. For many students, especially the underserved, dual enrollment can be a life-changing experience. Forty-five percent of students in this study indicated that dual enrollment changed their career path. For this reason, colleges, universities, the College Board (who administers Advanced Placement external exams) the International Baccalaureate Organization, school boards, researchers, and departments of education need to ensure that dual-credit opportunities are available to all students.

Final Conclusion

This research has explored relationships between dual enrollment, teacher and administrator leadership, and student engagement. The results of this correlational study are not causal, but they provide evidence of the student- and classroom- level factors that may impact dual-credit students' engagement. The central research question was "Does grade in school (e.g., grade 12) or enrollment in multiple dual-credit courses impact student engagement before and after moderation by leadership and dual-enrollment related variables at the classroom and school level?" Based on this research, there is some evidence of student- and classroom- level effects. Although enrollment in multiple dual-credit courses had no significant impact on students' engagement at the .05 level (initially $p = .080$) before moderation by type of dual-credit teacher (high school or post-secondary) and teachers' transformational leadership, it *did* impact engagement after moderation by both of these classroom-level predictors ($p = .012$ and $p = .018$ respectively) in the two-level hierarchical model. Thus, there is some evidence to suggest that taking multiple dual credits, the type of dual-credit teacher (high school or post-

secondary), and teachers' transformational leadership impact student engagement. This research found that being a senior twelfth-grade student had no significant impact at the .05 level on student engagement (initially $p = .391$) before and after accounting for moderation by the type of dual credit (academic or vocational; $p = .055$), type of dual-credit teacher (high school or post-secondary; $p = .094$), and teachers' transformational leadership ($p = .241$). More research is needed to further study the classroom and school moderators that may have a significant impact on senior students' engagement. No school-level moderators were found to impact the relationship between enrollment in multiple dual-credit courses and student engagement at the 0.05 level in this study. Thus, this study has found some evidence of student- and classroom- level effects on student engagement, and therefore concludes that these findings are worth investigating in more detail. Correlational studies do not establish causation, but they provide evidence of associations that may have practical significance to researchers and practitioners. Additional research with a larger sample size and random sampling techniques is necessary before drawing conclusions about team-taught dual-credit programs or other school-level moderators (e.g., principals' or deans' transformational leadership) on dual-enrollment students.

In conclusion, the analyses performed in this study are based on sound statistical and psychometric principles. This research established the reliability and validity of both the MLQ 5x and CLASSE before proceeding with hierarchical linear modelling. The MLQ 5x was found to be a valid and reliable tool to gauge students' perceptions of their instructors' transformational leadership. An 18-item subset of CLASSE questions was

found to be a valid and reliable tool for measuring dual-credit students' engagement in this study. The psychometric work done on the CLASSE through exploratory factor analyses in this study may be useful to anyone who wishes to use the CLASSE to create predictive models of student outcomes. The hierarchical findings provided some evidence of the student- and classroom- levels factors that may impact dual-credit students' engagement, and this can be taken a positive conclusion. Thus, the results of this study may have use for educators, principals, post-secondary deans, and policy makers who are involved in dual-enrollment programming.

Final thoughts. Stephenson (2014) has emphasized that dual-enrollment leaders need a shared vision focused on helping all students succeed in their chosen pathways. Having a shared vision is a key component of transformational leadership. Stephenson has argued that this shared vision should be premised on three core principles: 1) raising awareness of dual enrollment, 2) providing free or low-cost dual-credit opportunities to all students, and 3) ensuring meaningful dual-enrollment opportunities are available to all students beginning in early high school. These three principles reflect the individual behaviours of leaders, their individualized consideration of followers, and their intellectual stimulation of followers—key components of transformational leadership. Transformational leadership was chosen as the basis of this study because of its potentially positive impact on student engagement for those in dual-enrollment programs. This research has provided some evidence to show that teachers' transformational leadership impacts students' engagement in dual-credit programs. Enrollment in multiple dual-credit courses, type of dual-credit teacher (high school or post-secondary), and

teachers' leadership were shown to be potential dual-enrollment variables that may act upon student engagement. This research has contributed to the growing literature surrounding the efficacy of dual enrollment and has made a contribution in the area of non-cognitive student outcomes and leadership.

References

Allen, D., & Dadgar, M. (2012). Does dual enrollment increase students' success in college? New evidence from a quasi-experimental analysis of dual enrollment in New York City [Special issue]. *New Directions for Community Colleges, 2012*(158), 11–19. doi:10.1002/he.20010

An, B. P. (2013). The impact of dual enrollment on college degree attainment: Do low-SES students benefit? *Educational Evaluation and Policy Analysis*, *35*, 57–75. doi:10.3102/0162373712461933

Andrews, H. A. (2001). *The dual-credit phenomenon: Challenging secondary school students across 50 states*. Stillwater, OK: New Forums Press.

Andrews, H. A. (2013). Phenomenal growth for dual-credit programs. *Illinois School Board Journal, March/April*. Retrieved from http://www.iasb.com/journal/ j030413_02.cfm

Antonakis, J., Avolio, B. J., & Sivasubramaniam, N. (2003). Context and leadership: An examination of the nine-factor full-range leadership theory using the Multifactor Leadership Questionnaire. *The Leadership Quarterly, 14*, 261–295. doi:10.1016/S1048-9843(03)00030-4

Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. *Psychology in the schools*, *45*, 369–386. doi:10.1002/pits.20303

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology*, *44*, 427–445. doi:10.1016/j.jsp.2006.04.002

Aron, A., Coups, E. J., & Aron, E. N. (2012). *Statistics for psychology* (6th ed.). New York, NY: Pearson.

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Development, 25*, 297–308.

Astin, A.W., & Antonio, A. L. (2012). *Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education*. Plymouth, UK: Rowman & Littlefield.

Avolio, B. J., & Bass, B. M. (2004). *Multifactor leadership questionnaire: Manual and sample set* (3rd ed.). Menlo Park, CA: Mind Garden.

Avolio, B. J., Bass, B. M., & Jung, D. I. (1999). Re-examining the components of transformational and transactional leadership using the Multifactor Leadership Questionnaire. *Journal of Occupational and Organizational Psychology, 72*, 441–462. doi:10.1348/096317999166789

Bachman, L. F. (2004). *Statistical analyses for language assessment*. New York, NY: Cambridge University Press.

Bailey, T., Hughes, K. & Karp, M. (2002). *What role can dual enrollment programs play in easing the transition between high school and postsecondary education*? Washington D.C.: Office of Vocational and Adult Education, U.S. Department of Education. (U.S. Department of Education Publication No. ED-99-CO-0160). Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/dual-enrollment-easing-transitions.pdf

Banta, T. W., Jones, E. A., & Black, K. E. (2009). *Designing effective assessment: Principles and practices of good practice*. San Francisco, CA: Jossey-Bass.

Barnett, E., Maclutsky, E., & Wagonlander, C. (2015). Emerging Early College models for traditionally underserved students [Special issue]. *New Directions for Community Colleges, 2015*(169), 39–50. doi:10.1002/cc.20131

Barnett, K., McCormick, J., & Conners, R. (2001). Transformational leadership in schools: Panacea, placebo or problem? *Journal of Educational Administration*, *39*, 24–46. http://dx.doi.org/10.1108/09578230110366892

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum.

Bell Canada. (2015). *How to use call blocking on my Bell home phone*. Retrieved from http://support.bell.ca/Home_Phone/Calling_features/How_to_use_Call_Blocking_on_my_Bell_Home_phone

Bergeron, L. (2015). *International Baccalaureate Diploma Programme students' enrollment and outcomes at US postsecondary institutions: 2008-2014*. Geneva, Switzerland: International Baccalaureate Organization. Retrieved from http://www.ibo.org/globalassets/publications/ib-research/dp/dp-student-enrollment-outcomes-us-en.pdf

Berry, S., & Woods, R. (2007). Leadership Practices Inventory. In R. A. Reynolds, R. Woods, & J. D. Baker (Eds.), *Handbook of research on electronic surveys and measurements* (Vol. 28, pp. 357–359). Hershey, PA: Idea Group Reference. doi:10.4018/978-1-59140-792-8

Borden, V. M. H., Taylor, J. L., Park, E., & Seiler, D. J. (2013). *Dual credit in U.S. higher education: A study of state policy and quality assurance practices.* Chicago, IL: Higher Learning Commission. Retrieved from https://downloadna11.springcm.com/content/DownloadDocuments.ashx?aid=5968&Selection=Document%2Ce3823bc3-3c88-e211-ad6c-0025b3af184e%3B

Borovilos, R. (2015). *The impact of dual credit programs on college students: A comparative study of dual credit participants and non-dual credit participants in one Ontario college* (Doctoral dissertation, University of Toronto). Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/69206/3/Borovilos_Rena_201506_PhD_thesis.pdf

Bouck, M., Williams, T., & Page, L. (2014). *Dual enrollment*. Retrieved http://www.fldoe.org/core/fileparse.php/5423/urlt/DualEnrollmentFAQ.pdf

Bryan, N. B., Eagle, B. W., Wright, B. M., & Icenogle, M. L. (2012). *Looking ahead to the NSSE 2.0 by knowing what to keep from NSSE 1.1: Construct validity and invariance properties of the NSSE benchmarks across institutional types*. Paper presented at the Association for Institutional Research Annual Forum, New Orleans, LA. Retrieved from https://www.presby.edu/ir/wp-content/uploads/sites/50/2013/03/2012-AIR-NSSE-Research.pdf

Burns, J. M. (1978). *Leadership*. New York, NY: Harper & Row.

Canadian Federation of Students. (2013). *Student debt in Canada: Education shouldn't be a debt sentence.* Retrieved from http://cfs-fcee.ca/wp-content/uploads/sites/2/2013/11/Factsheet-2013-11-Student-Debt-EN.pdf

Carless, S. A. (2001). Assessing the discriminant validity of the Leadership Practices Inventory. *Journal of Occupational and Organizational Psychology, 74*, 233–239. doi:10.1348/096317901167334

City University of New York. (2015). *About College Now*. Retrieved from http://collegenow.cuny.edu/about-college-now/

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis* (2nd ed.). Hillsdale, NJ: Erlbaum.

Constante, K. (2011). Student engagement: A leadership priority. *In Conversation, 3*(2). Retrieved from https://www.edu.gov.on.ca/eng/policyfunding/leadership/Summer2011.pdf

Cornell University Office of Research Integrity and Assurance Human Research Participant Protection Program. (2010). *Informed Consent, enrollment, and other considerations for research involving children*. Retrieved from https://www.irb.cornell.edu/documents/SOP%2011%20-%20Children.pdf

Crockett-Bell, S. A. (2007). *The dual credit program: Measuring the effectiveness on students' transition from high school to college.* Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3277657)

Delicath, T. A. (2000). The influence of dual credit programs on students' integration and goal attainment. *Journal of College Student Retention, 1*, 377–398. doi:10.2190/1YUD-Y451-6YED-81XN

Dennis-Raycroft, J. (2013). *The dual credit journey: Chronicling the success of dual credit students at St. Lawrence College*. Kingston, ON, Canada: PASS. Retrieved from http://www.scwi.ca/docs/research/The_Dual_Credit_Journey-Chronicling_the_Success_of_Dual%20Credits_at%20SLC_April-2013.pdf

Dougherty, C., Mellor, L., & Jian, S. (2006). *The relationship between Advanced Placement and college graduation: 2005 AP Study Series, Report 1*. Austin, TX: National Center for Educational Accountability. Retrieved from ERIC database. (ED519365)

Exploratory Factor Analysis. (2015). Retrieved November 15, 2015 from https://en.wikiversity.org/wiki/Exploratory_factor_analysis

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4*, 272–299. doi:1082-989X/99/S3.00

Farrell, P. L., & Seifert, K. A. (2007). Lessons learned from a dual-enrollment partnership [Special issue]. *New Directions for Community Colleges, 2007*(139), 69–77. doi:10.1002/cc.294

Figlio, D. N. (2007). *Teacher pay for performance* [PowerPoint slides]. Retrieved from http://film.fsu.edu/content/download/57832/672509/file/FiglioTQFlorida07.pdf

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research, 59*, 117–142. doi:10.3102/00346543059002117

Fredricks, J. A., & McColskey, W. (2013). The measurement of student engagement: A comparative analysis of various methods and student self-report instruments. In S. L. Christenson, Reschly, S. L., and Wylie, C. (Ed.), *Handbook of Research on Student Engagement* (Vol. 27, pp. 763–782). New York, NY: Springer-Verlag. Retrieved from http://www.lcsc.org/cms/lib6/MN01001004/Centricity/Domain/108/The%20Measurement%20of%20Student%20Engagement-%20A%20Comparative%20Analysis%20of%20Various%20Methods.pdf doi:10.1007/978-1-4614-2018-7_37

Fredricks, J., McColskey, W., Meli, J., Mordica, J., Montrosse, B., & Mooney, K. (2011). *Measuring student engagement in upper elementary through high school: A description of 21 instruments*. Greensboro, NC: SERVE Center at the University of North Carolina at Greensboro. Retrieved from http://ies.ed.gov/ncee/edlabs/regions/southeast/pdf/rel_2011098.pdf

Garg, R., Kauppi, C., Lewko, J., & Urajnik, D. (2002). A structural model of educational aspirations. *Journal of Career Development, 29*, 87–108. doi:10.1177/089484530202900202

Garson, D. G. (2013). Preparing to analyze multilevel data. In D. G. Garson (Ed.), *Hierarchical linear modeling* (pp. 27–51). Thousand Oaks, CA: Sage.

Gay, L. R., Mills, G. E., & Airasian, P. W. (2011). *Educational research: competencies for analysis and applications* (10th ed.). Toronto, ON: Pearson.

Georgian College. (2012). *Secondary students get a taste of college through dual-credit initiatives*. Retrieved from http://www.georgiancollege.ca/news/news-releases/secondary-students-get-a-taste-of-college-through-dual-credit-initiatives/

Gliem, J. A., & Gliem, R. R. (2003). *Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for likert-type scales*. Paper presented at the Midwest Research to Practice Conference in Adult, Continuing, and Community Education, Columbus, OH. Retrieved from http://www.ssnpstudents.com/wp/wp-content/uploads/2015/02/Gliem-Gliem.pdf

Gravetter, F. J., & Wallnau, L. B. (2009). *Essentials for statistics for the behavioral sciences* (7th ed.). Belmont, CA: Wadsworth Cengage Learning.

Greenberg, A. R. (1989). *Concurrent enrollment programs: College credit for high school students*. Bloomington, IN: Phi Delta Kappa Educational Foundation. Retrieved from ERIC database. (ED313936)

Griffin, D. (2003). *Transformational leadership*. Retrieved from http://desgriffin.com/leadership/transform/

Griffith, E. (2015, February 9). How to create an anonymous email address. *PC Magazine*. Retrieved from http://www.pcmag.com/article2/0,2817,2476288,00.asp

Gutman, L. M., & Schoon, I. (2013). *The impact of non-cognitive skills on outcomes for young people: Literature review*. Institute for Education: London, UK. Retrieved from https://educationendowmentfoundation.org.uk/uploads/pdf/Non-cognitive_skills_literature_review_2.pdf

Hair, J. F. J., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). *Multivariate data analysis* (4th ed.). Saddle River, NJ: Prentice Hall.

Hallinger, P. (2003). Leading educational change: Reflections on the practice of instructional and transformational leadership. *Cambridge Journal of Education, 33*, 329–352. doi:10.1080/0305764032000122005

Hay, I. (2012). *Transformational leadership: Characteristics and criticisms*. Retrieved from http://www.leadingtoday.org/weleadinlearning/transformationalleadership.htm

Health Canada. (2014). *Requirements for informed consent documents*. Retrieved from http://www.hc-sc.gc.ca/sr-sr/advice-avis/reb-cer/consent/index-eng.php

Heath, L. A. (2008). *Community college and university experiences of high school dual enrollment students* (Doctoral dissertation, Florida Atlantic University). Retrieved from http://www.broward.k12.fl.us/research_evaluation/researchresults/442Heath/HeathLauraSpring08.pdf

Hertberg-Davis, H., Callahan, C. M., & Kyburg, R. M. (2006). Advanced Placement and International Baccalaureate programs: A "fit" for gifted learners? (RM06222). Storrs, CT: University of Connecticut National Research Center on the Gifted and Talented. Retrieved from ERIC database. (ED505379)

Hoffman, N. (2003). *College credit in high school: Increasing postsecondary credential rates of underrepresented students*. Boston, MA: Jobs for the Future. Retrieved from ERIC database. (ED476457)

Hugo, E. (2001). Dual Enrollment for underrepresented student populations [Special issue]. *New Directions for Community Colleges, 2001*(113), 67–72. doi:10.1002/cc.10

Hunt, E., & Carroll, C. E. (2006). Florida's dual enrollment initiative: How state policy influences community colleges' service to underrepresented youth. *New Directions for Community Colleges, 135,* 39–47. doi: 10.1002/cc.246

IBM SPSS Statistics for Windows (Version 23.0). [Computer software]. Toronto, ON: IBM. Available from http://www-01.ibm.com/software/analytics/spss/

Indiana University Center for Evaluation and Educational Policy. (2015). *High School Survey of Student Engagement*. Retrieved from http://ceep.indiana.edu/hssse/index.shtml

Indiana University Center for Postsecondary Research. (2012). *National Survey of Student Engagement 2012 Codebook*. Retrieved from http://www.colorado.edu/pba/surveys/nsse-aaude/codebook/Codebook12.pdf

Indiana University Center for Postsecondary Research. (2013). *National Survey of Student Engagement 2013 Codebook (U.S. Version)*. Retrieved from http://nsse.indiana.edu/2013_Institutional_Report/data_codebooks/NSSE%202013%20%20Codebook.pdf

Indiana University Center for Postsecondary Research. (2014a). *Canadian English National Survey of Student Engagement.* Retrieved from http://nsse.iub.edu/pdf/survey_instruments/2014/NSSE%202014%20-%20Canadian%20English.pdf

Indiana University Center for Postsecondary Research. (2014b). *Item by item comparisons of the original and updated NSSE*. Retrieved from http://hilo.hawaii.edu/uhh/iro/documents/ItembyItemComparisonofNSSE2012andNSSE2014.pdf

Indiana University Center for Postsecondary Research. (2014c). *National Survey of Student Engagement: About NSSE.* Retrieved from http://nsse.iub.edu/html/about.cfm

Indiana University Center for Postsecondary Research. (2015a). *Classroom Survey of Student Engagement*. Retrieved from http://nsse.indiana.edu/html/classroom_survey_of_student_engagement.cfm

Indiana University Center for Postsecondary Research. (2015b). *Construction of the NSSE benchmarks*. Retrieved from http://nsse.indiana.edu/html/benchmark_construction.cfm

International Baccalaureate Organization. (2015a). *Understanding* [*IB Diploma*] *assessment*. Retrieved from http://www.ibo.org/en/programmes/diploma-programme/assessment-and-exams/understanding-ib-assessment/

International Baccalaureate Organization. (2015b). *Recognition of IB programmes*. Retrieved from http://www.ibo.org/en/university-admission/recognition-of-the-ib-diploma-by-countries-and-universities/

International Baccalaureate Schools of Ontario. (2008). *IB programme in Ontario schools*. Retrieved from http://www.mpsj.ca/ib/pdf/IBSO_Brochure.pdf

Janowski, Z. (2010, November 10). *Union challenges teacher bonuses for AP scores*. [Blog post]. Retrieved from http://www.raisinghale.com/2010/11/10/union-challenges-teacher-bonuses-for-ap-scores/

Johnson, T. E., & Brophy, M. (2006). Dual enrollment: Measuring factors for rural high school student participation. *The Rural Educator, 28*(1), 25–32.

Johnstone, D. B. (1993). *Learning productivity: A new imperative for American higher education*. Albany, NY: Office of the Chancellor, State University of New York. Retrieved from ERIC database. (ED357721)

Karp, M. M., Calcagno, J. C., Hughes, K. L., Jeong, D. W., & Bailey, T. R. (2007). *The postsecondary achievement of participants in dual enrollment: An analysis of student outcomes in two states.* New York, NY: National Research Center for Career and Technical Education. Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/dual-enrollment-student-outcomes.pdf

Khazem, J. H., & Khazem, H. A. (2012). Dual enrollment: The way forward. *International Journal of Education Research, 7*(2), 135–150.

Kenny, D. A. (2014). *Measuring model fit*. Retrieved from http://davidakenny.net/cm/fit.htm

Kim, J. & Bragg, D. (2008). The impact of dual and articulated credit on college readiness and retention in four community colleges. *Career and Technical Education, 26*(2), 133–158.

Kouzes, J. M., & Posner, B. Z. (2014). *Research on the leadership challenge*. Retrieved from http://www.leadershipchallenge.com/research.aspx

Kouzes, J. M., & Posner, B. Z. (2006). *Student Leadership Practices Inventory: Facilitator's guide* (2nd ed.). San Francisco, CA: Jossey-Bass.

Kouzes, J. M., & Posner, B. Z. (2003). *The Leadership Practices Inventory (LPI): Participant's workbook* (3rd ed.). San Francisco, CA: Jossey-Bass.

Kouzes, J. M., & Posner, B. Z. (2015). *Using the LPI in your research*. Retrieved from http://www.leadershipchallenge.com/professionals-section-lpi-sample-report.aspx

Kreft, I. G. G., & De Leeuw, J. (1998). *Introducing multilevel modeling*. Newbury Park, CA: Sage.

Kuh, G. D. (2003). What we're learning about student engagement from NSSE: Benchmarks for effective educational practices. *Change: The Magazine of Higher Learning*, *35*(2), 24–32. doi:10.1080/00091380309604090

Kuh, G. D. (2009). The National Survey of Student Engagement: Conceptual and empirical foundations. *New Directions for Institutional Research, 141*, 5–20. doi:10.1002/ir.283

Kuh, G. D., Cruce, T. M., Shoup, R., & Kinzie, J., & Gonyea, R. M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *Journal of Higher Education, 79,* 540–563. doi:10.1353/jhe.0.0019

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. A., & Hayek, J. C. (2006). What matters to student success: A review of the literature. Washington, DC: National Postsecondary Education Cooperative. Retrieved from http://nces.ed.gov/npec/pdf/kuh_team_report.pdf

Kyburg, R. M., Herberg-Davis, H., & Callahan, C. M. (2007). Advanced Placement and International Baccalaureate Programs: Optimal learning environments for talented minorities? *Journal of Advanced Academics*, *18*, 172–215. doi:10.4219/jaa-2007-357

Leithwood, K. (2003). Teacher leadership: its nature, development, and impact on schools and students. In M. Brundrett, N. Burton, & R. Smith (Eds.), *Leadership in education* (pp. 103-117). Thousand Oaks, CA: Sage. Retrieved from http://uk.sagepub.com/sites/default/files/upm-binaries/9649_022715Ch7.pdf

Leithwood, K., & Aitken, R. (1992). *Making schools smarter: A system for monitoring school and district progress*. Newbury Park, CA: Corwin.

Leithwood, K., & Jantzi, D. (1999a). The relative effects of principal and teacher sources of leadership on student engagement with school. *Educational Administration Quarterly, 35*, 679–706. doi:10.1177/0013161X99355002

Leithwood, K., & Jantzi, D. (1999b). Transformational school leadership effects: A replication. *School Effectiveness and School Improvement, 4*, 451–479. doi:10.1076/sesi.10.4.451.3495

Leithwood, K., & Jantzi, D. (2000). The effects of transformational leadership on organizational conditions and student engagement with school. *Journal of Educational Administration, 38*, 112–129. http://dx.doi.org/10.1108/09578230010320064

Leithwood, K., Jantzi, D., & Steinbach, R. (1999). *Changing leadership for changing times*. London, UK: Open University Press.

Leslie, J. B., & Fleenor, J. W. (1998). *Feedback to managers: A review and comparison of multi-rater instruments for management development* (3rd ed.). Greensboro, NC: Center for Creative Leadership.

Lichtenberger, E., Witt, M. A., Blankenberger, B., & Franklin, D. (2014). Dual credit/dual enrollment and data driven policy implementation. *Community College Journal of Research and Practice, 38*, 959–979. doi:10.1080/10668926.2013.790305

Maas, C. J. M., & Hox, J. J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology, 1*, 86–92. doi:10.1027/1614-1881.1.3.86

MacMillan, J. H., & Schumacher, S. (2006). *Research in education: Evidence-based inquiry* (6th ed.). Toronto, ON: Pearson.

Marzano, R. J. (2005). Two types of change. In R. J. Marzano, T. Waters, & B. A. McNulty (Eds.), *School leadership that works: From research to results* (pp. 65–75). Alexandria, VA: Association for Supervision and Curriculum Development.

Mattern, K. D., Marini, J. P., & Shaw, E. J. (2013). *Are AP students more likely to graduate on time?* New York, NY: The College Board. Retrieved from https://research.collegeboard.org/sites/default/files/publications/2014/1/research-report-2013-5-are-ap-students-more-likely-graduate-college.pdf

McCormick, A.C. (Ed.). (2014). *National survey of student engagement (NSSE) 2014 overview*. Retrieved from http://nsse.iub.edu/2014_Institutional_Report/pdf/NSSE%202014%20Overview.pdf

McCormick, A. C., Kinzie, J., & Gonyea, R. M. (2013). Student engagement: Bridging research and practice to improve the quality of undergraduate education. In M. B. Paulsen (Ed.), *Higher education: Handbook of theory and research* (Vol. 28, pp. 47–92). Dordrecht, Netherlands: Springer. doi:10.1007/978-94-007-5836-0_2

Michael, C. M. (2003). *The relationship of the transformational leadership of the administrators in America's Middle College High School and their feeder institutions to selected indicators of effectiveness* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3098049)

Midgley, C., Kaplan, A., Middleton, M., Maehr, M. L., Urdan, T., . . . Roeser, R. W. (1998). Development and validation of scales assessing students' achievement goal orientation. *Contemporary Educational Psychology, 23,* 113–131. doi:10.1006/ceps.1998.0965

Midgley, C., Maehr, M. M., Hruda, L. Z., Anderman, E., Anderman, L., . . . Urdan, T. (2000). *Manual for the Patterns of Adaptive Learning scales.* Ann Arbor, MI: University of Michigan. Retrieved from http://www.umich.edu/~pals/PALS%202000_V13Word97.pdf

Mind Garden Inc. (2015). *How do I score the MLQ with missing data?* Retrieved from http://www.mindgarden.com/content/23-faq#horizontalTab3

Mombourquette, F., McEwan, R., & McBridge, A. (1999). *Narrowing opportunities for adults in Ontario secondary schools: A study of students affected by the changes to provincial funding of adults and the Education Act 1996* (WALL Working Paper No. 9). Toronto, ON: Centre for the Study of Education and Work Department of Sociology and Equity Studies in Education (University of Toronto). Retrieved from https://tspace.library.utoronto.ca/retrieve/4450/09narrowing.pdf

Mplus (Version 7.31). [Computer software]. Los Angeles, CA: Muthén & Muthén. Available from https://www.statmodel.com/index.shtml

Mulford. B., Kendall, D., Edmunds, B., Kendall, L., Ewington, J., & Silins, H. (2007). Successful school leadership: What and who decides? *Australian Journal of Education, 51*, 228–246. doi:10.1177/000494410705100302

National Alliance of Concurrent Enrollment Partnerships. (2015). *NACEP's history*. Retrieved from http://www.nacep.org/about-nacep/history/

National Center for Public Policy and Higher Education. (2010). *Beyond the rhetoric: Improving college readiness through coherent state policy*. Retrieved from http://www.highereducation.org/reports/college_readiness/CollegeReadiness.pdf

Newfoundland and Labrador Department of Advanced Education and Skills. (2014a). *International Baccalaureate transfer credits*. Retrieved from http://www.aes.gov.nl.ca/postsecondary/transferguide/2014_15/4.2_ib_program.pdf

Newfoundland and Labrador Department of Advanced Education and Skills. (2014b). *Advanced Placement transfer credits*. Retrieved from http://www.aes.gov.nl.ca/postsecondary/transferguide/2014_15/4.1_adv_placement.pdf

Norton, L. F. (2012). *Teacher leadership style and student engagement in the middle school classroom* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3507566)

Ontario Ministry of Education. (2014). *Achieving excellence: A renewed vision for education in Ontario*. Toronto, ON: Author. Retrieved from http://www.edu.gov.on.ca/eng/about/renewedVision.pdf

Ontario Ministry of Education. (2013a). *Dual credit programs: Policy and program requirements*. Toronto, ON: Author. Retrieved from http://www.edu.gov.on.ca/eng/teachers/studentsuccess/DualCreditPro.pdf

Ontario Ministry of Education. (2013b). *Dual credit programs 2012–2013 school year report.* Toronto, ON: Author. Retrieved from http://www.edu.gov.on.ca/eng/teachers/studentsuccess/SummaryDualCredit.pdf

Orpwood, G., & Brown, E. (2013). *College student achievement project: Final report*. Retrieved from Seneca College, College Student Achievement Project website: http://csap.senecacollege.ca/docs/Revised%20CSAP%20Final%20Report%20Cycle%201.pdf

Osborne, J. W., & Costello, A. B. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation, 10*(7), 1–9. Retrieved from http://pareonline.net/pdf/v10n7a.pdf

Pace, C. R. (1980). Measuring the quality of student effort. *Current Issues in Higher Education, 2*, 10–16.

Philpott-Skilton, L. (2013). *High school/college transitions: A case study examining the impact of a dual credit program at Fleming College* (Doctoral dissertation, University of Toronto). Retrieved from https://tspace.library.utoronto.ca/handle/1807/35928

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Newbury Park, CA: Sage.

Reid, L. R. (2012). Redesigning a large lecture course for student engagement: Process and Outcomes. *The Canadian Journal for the Scholarship of Teaching and Learning, 3*(2), 1–37. http://dx.doi.org/10.5206/cjsotl-rcacea.2012.2.5

Reschly, A. L., Huebner, E. S., Appleton, J. J., & Antaramian, S. (2008). Engagement as flourishing: The contribution of positive emotions and coping to adolescents' engagement at school and with learning. *Psychology in the Schools, 45*, 419–431. doi:10.1002/pits.20306

Ryan, S. (1999). *Teacher leadership: a qualitative study in three secondary schools*. (Doctoral dissertation, Ontario Institute for Studies in Education at the University of Toronto). Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/12797/1/NQ45802.pdf

Schedlitzki, D., & Edwards, G. (2014). *Study leadership: Traditional and critical approaches*. Thousand Oaks, CA: Sage.

School College Work Initiative. (2015). *Dual credit: Course codes*. Retrieved from http://www.scwi.ca/coursecodes.php

Schwab, J. (2002). Detecting outliers [PowerPoint slides]. Retrieved from http://www.utexas.edu/courses/schwab/sw388r7/SolvingProblems/DetectingOutliers.ppt

Sedlacek, W. E. (2004). *Beyond the big test: Noncognitive assessment in higher education*. San Francisco, CA: Jossey-Bass.

Shaunessy, E., Suldo, S. M., Hardesty, R. B., & Shaffer, E. J. (2006). School functioning and psychological well-being of International Baccalaureate and general education students: A preliminary examination. *Journal of Secondary Gifted Education, 17*, 76–89. Retrieved from ERIC database. (EJ746047)

Shaw, E. J., Marini, J. P., & Mattern, K. D. (2013). Exploring the utility of Advanced Placement Participation and Performance in College Admission Decisions. *Educational and Psychological Measurement, 73*, 229–253. doi:10.1177/0013164412454291

Silins, H., & Mulford, B. (2002). Leadership and school results. In K. Leithwood & P. Hallinger (Eds). *Second International Handbook of Educational Leadership and Administration* (pp. 561–612). Norwell, MA: Kluwer.

Silins, H., & Mulford, B. (2003). Leadership for organisational learning and improved student outcomes—What do we know? *Cambridge Journal of Education, 33*, 175–195. doi:10.1080/03057640302041

Smallwood, B. (2010). *CLASSE: Classroom Survey of Student Engagement overview*. Retrieved from http://www.assessment.ua.edu/CLASSE/Overview.htm

Smith, D. (2007). Why expand dual-credit programs? *Community College Journal of Research and Practice, 31*, 371–387. doi:10.1080/10668920600932884

Soper, D. (2014). *A-priori sample size calculator for hierarchical multiple regression*. Retrieved from http://www.danielsoper.com/statcalc3/calc.aspx?id=16

Spillane, J. P. (2005). Distributed leadership. *Educational Forum, 69*, 143–150. Retrieved from http://sdexter.net/courses/589/downloads/SpillaneLeadership05.pdf

Stephenson, L. G. (2014). College to high school: Kentucky's dual enrollment alternative [Special Issue]. *New Directions for Community Colleges, 2014*(165), 7–16. doi:10.1002/cc.20086

Stewart, J. (2006). Transformational leadership: An evolving concept examined through the works of Burns, Bass, Avolio, and Leithwood. *Canadian Journal of Educational Administration and Policy, 54*. Retrieved from http://www.umanitoba.ca/publications/cjeap/pdf_files/stewart.pdf

Swanson, J. L. (2008). *An analysis of the impact of high school dual enrollment course participation on post-secondary academic success, persistence and degree completion* (Doctoral dissertation, University of Iowa). Retrieved from http://nacep.org/wp-content/uploads/2010/02/Dissertation-2008-Joni-L.-Swanson.pdf

Syracuse University. (2015a). *Project Advance: Our history*. Retrieved from http://supa.syr.edu/about/about.php?page=562&activemenu=566

Syracuse University. (2015b). *Syracuse University summer college for high school students*. Retrieved from http://summercollege.syr.edu/

The College Board. (2014). *Bulletin for AP students and parents: Your guide to the AP program*. Retrieved from https://secure-media.collegeboard.org/digitalServices/pdf/professionals/2014-15_ap_student_bulletin.pdf

The College Board. (2015a). *AP Canada: Exam & score data*. Retrieved from http://apcanada.collegeboard.org/exam-score-data

The College Board. (2015b). *AP Research: Beginning 2015–2016 academic year*. Retrieved from https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap-capstone/ap-research-course-overview.pdf

The Institute for Educational Leadership. (2013). *The Ontario leadership framework: A school and system leader's guide to putting Ontario's leadership framework into action*. Retrieved from https://iel.immix.ca/storage/6/1380680840/OLF_User_Guide_FINAL.pdf

Thomas, N., Marken, S. Gray, L., Lewis, L., & Ralph, J. (2013). *Dual credit and exam-based courses in U.S. public high schools: 2010–2011*. Washington, DC: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubs2013/2013001.pdf

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research, 45*, 89–125.

Tinto, V. (1982). Limits of theory and practice in student attrition. *Journal of Higher Education, 53*, 687–700.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, IL: University of Chicago Press.

Tukey, J. W. (1977). *Exploratory data analysis*. Reading, MA: Addison-Wesley.

University of Massachusetts Department of Psychology. (2013). *Indices of model fit* [PowerPoint slides]. Retrieved from http://www.psych.umass.edu/uploads/people/79/Fit_Indices.pdf

University of Minnesota. (2014). *The Student Engagement Instrument (SEI*). Retrieved from http://checkandconnect.umn.edu/research/engagement.html

Vargas, J. G., Roach, R., & David, K. M. (2014). Successful concurrent programs: An EXCELerate program in Oklahoma. *Community College Journal of Research and Practice, 38*, 166–173. doi:10.1080/10668926.2014.851958

Waterloo Catholic District School Board. (2015). University Cooperative Education Program (UCEP). Retrieved from https://coop.wcdsb.ca/ucep.html

Wathington, H. D., & Pretlow, J. (2014). Expanding dual enrollment: Increasing postsecondary access for all? *Community College Review, 42*, 41–54. doi:10.1177/0091552113509664

Western University Student Success Centre. (2015). *Western's imitative for scholarly excellence*. Retrieved from http://www.success.uwo.ca/Scholars/westerns_initiative_for_scholarly_excellence/index.html

Willms, J. D., Friesen, S., & Milton, P. (2009). *What did you do in school today? Transforming classrooms through social, academic and intellectual engagement: Final national report.* Toronto, ON: Canadian Educational Association. Retrieved from http://www.cea-ace.ca/sites/default/files/cea-2009-wdydist.pdf

Woltman, H., Feldstain, A., MacKay, J. C., & Rocchi, M. (2012). An introduction to hierarchical linear modeling. *Tutorials in Quantitative Methods for Psychology, 8*, 52–69.

Youth Communication. (2012, January 28). High school graduation: Four students discuss obstacles to success. *The Huffington Post Teen*. Retrieved from http://www.huffingtonpost.com/2012/01/28/high-school-graduation-fo_n_1238402.html

Zhao, H. (2011). *Student engagement as a quality measure in the Ontario postsecondary education system: What we have learned about measures of student engagement* (Issue Paper No. 5). Toronto, ON: Higher Education Quality Council of Ontario. Retrieved from http://heqco.ca/SiteCollectionDocuments/AtIssueStudentEngagement.pdf

Appendix A. Western University Ethics Approval

Western Research

Research Ethics

Western University Health Science Research Ethics Board
NMREB Delegated Initial Approval Notice

Principal Investigator: Dr. Vicki Schwean
Department & Institution: Education,Western University

NMREB File Number: 106165
Study Title: Dual-credit Program Leadership and Student Engagement
Sponsor:

NMREB Initial Approval Date: March 10, 2015
NMREB Expiry Date: March 10, 2016

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Revised Letter of Information & Consent	Revised.	2015/01/17
Revised Letter of Information & Consent	Revised.	2015/01/17
Revised Letter of Information & Consent	Revised.	2015/01/17
Instruments	Revised Instrument.	2015/01/17
Instruments	Revised Instrument.	2015/01/17
Instruments	Revised Instrument.	2015/01/17
Revised Western University Protocol	Revised Ethics Protocol (Clean PDF)	2015/02/13

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the NMREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

[redacted]

Ethics Officer, on behalf of Riley Hinson, NMREB Chair or delegated board member

Ethics Officer to Contact for Further Information

Erika Basile ebasile@uwo.ca	Grace Kelly grace.kelly@uwo.ca	Mina Mekhail mmekhail@uwo.ca	Vikki Tran vikki.tran@uwo.ca

This is an official document. Please retain the original in your files.

Western Research

Research Ethics

Western University Non-Medical Research Ethics Board
NMREB Amendment Approval Notice

Principal Investigator: Dr. Vicki Schwean
Department & Institution: Education,Western University

NMREB File Number: 106165
Study Title: Dual-credit Program Leadership and Student Engagement
Sponsor:

NMREB Revision Approval Date: July 24, 2015
NMREB Expiry Date: March 10, 2016

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Revised Western University Protocol		2015/06/18
Revised Letter of Information & Consent	Under 18 Years of Age	2015/06/18
Revised Letter of Information & Consent	Over 18 years of age	2015/06/18
Revised Letter of Information & Consent	Dual Credit Instructor	2015/06/18

The Western University Non-Medical Science Research Ethics Board (NMREB) has reviewed and approved the amendment to the above named study, as of the NMREB Amendment Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

[redacted]
Ethics Officer, on behalf of Riley Hinson, NMREB Chair

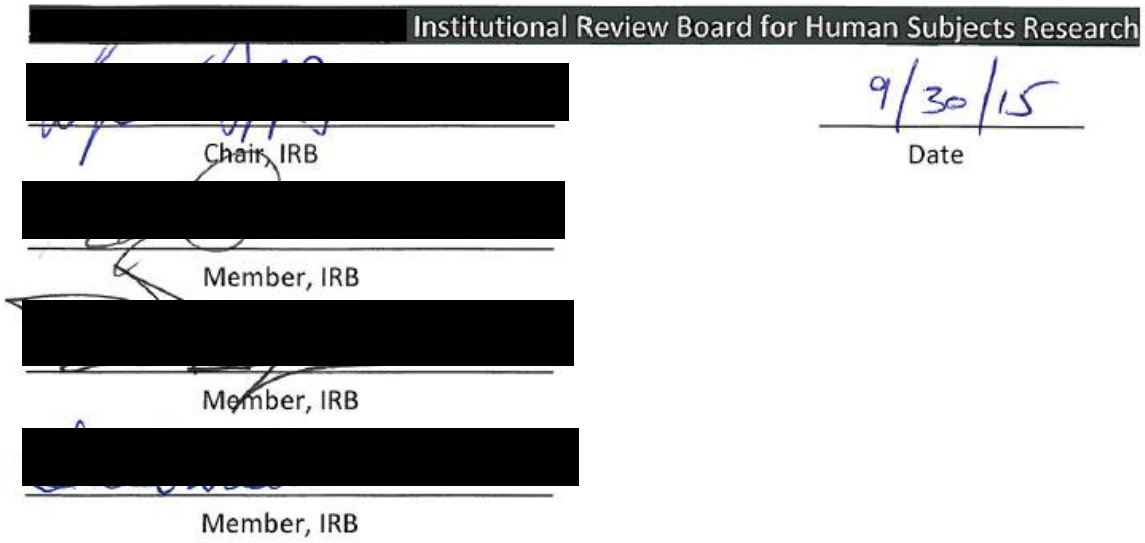
Ethics Officer to Contact for Further Information

Erika Basile ebasile@uwo.ca	Grace Kelly grace.kelly@uwo.ca	Mina Mekhail mmekhail@uwo.ca	Vikki Tran vikki.tran@uwo.ca

This is an official document. Please retain the original in your files.

Appendix B. Other Ethics Approvals

State University of New York


[redacted] Institutional Review Board for Human Subjects Research

[redacted]
Chair, IRB

9/30/15
Date

[redacted]
Member, IRB

[redacted]
Member, IRB

[redacted]
Member, IRB

☐ **Conditional approval**

The committee approves the request only if the following conditions are met:

_____

_____

_____

_____

Note: The specific campus of the State University of New York was disguised to protect their partnering high schools' anonymity. Permission to survey in all New York high schools was arranged in person with the high schools' principal and superintendant.

[redacted]

Research Ethics
Board Members
[redacted]

December 3, 2014

Principal Investigator: **Melanie Christian, [redacted]**
Research Study: **Dual-Enrollment Program Leadership and Student Engagement [redacted] REB #2014-109MC**

This application was subject to:

☐ Full Board Review ☑ Delegated Review

Dear Melanie:

I am writing to advise you that the Research Ethics Board (REB) of [redacted] College has granted **Approval** to the above-named research study. Your research may now begin at [redacted] I understand that you will be obtaining UWO REB approval for your project. Please forward a copy of the UWO REB approval letter to [redacted] once you have received it and it will be added to your [redacted] REB file.

You have one year to complete the project from the time of approval. Should you require more time to complete your project, you will be required to submit a Request for Continuation (or Amendment) of an Approved Project Form, in order to obtain ongoing ethics approval for your project. This must be submitted prior to REB approval expiry.

Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process prior to its implementation. Both a Request for Amendment of an Approved Project form and a revised [redacted] REB application must be submitted to the research office for review by the REB.

Any adverse or unanticipated events should be reported to the REB as soon as possible.The REB reserves the right to review your file at any time to ensure that research is being conducted in accordance with all [redacted] policies.

Once your project is complete, you are required to complete a Project Termination form. This form must be submitted as a final report about your research to the REB.

Best wishes for the successful completion of your project.

Sincerely,

[redacted]
Chair, Research Ethics Board

cc. Dr. Vicki Schwean, UWO
[redacted], Director, Research

[redacted] COLLEGE | Research Ethics Board

[redacted] College Research Ethics Board
Certificate of Approval to Conduct Research

Protocol #: 2015-APR-SCHWEAN

This is to certify that the [redacted] College Research Ethics Board (REB) has approved the application for the research project titled:

"Dual-Credit Program Leadership and Student Engagement"

to be conducted by:

Dr. Vicki Schwean and Ms. Melanie Christian.

The members of the REB are satisfied that this research project, as described in the application package, meets the appropriate ethical standards as set out in [redacted] College Policy [redacted] – Research Involving Human Subjects.

This certification is valid for one year from the date indicated below. If the researcher(s) wish to continue their study beyond the date indicated below, they will be required to submit an Annual Research Renewal Form.

If at any time during the course of the study the participants or researcher(s) encounter any adverse events, they are required to report them to the REB immediately, per [redacted] – Research Involving Human Subjects.

If at any time researchers wish to change any aspect of the study (e.g. data collection, recruitment procedures, research personnel), the researchers must inform the REB of the proposed changes and request their approval prior to implementing any changes.

Upon completion of the project, and no later than one year from the date indicated below, the principal investigator is required to submit a Project Completion Form to the REB.

The members of the [redacted] College REB would like to wish the researcher(s) well in their research.

[redacted]

[redacted], Ph.D.
Chair, REB
[redacted] College

June 3, 2015

Approval Date

[redacted] COLLEGE

REB Members:
[redacted]

June 25, 2015

Principal Investigator: Dr. Vicki Schwean

Research Study: Dual-Credit Program Leadership and Student Engagement - [redacted] REB #2015-2VS

This application was subject to:

Full Board Review ☐ Delegated Review ☒

Dear Dr. Vicki Schwean:

I am writing to advise you that the Research Ethics Board (REB) of [redacted] College has granted **Approval** to the above-named research study. Your research may begin.

You have one year to complete the project from the time of approval. Should you require more time to complete your project, you will be required to submit a Renewal and Amendment form, in order to obtain ongoing ethics approval for your project. This must be submitted prior to REB approval expiry. Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process as well, prior to its implementation. Both a Renewal and Amendment form and a revised [redacted] REB application must be submitted to the REB coordinator for review by the REB.

Any adverse or unanticipated events should be reported to the REB within five business days of the event by filling out an Adverse Event form. The REB reserves the right to review your file at any time to ensure that research is being conducted in accordance with all [redacted] policies.

Once your project is complete, you are required to submit a Completion and Termination form. This form must be submitted as a final report about your research to the REB.

Best wishes for the successful completion of your project.

If you have any questions or concerns, please do not hesitate to contact [redacted], Research Ethics Coordinator.

Sincerely,

[redacted]
Co-Chair, Research Ethics Board

[redacted]
Co-Chair, Research Ethics Board

cc. [redacted], Director, Research
[redacted], Loyalist College

[redacted] • [redacted] • [redacted], Ontario [redacted] • [redacted] • [redacted]

Ontario School Board #1

[redacted] [redacted]

March 23, 2015

Melanie Christian
Mathematics Professor
[redacted]

Dear Melanie:

Re: "Dual-credit Program Leadership and Student Engagement"

I am responding to your request to conduct a research project for the study "Dual-credit Program Leadership and Student Engagement" from [redacted] in the [redacted]. I have reviewed your materials, and approval is granted.

You have submitted the following components required as part of the [redacted] Administrative Procedure regarding External Research:

- written commitment to ensure anonymity of Board, schools, staff and students
- abstract of the research proposal
- copies of questionnaires, schedules
- participant consent form
- official ethics review

May I emphasize that in accordance with our Administrative Procedure [redacted]: External Research participation in this research is entirely voluntary by the schools involved. Also, it is understood that for all research projects, the names of schools, participants, principals, teachers and students will not be identified in your final report, and participants would have the right to opt out of this project at any time.

Best of luck on your research. I would appreciate a copy of your report when it is completed.

Sincerely,

[redacted]
Superintendent of Education
Program
[redacted]

cc [redacted], *Director of Education*
[redacted] *Dual Credit, St. Lawrence College*

[redacted] – Chair | [redacted] - Director of Education and Secretary | [redacted] – Treasurer

Our Students, Our Future

[redacted] CATHOLIC DISTRICT SCHOOL BOARD

Office of the Superintendent of School Effectiveness

January 9, 2015

Melanie Christian
[redacted]

Dear Ms. Christian,

Thank you for your interest in having the [redacted] Catholic District School Board participate in *"Dual-credit Program Leadership and Student Engagement"*. We have reviewed your request for participation in the research and are pleased to inform you that your proposal meets the criteria for conducting research in [redacted] Catholic District School Board.

You have been approved to begin your research in the school year 2014-2015. Each school principal that you have chosen will be encouraged to participate in the research project; participation will be at discretion of the principal, teacher and student.

I wish you every success with your research. We look forward to receiving the results of your study. Please feel free to contact me with any questions that you might have.

Sincerely,

[redacted]
Superintendent of School Effectiveness
DPG/bc

cc: [redacted] Director of Education
[redacted] Superintendent of School Effectiveness
[redacted] Superintendent of School Effectiveness
[redacted] Superintendent of School Effectiveness
[redacted] Assistant to the Director

[redacted]

[redacted] Actions

To: Melanie Christian

Inbox January 13, 2015 3:07 PM

- You forwarded this message on 29/01/2015 3:20 PM.

January 13, 2015

Attention: Melanie Christian

Dear Melanie,

Thank you for your sharing your research proposal entitled *Dual Enrollment Program Leadership and Student Engagement*, which has been reviewed by the [redacted]DSB External Research Steering Committee. I am pleased to advise you that your research application has been approved, pending receipt of the University of Western Ontario Ethics approval letter and your Criminal Reference Check.

Once your approval is confirmed with receipt of the above documents, please forward the names of the schools you wish to involve in your research to this email address so that we can make the initial contact with principals to advise of the approval of your study, and that you will be contacting them directly with further details. Please note that the decision to participate in such research is at the discretion of the school principal.

Thank you for your interest with the [redacted] District School Board. We wish you the very best with your research and look forward to receipt of your final report.

Sincerely,

Patti

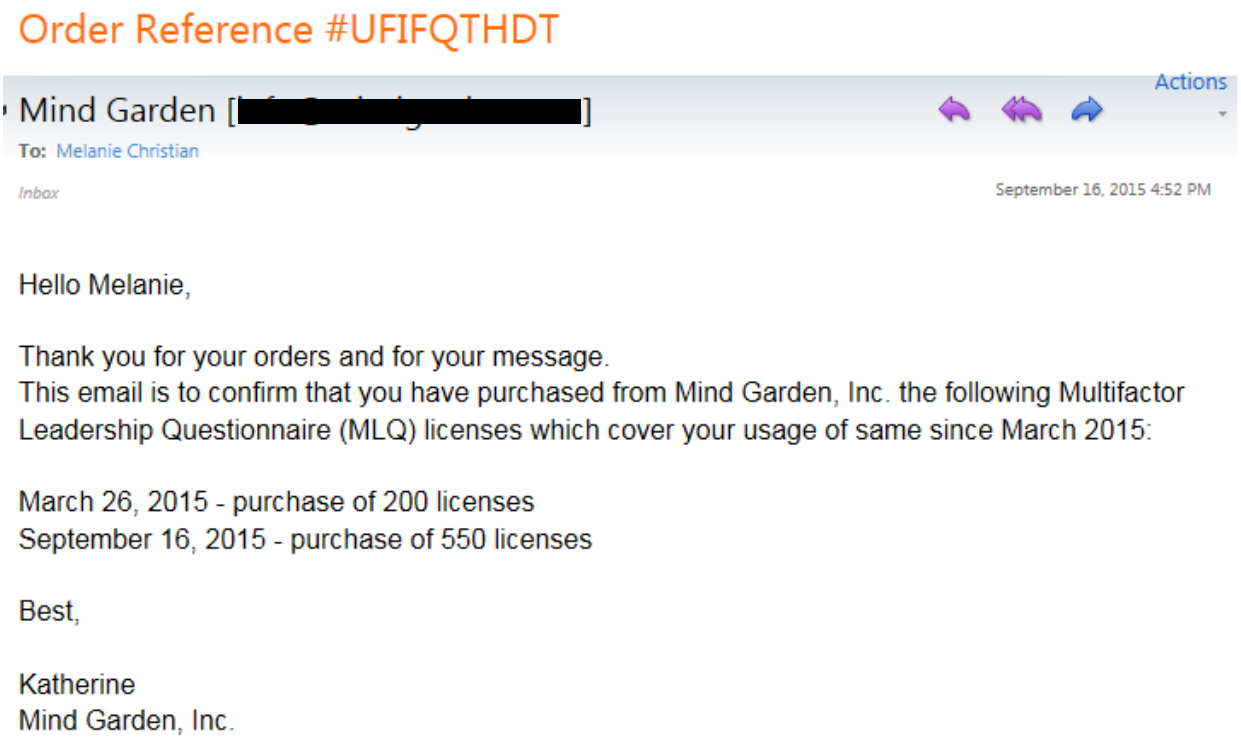
[redacted]

[redacted] District School Board

What have we done for our students today?

[redacted]

Appendix C. MLQ 5x License



Order Reference #UFIFQTHDT

Mind Garden [redacted]

Actions

To: Melanie Christian

Inbox

September 16, 2015 4:52 PM

Hello Melanie,

Thank you for your orders and for your message.
This email is to confirm that you have purchased from Mind Garden, Inc. the following Multifactor Leadership Questionnaire (MLQ) licenses which cover your usage of same since March 2015:

March 26, 2015 - purchase of 200 licenses
September 16, 2015 - purchase of 550 licenses

Best,

Katherine
Mind Garden, Inc.

Appendix D. CLASSE License

NSSE
national survey of
student engagement

The College Student Report
Item Usage Agreement

The National Survey of Student Engagement's (NSSE) survey instrument, *The College Student Report*, is copyrighted and the copyright is owned by The Trustees of Indiana University. Any use of survey items contained within *The College Student Report* is prohibited without prior written permission from Indiana University. When fully executed, this Agreement constitutes written permission from the University, on behalf of NSSE, for the party named below to use an item or items from *The College Student Report* in accordance with the terms of this Agreement.

In consideration of the mutual promises below, the parties hereby agree as follows:

1) The University hereby grants **Melanie Christian** ("Licensee") a nonexclusive, worldwide, irrevocable license to use, reproduce, distribute, publicly display and perform, and create derivatives from, in all media now known or hereafter developed, the item(s) listed in the proposal attached as Exhibit A, solely for the purpose of including such item(s) in the survey activity described in Exhibit A, which is incorporated by reference into this Agreement. This license does not include any right to sublicense others. This license only covers the survey instrument, time frame, population, and other terms described in Exhibit A. Any different or repeated use of the item(s) shall require an additional license.

2) In exchange for the license granted in section 1, Licensee agrees:

   a) there will be no licensing fee to use NSSE items for the purposes described in Exhibit A;

   b) to provide to NSSE frequency distributions and means on the licensed item(s);

   c) on the survey form itself, and in all publications or presentations of data obtained through the licensed item(s), to include the following citation: "Items 1-38 used with permission from *The College Student Report,* National Survey of Student Engagement, Copyright 2001-15 The Trustees of Indiana University";

   d) to provide to NSSE a copy of any derivatives of, or alterations to, the item(s) that Licensee makes for the purpose of Licensee's survey ("modified items"), for NSSE's own nonprofit, educational purposes, which shall include the use of the modified items in *The College Student Report* or any other survey instruments, reports, or other educational or professional materials that NSSE may develop or use in the future. Licensee hereby grants the University a nonexclusive, worldwide, irrevocable, royalty-free license to use, reproduce, distribute, create derivatives from, and publicly display and perform the modified items, in any media now known or hereafter developed; and

   e) to provide to NSSE, for its own nonprofit, educational purposes, a copy of all reports, presentations, analyses, or other materials in which the item(s) licensed under this

NSSE
national survey of
student engagement

Agreement, or modified items, and any responses to licensed or modified items, are presented, discussed, or analyzed. NSSE shall not make public any data it obtains under this subsection in a manner that identifies specific institutions or individuals, except with the consent of the Licensee.

3) This Agreement expires on December 31, 2015.

The undersigned hereby consent to the terms of this Agreement and confirm that they have all necessary authority to enter into this Agreement.

For The Trustees of Indiana University:

[redacted]

Alexander C. McCormick
Director
National Survey of Student Engagement

12/9/2014
Date

For Licensee:

[redacted]

Melanie Christian
PhD Student
University of Western Ontario

1/4/2015
Date

[redacted]

Dr. Vicki Schwean
Dean of the Faculty of Education
University of Western Ontario

1/12/2015
Date

Indiana University Center for Postsecondary Research
1900 East Tenth Street • Eigenmann Hall, Suite 419 • Bloomington, IN 47406
Phone: (812) 856-5824 • Fax: (812) 856-5150 • E-mail: nsse@indiana.edu • Web Address: www.nsse.iub.edu
Last revised June 2006

Appendix E. Classroom Survey of Student Engagement

STUDY ID#: _____

Important: Please record for STUDY ID# for future reference. You may use this ID# to withdraw from the study at any time by contacting the researcher at mchris47@uwo.ca. You can use an anonymous email address of your choosing when emailing your intention to have your data deleted removed from this study.

This survey includes items that ask about your participation in your **dual credit course** and about educational practices that occur in this class. Your honest and straightforward responses to these questions will help us identify targets for improvements and enable us to provide an even higher quality academic experience. **If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank**. **You can skip answering any question you want for any reason.**

PART I: ENGAGEMENT ACTIVITIES So far this semester, how often have you done each of the following in your dual-credit class	**Never** ↓	**1 or 2 times** ↓	**3 to 5 times** ↓	**More than 5 times** ↓
1. Asked questions during your dual-credit class	☐	☐	☐	☐
2. Contributed to a class discussion that occurred during your dual-credit class	☐	☐	☐	☐
3. Prepared two or more drafts of a paper or assignment in your dual-credit class before turning it in	☐	☐	☐	☐
4. Worked on a paper or a project in your dual-credit class that required integrating ideas or information from various sources	☐	☐	☐	☐
5. Included diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments in your dual-credit class	☐	☐	☐	☐
6. Came to your dual-credit class without having completed readings or assignments	☐	☐	☐	☐
7. Worked with other students on projects **during** your dual-credit **class**	☐	☐	☐	☐
8. Worked with classmates **outside of** your dual-credit **class** to prepare class assignments	☐	☐	☐	☐
9. Put together ideas or concepts from different courses when completing assignments or during class discussions in your dual-credit class	☐	☐	☐	☐
10. Tutored or taught other students in your dual-credit class	☐	☐	☐	☐
11. Used an electronic medium (list-serve, chat group, Internet, instant messaging, etc.) to discuss or complete an assignment in your dual-credit class	☐	☐	☐	☐

12. Used email to communicate with the instructor of your dual-credit class	☐	☐	☐	☐
13. Discussed grades or assignments with the instructor of your dual-credit class	☐	☐	☐	☐
14. Discussed ideas from your dual-credit class with others outside of class (students, family members, coworkers, etc.)	☐	☐	☐	☐

15. Made a class presentation in your dual-credit class

☐ Never ☐ Once ☐ 2 times ☐ More than 2 times

16. Participated in a community-based project (e.g., service learning) as part of your dual-credit class

☐ Never ☐ Once ☐ 2 times ☐ More than 2 times

17. Discussed ideas from your readings or classes with your dual-credit instructor outside of class

☐ Never ☐ Once ☐ 2 times ☐ More than 2 times

18. Received prompt written or oral feedback on your academic performance from your dual-credit instructor

☐ Never/Rarely ☐ Sometimes ☐ Often ☐ Very Often

19. Worked harder than you thought you could to meet your dual-credit instructor's standards or expectations

☐ Never/Rarely ☐ Sometimes ☐ Often ☐ Very Often

PART II: COGNITIVE SKILLS

So far this semester, how much of your coursework in your dual-credit class emphasized the following mental activities?	**Very Little** ↓	**Some** ↓	**Quite a Bit** ↓	**Very Much** ↓
20. **Memorizing** facts, ideas, or methods from your courses and readings so you can repeat them in pretty much the same form	☐	☐	☐	☐
21. **Analyzing** the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components	☐	☐	☐	☐
22. **Synthesizing** and organizing ideas, information, or experiences into new, more complex interpretations and relationships	☐	☐	☐	☐
23. **Making Judgments** about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions	☐	☐	☐	☐
24. **Applying** theories or concepts to practical problems or in new situations	☐	☐	☐	☐

PART III: OTHER EDUCATIONAL PRACTICES

So far this semester

25. How often in your dual-credit class have you been required to prepare written reports or reports of more than 5 pages in length?

☐ Never ☐ Once ☐ 2 times ☐ 3 or more times

26. To what extent do the examinations in your dual-credit class challenge you to do your best work?

☐ Very little ☐ Some ☐ Quite a bit ☐ Very much

27. In a **typical week** in your dual-credit class, how many homework assignments take you more than one hour each to complete?

☐ None ☐ 1 or 2 ☐ 3 or 4 ☐ 5 or more

28. In a **typical week**, how often do you spend more than 3 hours preparing for your dual-credit class (studying, reading, doing homework or lab work, analyzing data, rehearsing, and other academic matters)?

☐ Never/Rarely ☐ Sometimes ☐ Often ☐ Very Often

29. How many times have you been absent so far this semester in your dual-credit class?

☐ None ☐ 1 – 2 absences ☐ 3 – 4 absences ☐ 5 or more absences

30. How frequently do you take notes in your dual-credit class?

☐ Never/Rarely ☐ Sometimes ☐ Often ☐ Very Often

31. How often do you review your notes prior to the next scheduled meeting in your dual-credit class?

☐ Never/Rarely ☐ Sometimes ☐ Often ☐ Very Often

32. How often have you participated in a study partnership with a classmate in your dual-credit class to prepare for a quiz or a test?

☐ Never ☐ Once ☐ 2 times ☐ 3 or more times

33. How often have you attended a review session or help sessions to enhance your understanding of the content of your dual-credit class?

☐ Never ☐ Once ☐ 2 times ☐ 3 or more times

34. How interested are you in learning the dual-credit course material?

☐ Very uninterested ☐ Uninterested ☐ Interested ☐ Very Interested

PART IV: CLASS ATMOSPHERE

So far this semester, what are your general impressions of the dual-credit class atmosphere?

35. How comfortable are you talking with the instructor of your dual-credit class?

☐ Uncomfortable ☐ Somewhat Comfortable ☐ Comfortable ☐ Very Comfortable

36. How much do you enjoy group work with your classmates in your dual-credit class?

☐ Very Little ☐ Some ☐ Quite a Bit ☐ Very Much

37. How difficult is the course material in your dual-credit class?

☐ Easy ☐ Somewhat Difficult ☐ Difficult ☐ Very Difficult

38. How easy is it to follow the lectures in your dual-credit class?

☐ Difficult ☐ Somewhat Easy ☐ Easy ☐ Very Easy

PART IV: OPTIONAL ITEMS

39. Where is the majority of your dual-credit course delivered?

☐ High School ☐ College ☐ Distance Education (i.e., online, video, etc.)

40. Who is your dual-credit instructor(s)? *Choose one.*

☐ High School Teacher ☐ College Professor ☐ Team-Taught (by both High School Teacher and College Professor)

41. Is your dual-credit course part of a trade/apprenticeship program?

☐ Yes ☐ No

42. Have you changed your career or post-secondary plans (if any) as a result of taking this dual-credit course?

☐ Yes ☐ No

PART VI: DEMOGRAPHICS

43. What state or province do you live in?

☐ Ontario ☐ New York

44. What is your current grade?

☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ Other

45. Have you taken or are currently enrolled in multiple dual credits?

☐ Yes ☐ No

Appendix F. Sample Letters of Information

Project Title: Dual-credit Program Leadership and Student Engagement

Principal Investigator: Dr. Vicki Schwean (Dean), Faculty of Education, University of Western Ontario

Letter of Information (Students Under Age 18)

1. **Invitation to Participate**

   You are being invited to participate in this research study about dual-credit program leadership and student engagement because you are involved in dual-credit programs.

2. **Purpose of the Letter**

   The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research.

3. **Purpose of this Study**

   The purpose of this study is to explore the potential relationship between dual-credit program leadership (teacher and principal) and student engagement. Establishing such a relationship may offer insight into the creation of leadership-based professional development programs for dual-credit instructors and administrators. Statistical analyses will be used in this study to relate different leadership styles of teachers and principals, particularly transformational leadership, to student engagement. Variables considered in the analysis will include the type of dual-credit (academic or vocational), dual-credit delivery mode (college, high school, or team-taught), location (New York or Ontario), the number of dual-credit courses taken by the student, and whether the student is currently enrolled in grade 9, grade 10, grade 11, grade 12, or other (i.e., post high-school graduation). Student academic performance (i.e., past or present course marks, number of course completions, etc.), ethnicity, gender, parental, and socio-economic status variables will not be collected.

4. **Inclusion Criteria**

   Current dual-credit students between the ages of 16 and 21 are eligible to participate in this study.

5. **Exclusion Criteria**

   Current dual-credit students who do not provide consent to participate and/or who do not have parental/guardian permission to participate (if they are under 18) are not eligible to participate in this study. Students may also be excluded for any reason by the school board, school, or teacher.

6. Study Procedures

If you agree to participate, you will be asked to complete two surveys. You will be invited to complete surveys about your experiences in your dual-credit course and about your perceptions of your teacher's leadership style. Your dual-credit teacher or professor will be invited to complete a survey (outside the classroom) about his/her perceptions of your principal or dean's leadership style. It is anticipated that the entire task will take no more than 15 minutes over one session. The task will be conducted in your classroom while your dual-credit instructor is not in the classroom. Another teacher from your school will be present in the classroom with the researcher at all times. If you decline participation in this study, you can use the ten-to-fifteen minutes to complete homework quietly. There will be a total of up to 400 local student participants and 25 local teacher participants, and up to 800 total student participants and 50 total teacher participants in this research. The co-investigator of this study, Melanie Christian, will be handing out and collecting surveys in your class. Your high school guidance counselor or dual-credit supervising teacher (not your actual dual-credit course instructor) will maintain your consent form if you chose to participate in this research.

7. Possible Risks and Harms

There are no known or anticipated risks or discomforts associated with participating in this study.

8. Possible Benefits

You may not directly benefit from participating in this study but information gathered may provide benefits to society as a whole which include building stronger and improved dual-credit programs.

9. Compensation

You will not be compensated for your participation in this research.

10. Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on your future academic status.

11. Confidentiality

All data collected will remain anonymous and accessible only to the investigator of this study. If the results are published, no student, instructor, leader, course code, or school names will be used. If you choose to withdraw from this study, your data will be removed

and destroyed from my database. Your survey(s) will contain a study-generated barcode for to allow you to delete your record at a later point in time if you wish. You can record this barcode and contact Melanie Christian, [phone number], email: [email], with this barcode to have your records destroyed. You can use an anonymous email address of your choosing when emailing your intention to have your data deleted removed from this study, or can block your out-going phone number using call blocking (contact your phone service provider for instructions) when contacting the researcher by phone. The bar code is not used in the analysis, is stored separately from the paper surveys, and is encrypted in the digital data files. These instructions are repeated on the survey. *The information collected for this project is confidential and protected under the Municipal Freedom of Information and Protection of Privacy Act, 1989.*

12. Contacts for Further Information

The Research Steering Committee of [your school board/college] and the University of Western Ontario has granted approval for this study. Your school principal or college dean has also given permission for this study to be carried out in your son/daughter's school.

If you require any further information regarding this research project or your participation in the study you may contact the co-investigator, Melanie Christian, [phone number], email: [email], or her EdD supervisor, Dr. Vicki Schwean (Dean of the Faculty of Education), [phone number], email: [email].

If you have any questions or concerns about your rights as a research participant or the conduct of this study, you may contact the University of Western Ontario's, Office of Research Ethics, at [phone number], email: [email].

13. Publication

If the results of the study are published, your name and school name will not be used. If you would like to receive a copy of any potential study results, please contact Melanie Christian, [phone number], email: [email].

14. Consent

Completion of the survey(s) and consent form is indication of your consent to participate.

This letter is yours to keep for future reference.

Student (Under Age 18) Consent Form

Project Title: Dual-credit program leadership and student engagement.

Study Investigator's Name: Melanie Christian

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Participant's Name (please print): _____

Participant's Signature: _____

Date: _____

Parent / Legal Guardian / Legally Authorized Representative (if applicable) Print: _____

Parent / Legal Guardian / Legally Authorized Representative (if applicable) Sign: _____

Parent / Legal Guardian / Legally Authorized Representative (if applicable) Date: _____

Project Title: Dual-credit Program Leadership and Student Engagement

Principal Investigator: Dr. Vicki Schwean (Dean), Faculty of Education, University of Western Ontario

Letter of Information (Students Aged 18 and older)

1. Invitation to Participate

You are being invited to participate in this research study about dual-credit program leadership and student engagement because you are involved in dual-credit programs.

2. Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research.

3. Purpose of this Study

The purpose of this study is to explore the potential relationship between dual-credit program leadership (teacher and principal) and student engagement. Establishing such a relationship may offer insight into the creation of leadership-based professional development programs for dual-credit instructors and administrators. Statistical analyses will be used in this study to relate different leadership styles of teachers and principals, particularly transformational leadership, to student engagement. Variables considered in the analysis will include the type of dual-credit (academic or vocational), dual-credit delivery mode (college, high school, or team-taught), location (New York or Ontario), the number of dual-credit courses taken by the student, and whether the student is currently enrolled in grade 9, grade 10, grade 11, grade 12, or other (i.e., post high-school graduation). Student academic performance (i.e., past or present course marks, number of course completions, etc.), ethnicity, gender, parental, and socio-economic status variables will not be collected.

4. Inclusion Criteria

Current dual-credit students between the ages of 16 and 21 are eligible to participate in this study.

5. Exclusion Criteria

Current dual-credit students who do not provide consent to participate and/or who do not have parental/guardian permission to participate (if they are under 18) are not eligible to participate in this study. Students may also be excluded for any reason by the school board, school, or teacher.

6. Study Procedures

If you agree to participate, you will be asked to complete two surveys. You will be invited to complete surveys about your experiences in your dual-credit course and about your perceptions of your teacher's leadership style. Your dual-credit teacher or professor will be invited to complete a survey (outside the classroom) about his/her perceptions of your principal or dean's leadership style. It is anticipated that the entire task will take no more than 15 minutes over one session. The task will be conducted in your classroom while your dual-credit instructor is not in the classroom. Another teacher from your school will be present in the classroom with the researcher at all times. If you decline participation in this study, you can use the ten-to-fifteen minutes to complete homework quietly. There will be a total of up to 400 local student participants and 25 local teacher participants, and up to 800 total student participants and 50 total teacher participants in this research. The co-investigator of this study, Melanie Christian, will be handing out and collecting surveys in your class. Your high school guidance counselor or dual-credit supervising teacher (not your actual dual-credit course instructor) will maintain your consent form if you chose to participate in this research.

7. Possible Risks and Harms

There are no known or anticipated risks or discomforts associated with participating in this study.

8. Possible Benefits

You may not directly benefit from participating in this study but information gathered may provide benefits to society as a whole which include building stronger and improved dual-credit programs.

9. Compensation

You will not be compensated for your participation in this research.

10. Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on your future academic status.

11. Confidentiality

All data collected will remain anonymous and accessible only to the investigator of this study. If the results are published, no student, instructor, leader, school, or course names will be used. If you choose to withdraw from this study, your data will be removed and destroyed from my database. Your survey(s) will contain a study-generated barcode to allow you to delete your record at a later point in time if you wish. You can record this

barcode and contact Melanie Christian, [phone number], email: [email], with this barcode to have your records destroyed. You can use an anonymous email address of your choosing when emailing your intention to have your data deleted removed from this study, or can block your out-going phone number using call blocking (contact your phone service provider for instructions) when contacting the researcher by phone. These instructions are repeated on the survey. The bar code is not used in the analysis, is stored separately from the paper surveys, and is encrypted in the digital data files. *The information collected for this project is confidential and protected under the Municipal Freedom of Information and Protection of Privacy Act, 1989.*

12. Contacts for Further Information

The Research Steering Committee of [your school board/college] and the University of Western Ontario has granted approval for this study. Your school principal or college dean has also given permission for this study to be carried out in your school.

If you require any further information regarding this research project or your participation in the study you may contact the co-investigator, Melanie Christian, [phone number], email: [email], or her EdD supervisor, Dr. Vicki Schwean (Dean of the Faculty of Education), [phone number], email: [email].

If you have any questions or concerns about your rights as a research participant or the conduct of this study, you may contact the University of Western Ontario's, Office of Research Ethics, at [phone number], email: [email].

13. Publication

If the results of the study are published, your name and school name will not be used. If you would like to receive a copy of any potential study results, please contact Melanie Christian, [phone number], email: [email].

14. Consent

Completion of the survey(s) and consent form is indication of your consent to participate.

This letter is yours to keep for future reference.

Student (Age 18 and Over) Consent Form

Project Title: Dual-credit program leadership and student engagement.

Study Investigator's Name: Melanie Christian

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Participant's Name (please print): _____

Participant's Signature: _____

Date: _____

Project Title: Dual-credit Program Leadership and Student Engagement

Principal Investigator: Dr. Vicki Schwean (Dean), Faculty of Education, University of Western Ontario

Letter of Information (Instructors)

1. Invitation to Participate

You are being invited to participate in this research study about dual-credit program leadership and student engagement because you are involved in dual-credit programs.

2. Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research.

3. Purpose of this Study

The purpose of this study is to explore the potential relationship between dual-credit program leadership (teacher and principal) and student engagement. Establishing such a relationship may offer insight into the creation of leadership-based professional development programs for dual-credit instructors and administrators. Statistical analyses will be used in this study to relate different leadership styles of teachers and principals, particularly transformational leadership, to student engagement. Variables considered in the analysis will include the type of dual-credit (academic or vocational), dual-credit delivery mode (college, high school, or team-taught), location (New York or Ontario), the number of dual-credit courses taken by the student, and whether the student is currently enrolled in grade 9, grade 10, grade 11, grade 12, or other (i.e., post high-school graduation). Student academic performance (i.e., past or present course marks, number of course completions, etc.), ethnicity, gender, parental, and socio-economic status variables will not be collected.

4. Inclusion Criteria

Current dual-credit students between the ages of 16 and 21 are eligible to participate in this study.

5. Exclusion Criteria

Current dual-credit students who do not provide consent to participate and/or who do not have parental/guardian permission to participate (if they are under 18) are not eligible to participate in this study. Students may also be excluded for any reason by the school board, school, or teacher.

6. Study Procedures

If you agree to participate, you will be asked to complete two surveys. You will be invited to complete surveys about your experiences in your dual-credit course and about your perceptions of your teacher's leadership style. Your dual-credit teacher or professor will be invited to complete a survey (outside the classroom) about his/her perceptions of your principal or dean's leadership style. It is anticipated that the entire task will take no more than 15 minutes over one session. The task will be conducted in your classroom while your dual-credit instructor is not in the classroom. Another teacher from your school will be present in the classroom with the researcher at all times. If you decline participation in this study, you can use the ten-to-fifteen minutes to complete homework quietly. There will be a total of up to 400 local student participants and 25 local teacher participants, and up to 800 total student participants and 50 total teacher participants in this research. The co-investigator of this study, Melanie Christian, will be handing out and collecting surveys in your class. Your high school guidance counselor or dual-credit supervising teacher (not your actual dual-credit course instructor) will maintain your consent form if you chose to participate in this research.

7. Possible Risks and Harms

There are no known or anticipated risks or discomforts associated with participating in this study.

8. Possible Benefits

You may not directly benefit from participating in this study but information gathered may provide benefits to society as a whole which include building stronger and improved dual-credit programs.

9. Compensation

You will not be compensated for your participation in this research.

10. Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on your future academic status.

11. Confidentiality

All data collected will remain anonymous and accessible only to the investigator of this study. If the results are published, no student, instructor, leader, school, or course names will be used. If you choose to withdraw from this study, your data will be removed and destroyed from my database. Your survey(s) will contain a study-generated barcode to allow you to delete your record at a later point in time if you wish. You can record this

barcode and contact Melanie Christian, [phone number], email: [email], with this barcode to have your records destroyed. You can use an anonymous email address of your choosing when emailing your intention to have your data deleted removed from this study, or can block your out-going phone number using call blocking (contact your phone service provider for instructions) when contacting the researcher by phone. These instructions are repeated on the survey. The bar code is not used in the analysis, is stored separately from the paper surveys, and is encrypted in the digital data files. *The information collected for this project is confidential and protected under the Municipal Freedom of Information and Protection of Privacy Act, 1989.*

12. Contacts for Further Information

The Research Steering Committee of [your school board/college] and the University of Western Ontario has granted approval for this study. Your school principal or college dean has also given permission for this study to be carried out in your school.

If you require any further information regarding this research project or your participation in the study you may contact the co-investigator, Melanie Christian, [phone number], email: [email], or her EdD supervisor, Dr. Vicki Schwean (Dean of the Faculty of Education), [phone number], email: [email].

If you have any questions or concerns about your rights as a research participant or the conduct of this study, you may contact the University of Western Ontario's, Office of Research Ethics, at [phone number], email: [email].

13. Publication

If the results of the study are published, your name and school name will not be used. If you would like to receive a copy of any potential study results, please contact Melanie Christian, [phone number], email: [email].

14. Consent

Completion of the survey(s) and consent form is indication of your consent to participate.

This letter is yours to keep for future reference.

Student (Age 18 and Over) Consent Form

Project Title: Dual-credit program leadership and student engagement.

Study Investigator's Name: Melanie Christian

I have read the s
, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Participant's Name (please print): _____

Participant's Signature: _____

Date: _____

Table 1

Specified Factors and Related Sample Items from the MLQ 5x (Raters Form)

Factor	Sample Items (My leader…)
Transformational	
1. Idealized Influence (Attributed Charisma)	instills pride in me for being associated with him or her.
2. Idealized Influence (Behaviours)	
3. Inspirational Motivation	
4. Intellectual Stimulation	
5. Individualized Consideration	
Transactional	
6. Contingent Reward	expresses satisfaction when I meet expectations.
7. Management-by-Exception (Active)	
Passive-Avoidant	
8. Management-by-Exception (Passive)	fails to interfere until problems become serious.
9. Non-transactional laissez-faire	delays responding to urgent requests.

Note. Copyright only allows reproduction of five or fewer MLQ 5x items. Adapted from (Bass & Riggio, 2006).

Table 2

Description of Student Participants

	n	%
Province		
New York	344	50.9
Ontario	332	49.1
Grade Level		
Grade 9	1	.1
Grade 10	43	6.4
Grade 11	253	37.5
Grade 12	341	50.6
Other (e.g., Post-Graduation)	36	5.3
Enrolled in Multiple Dual Credits		
Yes	449	67.0
No	221	33.0
Dual-credit delivery location		
High school	547	80.9
College	129	19.1
Type of Dual-credit instructor		
High school teacher	536	79.3
College professor	115	17.0
Team-taught	25	3.7
Type of dual credit		
Academic	594	87.9
Vocational	82	12.1
Course Type		
New York		
Advanced Placement	24	7.0
International Baccalaureate	159	46.2
University/College	161	46.8
Ontario		
Advanced Placement	82	24.7
International Baccalaureate	97	29.2
University/College	153	46.1

Table 3

Percent Frequency of MLQ 5x Item Responses Rated by Students and Related Descriptive Statistics (n = 668)

Leadership Style/Dimension	No. of students (%) Not at all 0	Once in a while 1	Sometimes 2	Fairly Often 3	Frequently, if not always 4	Skew	Kurtosis
Transformational							
1. II(A)10	64 (10.1)	66 (10.4)	153 (24.2)	180 (28.4)	170 (26.9)	-.54	-.68
2. II(A)18	21 (3.3)	40 (6.3)	117 (18.6)	230 (36.5)	222 (35.2)	-.92	.37
3. II(A)21	21 (3.3)	34 (5.3)	92 (14.3)	222 (34.5)	275 (42.7)	-1.16	.90
4. II(A)25	12 (1.9)	32 (5.0)	95 (14.8)	230 (35.9)	271 (42.3)	-1.08	.82
5. II(B)6	124 (19.4)	151 (23.6)	167 (26.1)	134 (21.0)	63 (9.9)	.12	-1.01
6. II(B)14	29 (4.6)	43 (6.8)	105 (16.6)	221 (34.9)	236 (37.2)	-.99	.35
7. II(B)23	28 (4.7)	46 (7.7)	147 (24.7)	205 (34.4)	170 (28.5)	-.70	-.09
8. II(B)34	31 (5.2)	54 (9.0)	166 (27.8)	186 (31.2)	160 (26.8)	-.56	-.34
9. IM9	24 (3.7)	45 (6.9)	138 (21.2)	210 (32.2)	235 (36.0)	-.83	.06
10. IM13	19 (2.9)	33 (5.0)	85 (12.9)	249 (37.9)	271 (41.2)	-1.20	1.16
11. IM26	31 (5.1)	39 (6.4)	144 (23.6)	191 (31.3)	206 (33.7)	-.79	-.01
12. IM36	15 (2.4)	31 (4.9)	94 (14.9)	211 (33.5)	279 (44.3)	-1.14	.88
13. IS2	20 (3.2)	50 (8.0)	149 (23.9)	259 (41.5)	146 (23.4)	-.69	.13
14. IS8	25 (3.9)	58 (9.0)	151 (23.5)	210 (32.7)	198 (30.8)	-.67	-.25
15. IS30	29 (4.6)	53 (8.4)	142 (22.5)	180 (28.5)	227 (36.0)	-.74	-.25
16. IS32	35 (5.5)	56 (8.9)	130 (20.6)	191 (30.2)	220 (34.8)	-.77	-.24
17. IC15	10 (1.5)	23 (3.5)	62 (9.4)	154 (23.3)	413 (62.4)	-1.69	2.52
18. IC19	26 (4.0)	31 (4.8)	114 (17.6)	194 (30.0)	282 (43.6)	-1.09	.60
19. IC29	173 (28.5)	70 (11.5)	129 (21.2)	134 (22.0)	102 (16.8)	.00	-1.38
20. IC31	27 (4.3)	35 (5.5)	100 (15.8)	204 (32.2)	268 (42.3)	-1.11	.63
Transactional							
21. CR1	12 (1.8)	26 (4.0)	113 (17.2)	224 (34.0)	283 (43.0)	-1.03	.74
22. CR11	54 (9.1)	47 (8.0)	174 (29.4)	202 (34.2)	114 (19.3)	-.58	-.30
23. CR16	13 (2.0)	20 (3.1)	93 (14.4)	210 (32.6)	309 (47.9)	-1.24	1.36
24. CR35	19 (3.0)	26 (4.1)	98 (15.5)	225 (35.7)	263 (41.7)	-1.15	1.05
25. MBEA4	93 (14.8)	143 (22.8)	164 (26.1)	153 (24.4)	75 (11.9)	-.01	-1.00
26. MBEA22	66 (10.7)	97 (15.7)	162 (26.2)	170 (27.5)	123 (19.9)	-.30	-.88
27. MBEA24	126 (20.8)	119 (19.6)	156 (25.7)	123 (20.3)	83 (13.7)	.07	-1.12
28. MBEA27	119 (19.8)	127 (21.1)	167 (27.8)	129 (21.5)	59 (9.8)	.07	-1.01
Laissez-Faire							
29. MBEP3	315 (49.5)	138 (21.7)	111 (17.5)	51 (8.0)	21 (3.3)	1.00	.01
30. MBEP12	381 (60.3)	110 (17.4)	80 (12.7)	41 (6.5)	20 (3.2)	1.38	.91
31. MBEP17	120 (20.5)	101 (17.3)	182 (31.1)	113 (19.3)	69 (11.8)	.04	-1.00
32. MBEP20	252 (42.6)	127 (21.5)	114 (19.3)	67 (11.3)	31 (5.2)	.75	-.56
33. LF5	398 (61.8)	121 (18.8)	79 (12.3)	31 (4.8)	15 (2.3)	1.50	1.50
34. LF7	342 (52.9)	144 (22.3)	89 (13.8)	48 (7.4)	23 (3.6)	1.19	.45
35. LF28	390 (63.1)	115 (18.6)	67 (10.8)	32 (5.2)	14 (2.3)	1.57	1.68
36. LF33	358 (57.6)	108 (17.4)	85 (13.7)	51 (8.2)	20 (3.2)	1.21	.37
Followers' Extra Effort							
37. EE39	39 (6.2)	44 (7.0)	142 (22.5)	183 (29.0)	223 (35.3)	-.80	-.15
38. EE42	31 (4.9)	33 (5.2)	112 (17.7)	179 (28.2)	279 (44.0)	-1.07	.44
39. EE44	33 (5.2)	35 (5.5)	103 (16.2)	171 (26.9)	294 (46.2)	-1.12	.47

Note. II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 4

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the MLQ 5x (n = 668)

	1	2	3	4	5	6	7	8	9	10
1. II(A)10	—									
2. II(A)18	.52***	—								
3. II(A)21	.65***	.67***	—							
4. II(A)25	.38***	.41***	.53***	—						
5. II(B)6	.08*	-.09*	-.00	.14***	—					
6. II(B)14	.58***	.48***	.54***	.50***	.12**	—				
7. II(B)23	.47***	.52***	.53***	.43***	.09*	.48***	—			
8. II(B)34	.54***	.48***	.55***	.50***	.14***	.64***	.51***	—		
9. IM9	.59***	.47***	.57***	.40***	.06	.52***	.42***	.45***	—	
10. IM13	.52***	.47***	.59***	.46***	.00	.64***	.42***	.46***	.54***	—
11. IM26	.58***	.50***	.62***	.57***	.10*	.61***	.53***	.60***	.59***	.51***
12. IM36	.56***	.59***	.67***	.46***	.02	.56***	.49***	.60***	.51***	.64***
13. IS2	.46***	.40***	.46***	.36***	.10*	.40***	.36***	.36***	.43***	.42***
14. IS8	.43***	.50***	.49***	.39***	.08*	.40***	.46***	.38***	.52***	.38***
15. IS30	.55***	.53***	.58***	.49***	.05	.48***	.53***	.59***	.46***	.41***
16. IS32	.53***	.50***	.56***	.42***	.03	.51***	.48***	.60***	.47***	.47***
17. IC15	.45***	.54***	.59***	.47***	-.12*	.51***	.40***	.42***	.40***	.57***
18. IC19	.53***	.54***	.63***	.40***	.03	.46***	.47***	.43***	.42***	.52***
19. IC29	.35***	.27***	.29***	.18***	.20***	.27***	.29***	.30***	.22***	.15**
20. IC31	.62***	.57***	.72***	.50***	-.02	.56***	.52***	.60***	.52***	.51***
21. CR1	.52***	.55***	.61***	.36***	.01	.40***	.45***	.40***	.44***	.46***
22. CR11	.54***	.37***	.43***	.36***	.24***	.48***	.44***	.43***	.38***	.40***
23. CR16	.51***	.58***	.62***	.52***	.09*	.53***	.47***	.56***	.52***	.53***
24. CR35	.58***	.51***	.61***	.45***	.00	.56***	.47***	.57***	.49***	.59***
25. MBEA4	.09*	.00	-.00	.05	.22***	.08	.08	.07	.10*	.05
26. MBEA22	.31***	.30***	.38***	.26***	.10*	.20***	.35***	.26***	.24***	.20***
27. MBEA24	.12**	.08	.09*	.19***	.10*	.14**	.27***	.15***	.11*	.08
28. MBEA27	.04	-.04	.01	.10*	.17***	.07	.12**	.09*	.08	.00
29. MBEP3	-.16***	-.30***	-.33***	-.23***	.14**	-.17***	-.16***	-.16***	-.19***	-.23***
30. MBEP12	-.15**	-.30***	-.35***	-.21***	.27***	-.24***	-.22***	-.16***	-.19***	-.29***
31. MBEP17	.14***	.13**	.08	.14**	.12**	.07	.10*	.17***	.01	-.05
32. MBEP20	-.13**	-.21***	-.20***	-.07	.18***	-.11*	-.13**	-.02	-.14**	-.20***
33. LF5	-.11*	-.29***	-.30***	-.20***	.26***	-.16**	-.15**	-.13*	-.20***	-.18***
34. LF7	-.19***	-.25***	-.36***	-.19***	.32***	-.27***	-.15**	-.22***	-.26***	-.23***
35. LF28	-.22***	-.27***	-.30***	-.26***	.15**	-.22***	-.20***	-.14**	-.23***	-.30***
36. LF33	-.20***	-.30***	-.37***	-.14**	.20***	-.23***	-.23***	-.13**	-.29***	-.33***
37. EE39	.51***	.45***	.54***	.41***	-.01	.46***	.47***	.55***	.44***	.44***
38. EE42	.64***	.60***	.72***	.52***	.01	.57***	.51***	.59***	.51***	.53***
39. EE44	.63***	.58***	.72***	.52***	-.02	.54***	.48***	.58***	.54***	.52***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 4 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the MLQ 5x (n = 668)

	11	12	13	14	15	16	17	18	19	20
11. IM26	—									
12. IM36	.58***	—								
13. IS2	.45***	.45***	—							
14. IS8	.42***	.41***	.44***	—						
15. IS30	.63***	.58***	.45***	.53***	—					
16. IS32	.56***	.60***	.36***	.46***	.68***	—				
17. IC15	.48***	.54***	.41***	.37***	.43***	.43***	—			
18. IC19	.50***	.59***	.36***	.39***	.50***	.51***	.48***	—		
19. IC29	.31***	.30***	.21***	.17***	.41***	.31***	.08	.33***	—	
20. IC31	.58***	.69***	.44***	.45***	.69***	.72***	.57***	.60***	.32***	—
21. CR1	.48***	.55***	.58***	.44***	.46***	.47***	.53***	.52***	.19***	.58***
22. CR11	.43***	.43***	.38***	.35***	.41***	.44***	.32***	.31***	.33***	.40***
23. CR16	.55***	.61***	.46***	.48***	.55***	.53***	.62***	.49***	.18***	.64***
24. CR35	.54***	.77***	.44***	.43***	.53***	.58***	.54***	.57***	.24***	.66***
25. MBEA4	.16***	-.02	.10*	.08	.13**	.07	-.08	-.01	.16***	.03
26. MBEA22	.33***	.19***	.19***	.22***	.27***	.29***	.23***	.28***	.09*	.30***
27. MBEA24	.17***	.05	.15**	.10*	.15***	.13**	.06	.07	.15***	.08
28. MBEA27	.16***	.00	.12**	.08	.09	.14**	-.08	.04	.21***	.06
29. MBEP3	-.15**	-.30***	-.13**	-.18***	-.18***	-.21***	-.31***	-.27***	.07	-.26***
30. MBEP12	-.17***	-.29***	-.09	-.16***	-.23***	-.20***	-.40***	-.28***	.17**	-.32***
31. MBEP17	.13**	.00	.10*	.06	.12*	.10*	-.04	.02	.10*	.07
32. MBEP20	-.05	-.18***	-.08	-.15**	-.04	-.03	-.34***	-.17***	.20***	-.15**
33. LF5	-.18***	-.28***	-.17***	-.19***	-.15**	-.16**	-.41***	-.21***	.19***	-.28***
34. LF7	-.17***	-.28***	-.13**	-.04	-.15**	-.17***	-.34***	-.18***	.05	-.26***
35. LF28	-.18***	-.27***	-.26***	-.22***	-.18***	-.14**	-.42***	-.22***	.19***	-.27***
36. LF33	-.20***	-.31***	-.18***	-.22***	-.15**	-.14**	-.41***	-.30***	.10*	-.27***
37. EE39	.48***	.60***	.38***	.34***	.58***	.57***	.39***	.48***	.27***	.62***
38. EE42	.60***	.69***	.44***	.43***	.61***	.63***	.55***	.55***	.25***	.75***
39. EE44	.58***	.67***	.45***	.42***	.64***	.62***	.54***	.57***	.25***	.74***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 4 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the MLQ 5x (n = 668)

	21	22	23	24	25	26	27	28	29	30
21. CR1	—									
22. CR11	.40***	—								
23. CR16	.55***	.46***	—							
24. CR35	.56***	.46***	.57***	—						
25. MBEA4	-.01	.19***	-.04	-.02	—					
26. MBEA22	.28***	.30***	.22***	.26***	.41***	—				
27. MBEA24	.09	.25***	.17***	.05	.42***	.50***	—			
28. MBEA27	.06	.24***	.05	.10*	.38***	.43***	.49***	—		
29. MBEP3	-.23***	-.02	-.31***	-.30***	.30***	-.03	.07	.14**	—	
30. MBEP12	-.22***	.00	-.34***	-.24***	.28***	.05	.12*	.23***	.62***	—
31. MBEP17	.07	.19***	.09	.07	.16***	.20***	.23***	.23***	.09*	.18***
32. MBEP20	-.20***	.09	-.18***	-.20***	.30***	.15***	.28***	.35***	.41***	.63***
33. LF5	-.27***	-.01	-.36***	-.27***	.36***	.01	.11*	.25***	.64***	.65***
34. LF7	-.24***	-.06	-.23***	-.18***	.10*	-.16***	.08	.09	.37***	.54***
35. LF28	-.26***	-.05	-.37***	-.27***	.17***	.04	.14**	.26***	.39***	.57***
36. LF33	-.27***	-.05	-.27***	-.29***	.22***	.02	.14**	.24***	.45***	.53***
37. EE39	.46***	.36***	.47***	.58***	.05	.19***	.09	.06	-.22***	-.20***
38. EE42	.56***	.47***	.61***	.64***	.01	.30***	.10*	.01	-.30***	-.31***
39. EE44	.56***	.42***	.61***	.66***	-.02	.25***	.17***	.01	-.32***	-.36***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 4 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the MLQ 5x (n = 668)

	31	32	33	34	35	36	37	38	39
31. MBEP17	—								
32. MBEP20	.30***	—							
33. LF5	.16**	.60***	—						
34. LF7	.16***	.40***	.46***	—					
35. LF28	.24***	.51***	.60***	.36***	—				
36. LF33	.23***	.50***	.57***	.46***	.64***	—			
37. EE39	.07	-.15**	-.16***	-.13**	-.16**	-.14**	—		
38. EE42	.09*	-.17***	-.23***	-.23***	-.26**	-.25**	.72***	—	
39. EE44	.09	-.19***	-.29***	-.23***	-.28**	-.26**	.69***	.89***	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 5

EFA Model Fit Indices for the MLQ 5x Student Responses (n = 668)

	χ^2 (df)	CFI/TLI	RMSEA (90% CI)	SRMR
1-factor	6555.343*** (702)	.798/.787	.112 (.109;.114)	.117
2-factor	2369.027*** (664)	.941/.934	.062 (.059;.065)	.052
3-factor	1740.675*** (627)	.962/.955	.052 (.049;.054)	.042
4-factor	1400.565*** (591)	.972/.965	.045 (.042;.048)	.036

Note. *** $p < .001$

Table 6

Factor Loadings (3-Factor Solution) for EFA with Geomin Oblique Rotation for 39 Items Rated by Students From the MLQ 5x (n = 668)

	Standardized Loadings		
	Factor 1	Factor 2	Factor 3
Transformational			
1. II(A)10	**.751*** **	.039(.541)	.027(.470)
2. II(A)18	**.629*** **	-.187(.002)	.040(.390)
3. II(A)21	**.759*** **	-.183(.005)	.015(.644)
4. II(A)25	**.563*** **	-.046(.520)	.112(.013)
5. II(B)6	.143(.005)	**.362*** **	.120(.023)
6. II(B)14	**.667*** **	-.039(.567)	.097(.028)
7. II(B)23	**.573*** **	-.024(.699)	.175***
8. II(B)34	**.763*** **	.095(.116)	-.001(.963)
9. IM9	**.586*** **	-.093(.225)	.125(.009)
10. IM13	**.592*** **	-.186(.004)	.075(.115)
11. IM26	**.710*** **	.040(.605)	.142***
12. IM36	**.817*** **	-.123(.017)	-.112(.007)
13. IS2	**.508*** **	-.046(.528)	.143(.003)
14. IS8	**.511*** **	-.064(.368)	.131(.007)
15. IS30	**.818*** **	.106(.053)	-.042(.275)
16. IS32	**.823*** **	.100(.062)	-.083(.046)
17. IC15	**.505*** **	-.373***	.056(.308)
18. IC19	**.654*** **	-.114(.035)	-.018(.603)
19. IC29	**.510*** **	.370***	-.023(.567)
20. IC31	**.882*** **	-.043(.363)	-.131***
Transactional			
21. CR1	**.598*** **	-.156(.031)	.077(.137)
22. CR11	**.568*** **	.199(.017)	.187***
23. CR16	**.647*** **	-.193(.008)	.074(.143)
24. CR35	**.784*** **	-.099(.069)	-.082(.057)
25. MBEA4	.007(.840)	.387***	**.490*** **
26. MBEA22	.173***	.131(.294)	**.583*** **
27. MBEA24	.001(.976)	.251(.041)	**.645*** **
28. MBEA27	.004(.894)	.373***	**.558*** **
Passive Avoidant			
29. MBEP3	-.106(.038)	**.637*** **	.062(.309)
30. MBEP12	-.079(.111)	**.787*** **	.095(.155)
31. MBEP17	.170(.001)	**.334*** **	.160(.004)
32. MBEP20	.015(.632)	**.729*** **	.179(.009)
33. LF5	-.003(.921)	**.822*** **	.034(.623)
34. LF7	-.042(.477)	**.565*** **	-.085(.228)
35. LF28	-.051(.354)	**.716*** **	-.004(.917)
36. LF33	-.054(.336)	**.717*** **	-.014(.769)
Followers' Extra Effort			
37. EE39	**.842*** **	.074(.053)	-.256***
38. EE42	**1.045*** **	.031(.193)	-.394***
39. EE44	**1.016*** **	-.010(.220)	-.384***

Note. ***$p < .001$, *p*-values in brackets, bolding indicates items' strongest rotated loadings, standardized loadings are identical to unstandardized loadings, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 7

Factor Loadings (4-Factor Solution) for EFA with Geomin Oblique Rotation for 39 Items Rated by Students From the MLQ 5x (n = 668)

	Standardized Loadings			
	Factor 1	Factor 2	Factor 3	Factor 4
Transformational				
1. II(A)10	**.777*** **	.071(.043)	.005(.886)	-.031(.348)
2. II(A)18	**.618*** **	-.194***	.076(.042)	.024(.450)
3. II(A)21	**.726*** **	-.202***	.095(.004)	.066(.015)
4. II(A)25	**.572*** **	-.055(.184)	.115(.010)	-.031(.363)
5. II(B)6	.202***	**.384*** **	.030(.534)	-.186***
6. II(B)14	**.762*** **	.039(.243)	-.053(.126)	-.173***
7. II(B)23	**.581*** **	-.050(.l70)	.182***	-.030(.400)
8. II(B)34	**.790*** **	.144***	-.026(.441)	.024(.421)
9. IM9	**.647*** **	-.060(.102)	.030(.421)	-.167***
10. IM13	**.700*** **	-.094(.006)	-.109(.005)	-.217***
11. IM26	**.751*** **	.057(.095)	.095(.008)	-.078(.008)
12. IM36	**.889*** **	-.002(.955)	-.226***	.017(.495)
13. IS2	**.558*** **	-.029(.458)	.069(.115)	-.161***
14. IS8	**.552*** **	-.053(.168)	.073(.072)	-.134(.003)
15. IS30	**.786*** **	.110(.002)	.040(.218)	.139***
16. IS32	**.787*** **	.114(.002)	.004(.893)	.179***
17. IC15	**.534*** **	-.352***	.013(.744)	-.083(.020)
18. IC19	**.662*** **	-.085(.020)	-.017(.668)	.033(.289)
19. IC29	**.521*** **	.400***	-.019(.667)	.033(.446)
20. IC31	**.824*** **	-.038(.182)	-.008(.766)	.199***
Transactional				
21. CR1	**.615*** **	-.150***	.063(.146)	-.056(.180)
22. CR11	**.611*** **	.201***	.137(.002)	-.121(.005)
23. CR16	**.666*** **	-.180***	.057(.111)	-.041(.199)
24. CR35	**.843*** **	.004(.901)	-.171***	.014(.613)
25. MBEA4	.025(.440)	.271***	**.480*** **	-.122(.005)
26. MBEA22	.124(.009)	-.068(.091)	**.698*** **	.036(.289)
27. MBEA24	-.032(.355)	.050(.171)	**.724*** **	.015(.647)
28. MBEA27	.001(.980)	.224***	**.585*** **	-.015(.689)
Passive Avoidant				
29. MBEP3	-.051(.189)	**.656*** **	-.037(.380)	-.181***
30. MBEP12	-.020(.491)	**.807*** **	-.002(.942)	-.163(.001)
31. MBEP17	.143(.005)	**.273*** **	.225***	.089(.079)
32. MBEP20	.012(.720)	**.681*** **	.205***	.027(.414)
33. LF5	.027(.443)	**.834*** **	-.014(.732)	-.073(.107)
34. LF7	-.028(.544)	**.596*** **	-.110(.039)	-.026(.527)
35. LF28	-.082(.055)	**.695*** **	.068(.114)	.181(.001)
36. LF33	-.092(.034)	**.690*** **	.070(.114)	.172(.001)
Followers' Extra Effort				
37. EE39	**.759*** **	.090(.008)	-.089(.006)	.292***
38. EE42	**.839*** **	-.027(.159)	-.011(.577)	.431***
39. EE44	**.808*** **	-.074(.008)	.001(.973)	.436***

Note. ***$p < .001$, p-values in brackets, bolding indicates items' strongest rotated loadings, standardized loadings are identical to unstandardized loadings, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 8

Factor Loadings (2-Factor Solution) for EFA with Geomin Oblique Rotation for 39 Items Rated by Students From the MLQ 5x (n = 668)

	Standardized Loadings	
	Factor 1	Factor 2
Transformational		
1. II(A)10	**.766*** **	.075(.136)
2. II(A)18	**.674*** **	-.131(.017)
3. II(A)21	**.789*** **	-.130(.033)
4. II(A)25	**.631*** **	.023(.667)
5. II(B)6	.169(.024)	**.379*** **
6. II(B)14	**.727*** **	.026(.638)
7. II(B)23	**.676*** **	.070(.144)
8. II(B)34	**.755*** **	.113(.027)
9. IM9	**.668*** **	-.016(.714)
10. IM13	**.656*** **	-.120(.028)
11. IM26	**.785*** **	.117(.030)
12. IM36	**.777*** **	-.118(.048)
13. IS2	**.594*** **	.029(.535)
14. IS8	**.593*** **	.009(.827)
15. IS30	**.790*** **	.111(.032)
16. IS32	**.775*** **	.091(.084)
17. IC15	**.577*** **	-.305***
18. IC19	**.660*** **	-.085(.125)
19. IC29	**.454*** **	.339***
20. IC31	**.826*** **	-.051(.379)
Transactional		
21. CR1	**.660*** **	-.091(.114)
22. CR11	**.653*** **	.275***
23. CR16	**.709*** **	-.126(.040)
24. CR35	**.757*** **	-.088(.137)
25. MBEA4	.244(.013)	**.544*** **
26. MBEA22	**.493*** **	.373***
27. MBEA24	.349***	**.497*** **
28. MBEA27	.284(.003)	**.560*** **
Passive Avoidant		
29. MBEP3	-.143(.221)	**.610*** **
30. MBEP12	-.114(.427)	**.765*** **
31. MBEP17	.223(.002)	**.372*** **
32. MBEP20	.031(.802)	**.734*** **
33. LF5	-.076(.598)	**.781*** **
34. LF7	-.154(.134)	**.492*** **
35. LF28	-.134(.296)	**.667*** **
36. LF33	-.141(.266)	**.663*** **
Followers' Extra Effort		
37. EE39	**.710*** **	.001(.944)
38. EE42	**.871*** **	-.082(.138)
39. EE44	**.855*** **	-.108(.070)

Note. ***$p < .001$, *p*-values in brackets, bolding indicates items' strongest rotated loadings, standardized loadings are identical to unstandardized loadings, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 9

Percent Frequency of CLASSE Item Responses Rated by Students and Related Descriptive Statistics (n = 676)

	No. of students (%)					
Response Options	Never	1 or 2 times	3 to 5 times	More than 5 times	Skew	Kurtosis
1. Asked questions **[clquest]**	29 (4.3)	133 (19.7)	155 (23.0)	357 (53.0)	-.84	-.52
2. Contributed to discussions [clqdiscuss]	31 (4.6)	126 (18.8)	177 (26.3)	338 (50.3)	-.83	-.45
3. Prepared 2 or more drafts **[rewropap]**	148 (22.4)	221 (33.4)	166 (25.1)	126 (19.1)	.16	-1.13
4. Integrated ideas **[integrat]**	58 (8.8)	190 (28.8)	222 (33.7)	189 (28.7)	-.26	-.94
5. Included diverse perspectives **[divclass]**	132 (20.6)	157 (24.5)	159 (24.8)	192 (30.0)	-.16	-1.34
6. Came unprepared for class[a] **[clunprep]**	73 (10.9)	79 (11.8)	260 (38.7)	260 (38.7)	-.83	-.28
7. Worked with others in class **[classgrp]**	42 (6.3)	143 (21.4)	213 (31.9)	269 (40.3)	-.60	-.69
8. Worked with others outside class **[occgrp]**	171 (25.7)	210 (31.6)	155 (23.3)	129 (19.4)	.20	-1.19
9. Used ideas from other courses **[intideas]**	93 (14.0)	242 (36.5)	207 (31.2)	121 (18.3)	.04	-.92
10. Tutored other students **[tutor]**	336 (50.2)	198 (29.6)	76 (11.4)	59 (8.8)	1.03	.00
11. Used electronic medium **[itacadem]**	170 (25.4)	180 (26.9)	142 (21.2)	177 (26.5)	.05	-1.40
12. Emailed instructor **[email]**	271 (40.3)	196 (29.1)	119 (17.7)	87 (12.9)	.61	-.87
13. Discussed grades with instructor **[facgrad]**	80 (12.0)	242 (36.2)	199 (29.8)	147 (22.0)	.01	-.99
14. Discussed course with family **[oocideas]**	55 (8.2)	160 (23.7)	177 (26.3)	282 (41.8)	-.54	-.93
Response Options	Never	Once	2 times	More than 2 times		
15. Made class presentation **[clpresen]**	236 (35.5)	111 (16.7)	85 (12.8)	233 (35.0)	.05	-1.70
16. Undertook community project **[commproj]**	477 (72.8)	103 (15.7)	32 (4.9)	43 (6.6)	1.93	2.69
17. Talked with faculty outside class **[facideas]**	248 (37.5)	166 (25.1)	100 (15.1)	148 (22.4)	.40	-1.34
25. Wrote reports > 5 pages **[writemid]**	334 (49.9)	125 (18.7)	120 (17.9)	90 (13.5)	.71	-.96
32. Had study partnership [studyprt]	198 (29.5)	128 (19.0)	165 (24.6)	181 (26.9)	-.02	-1.49
33. Attended review sessions [revsess]	388 (58.0)	110 (16.4)	85 (12.7)	86 (12.9)	1.00	-.50
Response Options	Never/Rarely	Sometimes	Often	Very Often		
18. Received prompt feedback **[facfeed]**	77 (11.5)	172 (25.8)	238 (35.7)	180 (27.0)	-.31	-.91
19. Worked harder **[workhard]**	72 (10.8)	239 (35.7)	224 (33.5)	134 (20.0)	-.02	-.88
28. Spent >3 hours preparing **[acadpr01]**	264 (39.2)	249 (37.0)	112 (16.6)	48 (7.1)	.73	-.35
30. Took notes [takenote]	76 (11.4)	159 (23.9)	162 (24.4)	267 (40.2)	-.47	-1.08
31. Reviewed notes **[lsnotes]**	189 (28.2)	268 (39.9)	152 (22.7)	62 (9.2)	.44	-.68
Response Options	Very Little	Some	Quite a Bit	Very Much		
20. Memorized facts[a] **[memorize]**	191 (28.4)	249 (37.0)	176 (26.2)	57 (8.5)	.34	-.81
21. Analyzed ideas, theories, etc. **[analyze]**	25 (3.7)	122 (18.1)	280 (41.5)	247 (36.6)	-.61	-.34
22. Synthesized ideas **[synthesz]**	47 (7.0)	163 (24.3)	254 (37.9)	207 (30.8)	-.41	-.72
23. Made judgments **[evaluate]**	57 (8.5)	163 (24.4)	247 (37.0)	200 (30.0)	-.40	-.78
24. Applied theories in new ways **[applying]**	52 (7.7)	122 (18.2)	241 (35.9)	256 (38.2)	-.66	-.51
26. Found exams challenging **[exams]**	40 (6.0)	125 (18.6)	320 (47.7)	186 (27.7)	-.56	-.19
36. Enjoyed group work [enjoygrp]	44 (6.6)	173 (26.0)	244 (36.6)	205 (30.8)	-.36	-.80
Response Options	None	1 or 2	3 or 4	5 or more		
27. Did homework lasting > 1 hour **[probseta]**	217 (32.4)	277 (41.3)	132 (19.7)	44 (6.6)	.56	-.45
29. Number of absences [absent]	196 (29.0)	176 (26.1)	218 (32.3)	85 (12.6)	.13	-1.17
Response Options	Very uninterested	Uninterested	Interested	Very Interested		
34. Interested in learning material [interest]	18 (2.7)	64 (9.6)	345 (51.5)	243 (36.3)	-.78	.68
Response Options	Not Comfortable	Somewhat Comfortable	Comfortable	Very Comfortable		
35. Comfort level with instructor [comfort]	22 (3.3)	88 (13.1)	232 (34.6)	328 (49.0)	-.95	.16
Response Options	Easy	Somewhat Difficult	Difficult	Very Difficult		
37. Course material difficulty [diffmate]	83 (12.4)	315 (46.9)	232 (34.6)	41 (6.1)	.12	-.36
Response Options	Difficult	Somewhat Easy	Easy	Very Easy		
38. How easy to follow lectures [difflect]	21 (3.1)	161 (24.1)	315 (47.2)	170 (25.5)	-.30	-.49

Notes. [a] = reverse coded. Bolding represents questions and variable names taken from the National Survey of Student Engagement (NSSE).

Table 10

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the CLASSE (n = 676)

	1	2	3	4	5	6	7	8	9	10
1. clquest	—									
2. clqdiscuss	.73***	—								
3. rewropap	.22***	.33***	—							
4. integrat	.23***	.40***	.53***	—						
5. divclass	.21***	.42***	.40***	.56***	—					
6. clunprep	-.06	-.09	-.01	-.11**	-.07	—				
7. classgrp	.19***	.22***	.18***	.30***	.14**	-.11*	—			
8. occgrp	.26***	.27***	.23***	.29***	.17***	-.07	.41***	—		
9. intideas	.24***	.42***	.41***	.46***	.45***	-.04	.40***	.44***	—	
10. tutor	.21***	.21***	.19***	.15**	.13**	-.03	.22***	.34***	.33***	—
11. itacadem	.20***	.26***	.18***	.31***	.33***	-.18***	.24***	.32***	.28***	.08
12. email	.07	.16***	.28***	.27***	.36***	-.14**	.13**	.08	.27***	.12**
13. facgrad	.35***	.47***	.29***	.25***	.30***	-.13**	.19***	.29***	.39***	.20***
14. oocideas	.29***	.42***	.29***	.30***	.38***	-.09	.25***	.35***	.47***	.27***
15. clpresen	.18***	.34***	.33***	.41***	.44***	-.08	.33***	.24***	.34***	-.02
16. commproj	.04	.14*	.15**	.17**	.08	-.14*	.24***	.22***	.25***	.28***
17. facideas	.27***	.38***	.30***	.26***	.21***	-.13**	.15**	.34***	.41***	.26***
18. facfeed	.27***	.40***	.37***	.34***	.38***	-.04	.25***	.24***	.41***	.21***
19. workhard	.20***	.33***	.36***	.32***	.29***	.13**	.12**	.26***	.37***	.24***
20. memorize	-.08	-.07	-.18***	-.07	-.14**	-.09*	-.09*	-.17***	-.16***	-.10*
21. analyze	.26***	.37***	.30***	.36***	.43***	-.02	.23***	.17***	.36***	.10*
22. synthesz	.31***	.41***	.35***	.43***	.45***	-.02	.22***	.20***	.42***	.16***
23. evaluate	.20***	.40***	.32***	.44***	.43***	-.05	.16***	.22***	.46***	.15***
24. applying	.25***	.28***	.23***	.19***	.17***	.07	.17***	.16***	.36***	.25***
25. writemid	.10*	.22***	.33***	.43***	.35***	-.13**	.16***	.14**	.25***	.02
26. exams	.22***	.21***	.28***	.24***	.22***	.08	.16***	.32***	.27***	.09*
27. probseta	.10*	.11*	.25***	.10*	.12*	-.11*	.06	.22***	.17***	.20***
28. acadpr01	.21***	.17***	.28***	.21***	.20***	.02	.14**	.31***	.26***	.29***
29. absent	-.06	-.10*	.00	-.14**	-.12**	.32***	-.05	-.15***	-.06	.06
30. takenote	.01	.02	.12*	.16***	.08	.11*	.05	.23***	.17***	.02
31. lsnotes	.08	.14**	.27***	.18***	.16***	.14***	.04	.22***	.24***	.17***
32. studyprt	.24***	.21***	.17***	.13**	.06	.02	.22***	.41***	.27***	.31***
33. revsess	.12*	.08	.11*	.07	.01	-.07	.10*	.30***	.24***	.34***
34. interest	.25***	.30***	.15**	.13**	.18***	.20***	.12*	.07	.25***	.22***
35. comfort	.35***	.42***	.16***	.14**	.19***	.15**	.11*	.03	.26***	.15***
36. enjoygrp	.25***	.32***	.14***	.12**	.05	.06	.35***	.17***	.22***	.20***
37. diffmate	.11*	.04	.12**	.08	.03	-.10*	.07	.27***	.10*	.07
38. difflect	.20***	.27***	.10*	.17***	.19***	.08	.05	-.08	.18***	.09

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$. Full questions are given in Appendix A and short-form questions can be found in Table 9.

Table 10 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the CLASSE (n = 676)

	11	12	13	14	15	16	17	18	19	20
11. itacadem	—									
12. email	.36***	—								
13. facgrad	.27***	.34***	—							
14. oocideas	.31***	.26***	.51***	—						
15. clpresen	.28***	.35***	.20***	.19***	—					
16. commproj	.11*	.20***	.19***	.16**	.34***	—				
17. facideas	.17***	.25***	.46***	.42***	.26***	.32***	—			
18. facfeed	.22***	.27***	.43***	.38***	.39***	.23***	.49***	—		
19. workhard	.18***	.13**	.35***	.36***	.21***	.21***	.37***	.42***	—	
20. memorize	-.07	-.01	-.19***	-.21***	.01	-.17**	-.16***	-.14**	-.33***	—
21. analyze	.25***	.23***	.32***	.36***	.25***	.04	.33***	.39***	.36***	-.30***
22. synthesz	.33***	.25***	.34***	.35***	.32***	.11	.32***	.45***	.42***	-.17***
23. evaluate	.22***	.23***	.31***	.43***	.32***	.19***	.30***	.39***	.41***	-.19***
24. applying	.17***	.09*	.27***	.34***	.07	.23***	.33***	.35***	.44***	-.29***
25. writemid	.23***	.38***	.21***	.24***	.40***	.31***	.27***	.33***	.19***	-.06
26. exams	.19***	-.06	.25***	.35***	.14**	.16**	.24***	.33***	.49***	-.25***
27. probseta	.24***	.08	.20***	.18***	.16***	.29***	.23***	.22***	.24***	-.11*
28. acadpr01	.25***	.14**	.24***	.28***	.10*	.22***	.26***	.28***	.39***	-.16***
29. absent	-.11**	-.08	-.18***	-.03	-.16***	.03	-.13**	-.10*	.06	.00
30. takenote	.25***	-.02	.23***	.23***	-.07	.06	.19***	.13**	.28***	-.23***
31. lsnotes	.21***	.05	.28***	.29***	-.01	.23***	.25***	.24***	.43***	-.30***
32. studyprt	.25***	.03	.34***	.33***	.08	.26***	.32***	.23***	.31***	-.23***
33. revsess	.25***	.16***	.19***	.21***	.01	.29***	.32***	.20***	.23***	-.16***
34. interest	.02	.10*	.18***	.35***	-.04	.11*	.27***	.20***	.34***	-.23***
35. comfort	.06	.11*	.34***	.30***	.11*	.16**	.31***	.34***	.27***	-.14**
36. enjoygrp	.13**	.07	.22***	.27***	.07	.20***	.25***	.26***	.26***	-.23***
37. diffmate	.12**	-.07	.28***	.15***	-.05	.05	.19***	.09*	.28***	-.18***
38. difflect	.10*	.15**	.15***	.19***	.08	-.03	.12**	.24***	.21***	-.09*

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$. Full questions are given in Appendix A and short-form questions can be found in Table 9.

Table 10 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the CLASSE (n = 676)

	21	22	23	24	25	26	27	28	29	30
21. analyze	—									
22. synthesz	.70***	—								
23. evaluate	.54***	.71***	—							
24. applying	.45***	.53***	.60***	—						
25. writemid	.30***	.31***	.39***	.23***	—					
26. exams	.27***	.30***	.25***	.31***	.24***	—				
27. probseta	.06	.16***	.16***	.18***	.25***	.28***	—			
28. acadpr01	.20***	.28***	.20***	.21***	.21***	.37***	.60***	—		
29. absent	-.10*	-.08	-.04	.01	-.09	-.01	-.03	.05	—	
30. takenote	.11*	.11**	.14**	.28***	.17***	.32***	.31***	.35***	-.08	—
31. lsnotes	.22***	.27***	.27***	.35***	.17***	.36***	.35***	.45***	.09*	.48***
32. studyprt	.16***	.22***	.17***	.33***	.14**	.32***	.35***	.37***	-.04	.36***
33. revsess	.14**	.18***	.10*	.28***	.19***	.20***	.37***	.36***	-.06	.33***
34. interest	.30***	.24***	.28***	.36***	.12*	.23***	.00	.16***	.17***	.19***
35. comfort	.29***	.33***	.28***	.32***	.14**	.26***	-.04	.01	.03	.09
36. enjoygrp	.24***	.27***	.23***	.35***	.14**	.25***	.09*	.08	.05	.11*
37. diffmate	.14**	.09*	.08	.17***	.09	.41***	.34***	.39***	-.17***	.38***
38. difflect	.27***	.24***	.22***	.18***	.07	.07	-.12**	-.04	.01	.03

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$. Full questions are given in Appendix A and short-form questions can be found in Table 9.

Table 10 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Students on the CLASSE (n = 676)

	31	32	33	34	35	36	37	38
31. lsnotes	—							
32. studyprt	.39***	—						
33. revsess	.34***	.52***	—					
34. interest	.35***	.15**	.17***	—				
35. comfort	.16***	.18***	.12*	.38***	—			
36. enjoygrp	.24***	.25***	.18***	.37***	.53***	—		
37. diffmate	.22***	.37***	.29***	-.08	-.00	.08	—	
38. difflect	.09	-.09	-.08	.33***	.41***	.29***	-.22***	—

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$. Full questions are given in Appendix A and short-form questions can be found in Table 9.

Table 11

EFA Model Fit Indices for CLASSE Student Responses (n = 676)

	χ^2 (*df*)	CFI/TLI	RMSEA (90% CI)	SRMR
All Items				
1-factor	3848.183*** (665)	.727/.711	.084 (.082;.087)	.100
2-factor	2854.296*** (628)	.809/.786	.072 (.070;.075)	.078
3-factor	2136.275*** (592)	.867/.843	.062 (.059;.065)	.061
4-factor	1593.124*** (557)	.911/.888	.052 (.049;.055)	.052
5-factor	1398.201*** (523)	.925/.899	.050 (.047;.053)	.046
6-factor	1199.852*** (490)	.939/.913	.046 (.043;.050)	.041
Educationally Purposeful Scale				
1-factor	655.085*** (104)	.848/.825	.089 (.082;.095)	.081
2-factor	408.735*** (89)	.912/.881	.073 (.066;.080)	.063
3-factor	314.745*** (75)	.934/.894	.069 (.061;.077)	.053
4-factor	209.442*** (62)	.959/.921	.059 (.051;.068)	.042
Final Selected Items				
1-factor	1619.649*** (135)	.734/.698	.128 (.122;.133)	.114
2-factor	986.381*** (118)	.844/.798	.104 (.098;.110)	.077
3-factor	583.343*** (102)	.914/.871	.084 (.077; .090)	.057
4-factor	285.420*** (87)	.964/.937	.058 (.051; .066)	.036
5-factor	228.748*** (73)	.972/.941	.056 (.048; .064)	.030

Note. *** $p < .001$

Table 12

Factor Loadings for EFA with Geomin Oblique Rotation for all 38 Items Rated by Students from the CLASSE (n = 676)

	Standardized Loadings					
	Factor 1 Basic	Factor 2 Academic	Factor 3 Non-Cognitive	Factor 4 Collaborative/ Outside	Factor 5 Emotional	Factor 6 Cognitive
1. Asked questions **[clquest]**	**.750*** **	.099(.661)	.072(.271)	.061(.221)	-.024(.616)	-.105(.151)
2. Contributed to discussions [clqdiscuss]	**.755*** **	.346(.120)	-.033(.543)	.017(.666)	.022(.654)	-.071(.273)
13. Discussed grades with instructor **[facgrad]**	**.280*** **	.250(.057)	.148(.034)	.240***	-.073(.163)	.080(.146)
3. Prepared 2 or more drafts **[rewropap]**	.028(.618)	**.621*** **	.151(.004)	-.131(.070)	.123(.032)	-.079(.105)
4. Integrated ideas **[integrat]**	.046(.487)	**.760*** **	.012(.763)	-.169(.028)	-.020(.660)	.023(.601)
5. Included diverse perspectives **[divclass]**	.080(.300)	**.743*** **	-.025(.489)	-.249***	.010(.787)	.089(.094)
9. Used ideas from other courses **[intideas]**	.049(.557)	**.521*** **	.007(.883)	.251***	.064(.228)	.035(.433)
11. Used electronic medium **[itacadem]**	-.007(.898)	**.393*** **	.115(.076)	.109(.129)	-.179(.001)	.060(.273)
12. Emailed instructor **[email]**	-.164(.049)	**.560*** **	-.219***	.138(.077)	-.031(.523)	.014(.738)
14. Discussed course with family **[oocideas]**	.184(.041)	**.307**(.001)	.128(.030)	.242(.001)	.077(.165)	.083(.116)
15. Made class presentation **[clpresen]**	-.053(.487)	**.712*** **	-.212***	.023(.685)	-.118(.061)	-.028(.562)
18. Received prompt feedback **[facfeed]**	.099(.254)	**.448*** **	.036(.453)	.166(.005)	.093(.084)	.095(.078)
25. Wrote reports > 5 pages **[writemid]**	-.188(.002)	**.573*** **	.010(.817)	.024(.653)	-.031(.536)	.109(.064)
19. Worked harder **[workhard]**	.093(.159)	.266(.002)	**.398*** **	-.011(.794)	.277***	.107(.066)
20. Memorized facts[a] **[memorize]**	-.001(.988)	.017(.716)	**-.258*** **	-.093(.129)	-.172(.005)	-.160(.005)
26. Found exams challenging **[exams]**	.172(.004)	.133(.268)	**.507*** **	-.042(.381)	.104(.117)	.060(.276)
27. Did homework lasting > 1 hour **[probseta]**	-.143(.083)	.248(.001)	**.557*** **	.070(.204)	-.083(.126)	-.153(.043)
28. Spent > 3 hours preparing **[acadpr01]**	-.050(.374)	.291(.002)	**.646*** **	-.009(.825)	.034(.433)	-.164(.030)
30. Took notes [takenote]	-.061(.382)	-.017(.778)	**.577*** **	.035(.503)	.054(.404)	.073(.188)
31. Reviewed notes **[lsnotes]**	-.096(.062)	.104(.149)	**.546*** **	.063(.231)	.319***	.017(.611)
32. Had study partnership [studyprt]	.046(.316)	-.049(.481)	**.453*** **	.443***	-.051(.320)	-.003(.934)
37. Course material difficulty [diffmate]	.133(.335)	-.118(.425)	**.673*** **	.003(.925)	-.339***	.123(.146)
7. Worked with others in class **[classgrp]**	.028(.653)	.275(.003)	-.110(.093)	**.386*** **	-.055(.391)	-.039(.433)
8. Worked with others outside class **[occgrp]**	.094(.097)	.243(.034)	.234(.006)	**.358*** **	-.183(.002)	-.106(.063)
10. Tutored other students **[tutor]**	.030(.648)	.098(.171)	.081(.169)	**.413*** **	.142(.033)	-.156(.006)
16. Undertook community project **[commproj]**	-.262(.005)	.287(.018)	.000(.995)	**.451*** **	.091(.182)	-.121(.120)
17. Talked with faculty outside class **[facideas]**	.108(.184)	.268(.002)	.093(.139)	**.365*** **	.021(.656)	.055(.287)
33. Attended review sessions [revsess]	-.159(.010)	-.018(.670)	.360***	**.489*** **	-.042(.359)	.004(.915)
36. Enjoyed group work [enjoygrp]	.196(.122)	-.067(.195)	-.040(.323)	**.429*** **	.336***	.078(.241)
6. Came unprepared for class[a] **[clunprep]**	-.001(.977)	-.153(.177)	.133(.094)	-.172(.046)	**.498*** **	-.094(.170)
29. Number of absences [absent]	-.100(.195)	-.087(.472)	.026(.608)	-.062(.353)	**.473*** **	-.195(.015)
34. Interested in learning material [interest]	.142(.289)	.024(.563)	.048(.377)	.163(.035)	**.565*** **	.032(.530)
35. Comfort level with instructor [comfort]	.353(.018)	-.014(.713)	-.127(.035)	.274***	**.408*** **	.108(.191)
38. How easy to follow lectures [difflect]	.206(.154)	.131(.020)	-.242***	.016(.710)	**.391*** **	.099(.217)
21. Analyzed ideas, theories, etc. **[analyze]**	.093(.140)	.324(.002)	.022(.546)	-.034(.350)	.009(.804)	**.568*** **
22. Synthesized ideas **[synthesz]**	.033(.483)	.412***	.024(.372)	-.027(.352)	-.021(.511)	**.655*** **
23. Made judgments **[evaluate]**	-.076(.207)	.427***	-.011(.744)	.034(.324)	.057(.166)	**.579*** **
24. Applied theories in new ways **[applying]**	-.046(.363)	.038(.319)	.162(.003)	.269***	.189(.004)	**.510*** **

Note. ***$p < .001$, *p*-values in brackets, [a] = reverse coded, standardized loadings are identical to unstandardized loadings, bolding of variable names represents questions and variable names taken from the National Survey of Student Engagement (IUCPR, 2012, 2013), bolding of factor loadings represents the item's strongest primary loading.

Table 13

Factor Loadings for EFA with Geomin Oblique Rotation for Items Rated by Students from the Educationally Purposeful Activities Scale on the CLASSE (n = 676)

	Standardized Loadings			
	Factor 1 Participation	Factor 2 Collaboration	Factor 3 Academic	Factor 4 Active Learning
Part I: Engagement Activities				
1. Asked questions **[clquest]**	**.817*** **	.069(.148)	-.014(.493)	-.050(.211)
2. Contributed to discussions [clqdiscuss]	**.800*** **	-.033(.081)	.208(.035)	.040(.155)
7. Worked with others in class **[classgrp]**	.015(.711)	**.521*** **	-.045(.366)	.212(.011)
8. Worked with others outside class **[occgrp]**	.002(.951)	**.753*** **	.056(.409)	-.023(.642)
10. Tutored other students **[tutor]**	-.008(.869)	**.344*** **	.254(.005)	-.187(.007)
6. Came unprepared for class[a] **[clunprep]**	-.061(.287)	-.133(.063)	.139(.076)	**-.294*** **
11. Used electronic medium **[itacadem]**	.089(.129)	.242(.008)	.035(.528)	**.402*** **
12. Emailed instructor **[email]**	-.079(.142)	-.075(.256)	.306(.022)	**.533*** **
15. Made class presentation **[clpresen]**	.031(.421)	.113(.229)	.212(.088)	**.432*** **
3. Prepared 2 or more drafts **[rewropap]**	.043(.404)	.016(.757)	**.461*** **	.086(.241)
13. Discussed grades with instructor **[facgrad]**	.207***	.022(.630)	**.522*** **	.058(.331)
14. Discussed course with family **[oocideas]**	.143(.011)	.156(.009)	**.471*** **	.015(.755)
16. Undertook community project **[commproj]**	-.177(.013)	.249(.005)	**.278(.002)**	.137(.140)
17. Talked with faculty outside class **[facideas]**	.031(.490)	.082(.163)	**.627*** **	-.044(.473)
18. Received prompt feedback **[facfeed]**	.053(.244)	-.020(.694)	**.653*** **	.055(.405)
19. Worked harder **[workhard]**	-.010(.750)	.002(.960)	**.704*** **	-.233(.002)

Note. ***$p < .001$, p-values in brackets, [a] = reverse coded, standardized loadings are identical to unstandardized loadings, bolding of variable names represents questions and variable names taken from the National Survey of Student Engagement (IUCPR, 2012, 2013), bolding of factor loadings represents the item's strongest primary loading.

Table 14

Factor Loadings for Exploratory Factor Analysis with Geomin Oblique Rotation for 18 Selected Items Rated by Students From the CLASSE (n = 676)

	Standardized Loadings			
	Factor 1 Participation	Factor 2 Academic	Factor 3 Cognitive	Factor 4 Non-Cognitive
Part I: Engagement Activities				
1. Asked questions **[clquest]**	**.970*** **	-.022(.138)	-.019(.262)	.035(.158)
2. Contributed to discussions [clqdiscuss]	**.646*** **	.247***	.118(.031)	-.032(.113)
3. Prepared 2 or more drafts **[rewropap]**	-.005(.885)	**.603*** **	-.005(.896)	.181(.001)
4. Integrated ideas **[integrat]**	.010(.777)	**.666*** **	.073(.190)	.055(.153)
7. Worked with others in class [classgrp]	.092(.066)	**.401*** **	-.026(.640)	.064(.185)
9. Used ideas from other courses **[intideas]**	.060(.193)	**.491*** **	.171(.005)	.143(.003)
12. Emailed instructor **[email]**	-.098(.058)	**.468*** **	.070(.235)	-.130(.015)
15. Made class presentation **[clpresen]**	.034(.424)	**.663*** **	-.029(.512)	-.126(.023)
Part II: Cognitive Skills				
21. Analyzed ideas, theories, etc. **[analyze]**	.037(.399)	.039(.244)	**.712*** **	-.022(.523)
22. Synthesized ideas **[synthesz]**	.018(.557)	.051(.069)	**.861*** **	-.032(.208)
23. Made judgments **[evaluate]**	-.057(.095)	.084(.059)	**.781*** **	.017(.532)
24. Applied theories in new ways **[applying]**	.029(.314)	-.191(.001)	**.690*** **	.256***
Part III: Other Educational Practices				
26. Found exams challenging **[exams]**	.094(.075)	.076(.178)	.096(.086)	**.512*** **
27. Did homework lasting > 1 hour **[probseta]**	-.021(.528)	.184(.001)	-.107(.059)	**.525*** **
30. Took notes [takenote]	-.127(.022)	-.033(.426)	.038(.366)	**.675*** **
31. Reviewed notes **[lsnotes]**	-.099(.039)	.016(.669)	.177(.001)	**.588*** **
32. Had study partnership [studyprt]	.143(.005)	.041(.388)	.003(.938)	**.571*** **
Part IV: Class Atmosphere				
37. Course material difficulty [diffmate]	.057(.205)	-.048(.349)	-.067(.221)	**.604*** **

Note. ***$p < .001$, p-values in brackets, standardized loadings are identical to unstandardized loadings, bolding of variable names represents questions and variable names taken from the National Survey of Student Engagement (IUCPR, 2012, 2013), bolding of factor loadings represents the item's strongest primary loading.

Table 15

Percent Frequency of MLQ 5x Item Responses Rated by Teachers and Related Descriptive Statistics (n = 43)

Leadership Style/Dimension	No. of teachers (%) Not at all 0	Once in a while 1	Sometimes 2	Fairly Often 3	Frequently, if not always 4	Skew	Kurtosis
Transformational							
1. II(A)10	3 (7.7)	3 (7.7)	9 (23.1)	11 (28.2)	13 (33.3)	-.75	-.23
2. II(A)18	7 (20.6)	4 (11.8)	5 (14.7)	10 (29.4)	8 (23.5)	-.37	-1.28
3. II(A)21	5 (13.9)	4 (11.1)	6 (16.7)	11 (30.6)	10 (27.8)	-.59	-.86
4. II(A)25	4 (11.4)	3 (8.6)	6 (17.1)	17 (48.6)	5 (14.3)	-.88	-.04
5. II(B)6	4 (11.4)	4 (11.4)	11 (31.4)	8 (22.9)	8 (22.9)	-.34	-.75
6. II(B)14	3 (7.3)	5 (12.2)	9 (22.0)	13 (31.7)	11 (26.8)	-.59	-.51
7. II(B)23	1 (2.9)	1 (2.9)	6 (17.6)	14 (41.2)	12 (35.3)	-1.12	1.60
8. II(B)34	3 (8.6)	7 (20.0)	7 (20.0)	12 (34.3)	6 (17.1)	-.35	-.87
9. IM9	1 (2.4)	1 (2.4)	6 (14.6)	17 (41.5)	16 (39.0)	-1.24	2.04
10. IM13	1 (2.4)	5 (12.2)	6 (14.6)	16 (39.0)	13 (31.7)	-.81	-.08
11. IM26	3 (8.6)	5 (14.3)	7 (20.0)	12 (34.3)	8 (22.9)	-.55	-.63
12. IM36	3 (8.3)	4 (11.1)	5 (13.9)	13 (36.1)	11 (30.6)	-.83	-.26
13. IS2	4 (11.4)	6 (17.1)	8 (22.9)	11 (31.4)	6 (17.1)	-.33	-.88
14. IS8	4 (10.5)	8 (21.1)	5 (13.2)	11 (28.9)	10 (26.3)	-.37	-1.16
15. IS30	8 (23.5)	3 (8.8)	10 (29.4)	10 (29.4)	3 (8.8)	-.26	-1.08
16. IS32	11 (34.4)	4 (12.5)	5 (15.6)	10 (31.2)	2 (6.2)	.06	-1.56
17. IC15	12 (31.6)	5 (13.2)	12 (31.6)	4 (10.5)	5 (13.2)	.32	-1.02
18. IC19	2 (5.6)	5 (13.9)	2 (5.6)	13 (36.1)	14 (38.9)	-1.02	-.01
19. IC29	10 (30.3)	2 (6.1)	6 (18.2)	7 (21.2)	8 (24.2)	-.15	-1.54
20. IC31	9 (25.7)	4 (11.4)	8 (22.9)	6 (17.1)	8 (22.9)	-.05	-1.40
Transactional							
21. CR1	8 (19.5)	3 (7.3)	6 (14.6)	15 (36.6)	9 (22.0)	-.59	-.98
22. CR11	3 (8.1)	7 (18.9)	11 (29.7)	10 (27.0)	6 (16.2)	-.19	-.74
23. CR16	8 (25.0)	6 (18.8)	4 (12.5)	5 (15.6)	9 (28.1)	-.00	-1.61
24. CR35	3 (8.8)	5 (14.7)	6 (17.6)	10 (29.4)	10 (29.4)	-.57	-.78
25. MBEA4	15 (41.7)	5 (13.9)	6 (16.7)	6 (16.7)	4 (11.1)	.49	-1.22
26. MBEA22	9 (26.5)	6 (17.6)	4 (11.8)	10 (29.4)	5 (14.7)	-.03	-1.49
27. MBEA24	11 (36.7)	9 (30.0)	5 (16.7)	4 (13.3)	1 (3.3)	.74	-.41
28. MBEA27	19 (59.4)	6 (18.8)	3 (9.4)	3 (9.4)	1 (3.1)	1.39	.93
Laissez-Faire							
29. MBEP3	21 (53.8)	3 (7.7)	5 (12.8)	6 (15.4)	4 (10.3)	.74	-1.05
30. MBEP12	20 (51.3)	6 (15.4)	2 (5.1)	6 (15.4)	5 (12.8)	.80	-1.00
31. MBEP17	5 (15.6)	6 (18.8)	6 (18.8)	11 (34.4)	4 (12.5)	-.28	-1.08
32. MBEP20	17 (50.0)	3 (8.8)	7 (20.6)	3 (8.8)	4 (11.8)	.75	-.84
33. LF5	21 (55.3)	6 (15.8)	5 (13.2)	5 (13.2)	1 (2.6)	1.01	-.28
34. LF7	23 (59.0)	10 (25.6)	1 (2.6)	2 (5.1)	3 (7.7)	1.74	2.06
35. LF28	16 (47.1)	5 (14.7)	5 (14.7)	4 (11.8)	4 (11.8)	.74	-.89
36. LF33	18 (52.9)	5 (14.7)	2 (5.9)	4 (11.8)	5 (14.7)	.87	-.89
Followers' Extra Effort							
37. EE39	8 (23.5)	4 (11.8)	11 (32.4)	6 (17.6)	5 (14.7)	-.00	-1.07
38. EE42	6 (17.1)	7 (20.0)	7 (20.0)	9 (25.7)	6 (17.1)	-.11	-1.21
39. EE44	6 (17.1)	7 (20.0)	8 (22.9)	8 (22.9)	6 (17.1)	-.05	-1.16

Note. II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 16

Polychoric Correlations (WLSMV estimation) Between Items Rated by Teachers on the MLQ 5x (n = 43)

	1	2	3	4	5	6	7	8	9	10
1. II(A)10	—									
2. II(A)18	.84***	—								
3. II(A)21	.89***	.79***	—							
4. II(A)25	.54***	.34	.45***	—						
5. II(B)6	.54***	.48***	.40**	.55***	—					
6. II(B)14	.78***	.79***	.69***	.46**	.63***	—				
7. II(B)23	.82***	.67***	.91***	.63***	.50***	.53***	—			
8. II(B)34	.84***	.68***	.66***	.42*	.48**	.67***	.78***	—		
9. IM9	.86***	.65***	.84***	.34*	.45**	.58***	.89***	.64***	—	
10. IM13	.77***	.79***	.82***	.45*	.57***	.86***	.77***	.67***	.75***	—
11. IM26	.88***	.61***	.73***	.47**	.42**	.75***	.66***	.81***	.69***	.77***
12. IM36	.91***	.81***	.69***	.27	.34*	.89***	.72***	.78***	.72***	.76***
13. IS2	.78***	.62***	.64***	.56***	.51***	.70***	.53***	.63***	.61***	.62***
14. IS8	.73***	.65***	.65***	.48***	.57***	.66***	.80***	.71***	.84***	.76***
15. IS30	.85***	.61***	.73***	.30	.53***	.71***	.65***	.60***	.77***	.71***
16. IS32	.64***	.46**	.56***	.39**	.62***	.62***	.43*	.33*	.63***	.68***
17. IC15	.73***	.55***	.61***	.26	.47**	.75***	.42*	.42**	.58***	.57***
18. IC19	.69***	.69***	.77***	.25	.41**	.62***	.83***	.52***	.81***	.70***
19. IC29	.53***	.39*	.42*	.38*	.59***	.49***	.38	.31	.56***	.41*
20. IC31	.91***	.72***	.77***	.55***	.45***	.81***	.67***	.51***	.79***	.74***
21. CR1	.90***	.85***	.78***	.49***	.56***	.77***	.73***	.65***	.72***	.68***
22. CR11	.64***	.52**	.61***	.45*	.39**	.69***	.40**	.37***	.25	.58***
23. CR16	.76***	.79***	.73***	.39	.36*	.72***	.51***	.54***	.48**	.66***
24. CR35	.76***	.70***	.54***	.10	.23	.67***	.57***	.40**	.47***	.67***
25. MBEA4	-.27	-.07	-.35	-.08	.43*	.17	-.41*	-.13	-.24	.18
26. MBEA22	.13	.26	.33	.34*	.51**	.22	.12	.03	.17	.36*
27. MBEA24	-.38	-.24	-.52*	.15	.04	-.29	-.37	-.24	-.46*	-.30
28. MBEA27	-.14	-.03	-.14	.03	.25	-.06	-.27	-.36	-.18	-.04
29. MBEP3	-.48***	-.14	-.33	-.07	.10	-.38*	-.33	-.46*	-.29	-.21
30. MBEP12	-.50***	-.31	-.50*	-.18	-.18	-.54***	-.47**	-.49***	-.36*	-.41*
31. MBEP17	-.50***	-.41**	-.51***	-.36	-.50**	-.38**	-.48***	-.50***	-.31*	-.39**
32. MBEP20	-.82***	-.53**	-.69***	-.27	-.29	-.84***	-.46**	-.66***	-.58***	-.63***
33. LF5	-.56***	-.41*	-.41*	-.30	-.20	-.58***	-.46**	-.46**	-.42**	-.55***
34. LF7	-.42*	-.23	-.25	.22	.18	-.35	-.35	-.28	-.49*	-.35
35. LF28	-.53***	-.37*	-.36*	-.16	-.15	-.59***	-.27	-.44**	-.36*	-.36*
36. LF33	-.65***	-.45*	-.62***	-.26	-.14	-.57***	-.45*	-.38*	-.49***	-.47**
37. EE39	.58***	.44**	.49***	.65***	.13	.42**	.58***	.47**	.34	.40*
38. EE42	.87***	.70***	.78***	.47***	.43*	.84***	.57***	.57***	.48***	.72***
39. EE44	.85***	.67***	.80***	.42**	.44**	.82***	.53***	.52***	.54***	.68***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 16 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Teachers on the MLQ 5x (n = 43)

	11	12	13	14	15	16	17	18	19	20
11. IM26	—									
12. IM36	.78***	—								
13. IS2	.61***	.61***	—							
14. IS8	.64***	.62***	.72***	—						
15. IS30	.71***	.58***	.80***	.75***	—					
16. IS32	.48***	.36	.79***	.56***	.83***	—				
17. IC15	.53***	.63***	.60***	.64***	.86***	.71***	—			
18. IC19	.49***	.70***	.38*	.59***	.57***	.28	.39*	—		
19. IC29	.37*	.39**	.55***	.39*	.71***	.58***	.65***	.59***	—	
20. IC31	.62***	.69***	.85***	.79***	.93***	.85***	.88***	.63***	.66***	—
21. CR1	.58***	.81***	.72***	.75***	.63***	.40	.60***	.68***	.26	.77***
22. CR11	.43**	.46***	.59***	.52***	.63***	.43*	.65***	.32	.24	.66***
23. CR16	.70***	.76***	.70***	.50***	.67***	.54***	.54***	.51***	.38*	.75***
24. CR35	.44***	.77***	.50*	.36*	.52***	.33	.48**	.67***	.41**	.55***
25. MBEA4	-.10	-.20	-.01	.09	-.23	.13	-.2	-.51**	-.38*	-.34
26. MBEA22	.25	.06	.19	.06	.20	.60***	.14	-.03	.20	.24
27. MBEA24	-.40*	-.25	-.21	-.15	-.33	.01	-.37	-.68***	-.64***	-.39*
28. MBEA27	-.18	-.17	-.14	-.08	-.03	.25	-.17	-.37	-.12	-.06
29. MBEP3	-.37*	-.48**	-.28	-.45**	-.34*	.03	-.54***	-.08	.11	-.36*
30. MBEP12	-.56***	-.60***	-.27	-.52**	-.42*	-.01	-.54***	-.33	.08	-.35*
31. MBEP17	-.37*	-.31	-.39*	-.42*	-.59***	-.36	-.41*	-.18	-.16	-.36*
32. MBEP20	-.82***	-.79***	-.66***	-.57***	-.77***	-.45*	-.72***	-.48***	-.22	-.70***
33. LF5	-.51**	-.63***	-.35	-.60***	-.46**	-.29	-.56***	-.28	-.17	-.58***
34. LF7	-.25	-.42*	-.22	-.47**	-.36	-.09	-.51**	-.34	-.04	-.38
35. LF28	-.62***	-.66***	-.28	-.38*	-.22	.10	-.37*	-.30	.01	-.30
36. LF33	-.55***	-.68***	-.22	-.37	-.50**	-.02	-.51**	-.62***	-.24	-.49**
37. EE39	.51***	.50***	.47**	.51***	.47***	.04	.38*	.23	-.02	.41**
38. EE42	.74***	.74***	.75***	.52***	.76***	.59***	.76***	.48***	.40**	.78***
39. EE44	.68***	.70***	.70***	.59***	.79***	.60***	.78***	.49***	0.42**	.79***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 16 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Teachers on the MLQ 5x (n = 43)

	21	22	23	24	25	26	27	28	29	30
21. CR1	—									
22. CR11	.64***	—								
23. CR16	.72***	.81***	—							
24. CR35	.56***	.55***	.77***	—						
25. MBEA4	-.09	-.08	-.12	-.40*	—					
26. MBEA22	-.05	.23	.35	.12	.35	—				
27. MBEA24	-.17	-.21	-.18	-.30	.65***	.24	—			
28. MBEA27	-.29	.05	-.07	-.19	.66***	.48**	.76***	—		
29. MBEP3	-.48***	-.40*	-.21	-.13	.34	.47**	.08	.40	—	
30. MBEP12	-.51***	-.51***	-.41	-.42*	.20	.24	.20	.36*	.81***	—
31. MBEP17	-.20	-.37*	-.17	-.21	-.11	-.26	-.25	-.50**	.19	.42*
32. MBEP20	-.73***	-.47**	-.49*	-.40*	.20	.01	.33	.24	.72***	.79***
33. LF5	-.55***	-.33	-.37	-.25	.01	.28	.15	.06	.69***	.66***
34. LF7	-.46**	-.17	-.18	-.36*	.37*	.40*	.28	.69***	.81***	.61***
35. LF28	-.56***	-.31	-.35	-.19	.16	.19	.38*	.57***	.54***	.71***
36. LF33	-.54***	-.29	-.35	-.41*	.50*	.22	.46*	.30	.60***	.81***
37. EE39	.53***	.55***	.42**	.24	-.23	.08	.22	-.06	-.38*	-.50*
38. EE42	.73***	.91***	.89***	.75***	-.33	.29	-.35	-.14	-.28	-.62***
39. EE44	.73***	.90***	.81***	.68***	-.34	.24	-.37*	-.10	-.33*	-.65***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 16 cont.

Polychoric Correlations (WLSMV estimation) Between Items Rated by Teachers on the MLQ 5x (n = 43)

	31	32	33	34	35	36	37	38	39
31. MBEP17	—								
32. MBEP20	.49**	—							
33. LF5	.30	.68***	—						
34. LF7	.05	.58***	.54**	—					
35. LF28	-.17	.69***	.46**	.51**	—				
36. LF33	.41*	.85***	.73***	.53**	.66***	—			
37. EE39	-.47**	-.51**	-.19	-.08	-.36	-.36	—		
38. EE42	-.37*	-.72***	-.43*	-.12	-.51***	-.46**	.61***	—	
39. EE44	-.40**	-.78***	-.44*	-.23	-.54***	-.53***	.56***	.99***	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

Table 17

Psychometric Properties of the Major Study Variables for Teacher Leadership as Rated by Students (MLQ 5x)

Variable	*n*	*M*	*SD*	α	Potential	Actual	Skew	Kurtosis
Transformational								
1. Idealized Influence (Attributed Charisma)	636	2.92	.83	.76	0–4	.25–4.00	-.74	.29
2. Idealized Influence (Behaviours)	607	2.53	.78	.60	0–4	.00–4.00	-.43	.01
3. Inspirational Motivation	632	2.98	.81	.78	0–4	.00–4.00	-.79	.50
4. Intellectual Stimulation	628	2.80	.81	.75	0–4	.00–4.00	-.48	-.23
5. Individualized Consideration	639	2.87	.79	.63	0–4	.00–4.00	-.64	.25
Transactional								
6. Contingent Reward	637	2.99	.76	.74	0–4	.00–4.00	-.82	.66
7. Management-by-Exception (Active)	605	1.98	.94	.73	0–4	.00–4.00	-.10	-.63
Passive-Avoidant								
8. Management-by-Exception (Passive)	604	1.16	.82	.64	0–4	.00–4.00	.62	-.13
9. Non-transactional laissez-faire	628	.74	.79	.73	0–4	.00–4.00	1.14	.77
Enriching Experiences								
Leader Effectiveness	622	2.95	1.03	.87	0–4	.00–4.00	-.96	.35

Table 18

Psychometric Properties of the Major Study Variables for Administrator Leadership as Rated by Teachers (MLQ 5x)

Variable	*n*	*M*	*SD*	α	Potential	Actual	Skew	Kurtosis
Transformational								
1. Idealized Influence (Attributed Charisma)	35	2.49	1.04	.82	0–4	.00–4.00	-.50	-.29
2. Idealized Influence (Behaviours)	35	2.50	.95	.82	0–4	.00–4.00	-.40	-.5
3. Inspirational Motivation	36	2.75	1.00	.90	0–4	.25–4.00	-.91	.17
4. Intellectual Stimulation	31	1.98	1.15	.92	0–4	.00–3.75	-.09	-1.12
5. Individualized Consideration	33	2.07	1.14	.83	0–4	.00–4.00	-.16	-.91
Transactional								
6. Contingent Reward	33	2.28	1.15	.88	0–4	.25–4.00	-.17	-1.31
7. Management-by-Exception (Active)	32	1.25	.97	.74	0–4	.00–4.00	1.04	.84
Passive-Avoidant								
8. Management-by-Exception (Passive)	29	1.60	1.20	.82	0–4	.00–3.75	.32	-1.22
9. Non-transactional laissez-faire	34	1.11	1.09	.81	0–4	.00–3.50	1.00	-.31
Enriching Experiences								
Leader Effectiveness	34	1.95	1.19	.86	0–4	.00–4.00	-.14	-.97

Table 19

Descriptive Statistics for Major Study Variables Used in the 2-Level Hierarchical Linear Model

	n	Yes	No	*M*	*SD*	α	Potential	Actual	Skew	Kurtosis
Level 1 (Student Level)										
Senior (Twelfth Grade) Student	674	377	297	–	–	–	–	–	-.24	-1.95
Taken Multiple Dual Credits	670	449	221	–	–	–	–	–	-.73	-1.48
Student Engagement	668	–	–	2.71	.48	.816	0–4	1.28–3.83	-.12	-.31
Level 2 (Classroom Level)										
High School Teacher Delivered	49	38	11	–		–	–	–	-1.59	.75
Academic Dual Credit	49	42	7	–		–	–	–	-2.11	2.53
Teachers' Transformational Leadership	49	–	–	14.14	1.47	.919	0–20	10.25–17.26	-.04	-.23

Table 20

Descriptive Statistics for Major Study Variables Used in the 3-Level Hierarchical Linear Model

	n	Yes	No	*M*	*SD*	α	Potential	Actual	Skew	Kurtosis
Level 1 (Student Level)										
Taken Multiple Dual Credits	662	442	220	–	–	–	–	–	-.71	-1.50
Student Engagement	660	–	–	2.70	.48	.816	0–4	1.28–3.83	-.11	-.31
Level 2 (Classroom Level)										
Teachers' Transformational Leadership	48	–	–	14.09	1.45	.919	0–20	10.25–17.26	-.02	-.13
Level 3 (School Level)										
Delivered in Ontario	15	12	3	–		–	–	–	-1.67	.90
Delivered at a High School	15	9	6	–		–	–	–	-.46	-2.09
Principal's Transformational Leadership	15	–	–	11.35	4.50	.968	0–20	.75–18.42	-.50	1.04

Note. Ten level-1 records and one associated level-2 record were removed by Mplus 7.31 due to a missing data point at level 3. Reliability coefficients (α) were computed on full data set before the removal of records by Mplus 7.31.

Table 21

Proposed 2-Level Hierarchical Dual-Credit Student Engagement Model

Hierarchical Level	Actual Hierarchical Level	Variables
Level-2	Classroom Level	Type of dual credit[a]
		Type of dual-credit teacher[b]
		Dual-credit instructor's transformational leadership
		Idealized influence (behaviours)
		Idealized influence (attributes)
		Inspirational motivation
		Intellectual stimulation
		Consideration for others
Level-1	Student Level	Number of dual credits taken[c]
		Grade level[d]
		Student engagement[e]
		Participation and Identification with school
		Cognitive skills
		Other educational practices
		Class atmosphere

[a] Variable has two options: academic or vocational.
[b] Variable has two options: high school teacher or post-secondary professor.
[c] Variable has two options: multiple dual credits or not.
[d] Variable has two options: senior student (grade 12 or post graduation) or other.
[e] Student engagement is the outcome variable generated from averaging 18 items on the CLASSE.

Table 22

Proposed 3-Level Hierarchical Dual-Credit Student Engagement Model

Hierarchical Level	Actual Hierarchical Level	Variables
Level-3	School Level	Geographical location[a] Dual-credit delivery location[b] Principal or dean's transformational leadership Idealized influence (behaviours) Idealized influence (attributes) Inspirational motivation Intellectual stimulation Consideration for others
Level-2	Classroom Level	Dual-credit instructor's transformational leadership Idealized influence (behaviours) Idealized influence (attributes) Inspirational motivation Intellectual stimulation Consideration for others
Level-1	Student Level	Number of dual credits taken[c] Student engagement[d] Participation and Identification with school Cognitive skills Other educational practices Class atmosphere

[a] Variable has two options: New York and Ontario.
[b] Variable has two options: high school or post-secondary campus.
[c] Variable has two options: multiple dual credits or not.
[d] Student engagement is the outcome variable generated from averaging 18 items on the CLASSE.

Table 23

Factor Loadings (3-Factor Solution, Multivariate Outliers Identified by Mahalanobis's Distance Removed) for EFA with Geomin Oblique Rotation for 39 Items Rated by Students from the MLQ 5x (n = 636)

	Standardized Loadings		
	Factor 1	Factor 2	Factor 3
Transformational			
1. II(A)10	**.768*** **	.027(.451)	.013(.749)
2. II(A)18	**.648*** **	-.212***	.023(.500)
3. II(A)21	**.752*** **	-.211***	.052(.146)
4. II(A)25	**.594*** **	-.047(.268)	.070(.164)
5. II(B)6	.207***	**.404*** **	.049(.374)
6. II(B)14	**.721*** **	-.026(.502)	.037(.397)
7. II(B)23	**.571*** **	-.046(.287)	.165***
8. II(B)34	**.793*** **	.117(.005)	-.042(.330)
9. IM9	**.620*** **	-.123(.003)	.084(.067)
10. IM13	**.610*** **	-.199***	.041(.293)
11. IM26	**.736*** **	.000(.997)	.108(.016)
12. IM36	**.835*** **	-.086(.019)	-.138(.001)
13. IS2	**.583*** **	-.024(.550)	.087(.044)
14. IS8	**.558*** **	-.047(.248)	.078(.098)
15. IS30	**.841*** **	.090(.008)	-.077(.070)
16. IS32	**.839*** **	.108(.004)	-.109(.020)
17. IC15	**.555*** **	-.369***	.020(.512)
18. IC19	**.654*** **	-.132***	-.014(.685)
19. IC29	**.500*** **	.372***	-.028(.496)
20. IC31	**.902*** **	-.017(.564)	-.165***
Transactional			
21. CR1	**.624*** **	.144(.001)	.062(.184)
22. CR11	**.600*** **	.190***	.159(.001)
23. CR16	**.702*** **	-.174***	.007(.797)
24. CR35	**.812*** **	-.060(.119)	-.114(.010)
25. MBEA4	.016(.676)	.320***	**.484*** **
26. MBEA22	.159(.001)	.038(.488)	**.615*** **
27. MBEA24	-.003(.917)	.167(.009)	**.676*** **
28. MBEA27	.011(.715)	.328***	**.544*** **
Passive Avoidant			
29. MBEP3	-.106(.063)	**.621*** **	.050(.367)
30. MBEP12	-.062(.218)	**.784*** **	.087(.118)
31. MBEP17	.182***	**.335*** **	.183(.001)
32. MBEP20	.007(.807)	**.694*** **	.198(.001)
33. LF5	-.024(.631)	**.820*** **	.042(.475)
34. LF7	.011(.769)	**.607*** **	-.139(.040)
35. LF28	-.087(.118)	**.724*** **	.019(.621)
36. LF33	-.045(.413)	**.739*** **	-.022(.649)
Followers' Extra Effort			
37. EE39	**.830*** **	.064(.090)	-.235***
38. EE42	**1.032*** **	.038(.143)	-.373***
39. EE44	**1.005*** **	-.009(.351)	-.372***

Note. ***p < .001, p-values in brackets, fit indices were $\chi^2(627) = 1677.974$, p <. 001, RMSEA = .051 (90% CI .048;.054), p(<.05) = .226, SRMR = .042, CFI/TLI = .964/.957; bolding indicates items' strongest rotated loadings, standardized loadings are identical to unstandardized loadings, II(A) = Idealized Influence (Attributes), II(B) = Idealized Influence (Behaviours), IM = Inspirational Motivation, IS = Intellectual Stimulation, IC = Individualized Consideration, CR = Contingent Reward, MBEA = Management-by-Exception (Active), MBEP = Management-by-Exception (Passive), LF = Laissez-Faire, EE = Extra Effort.

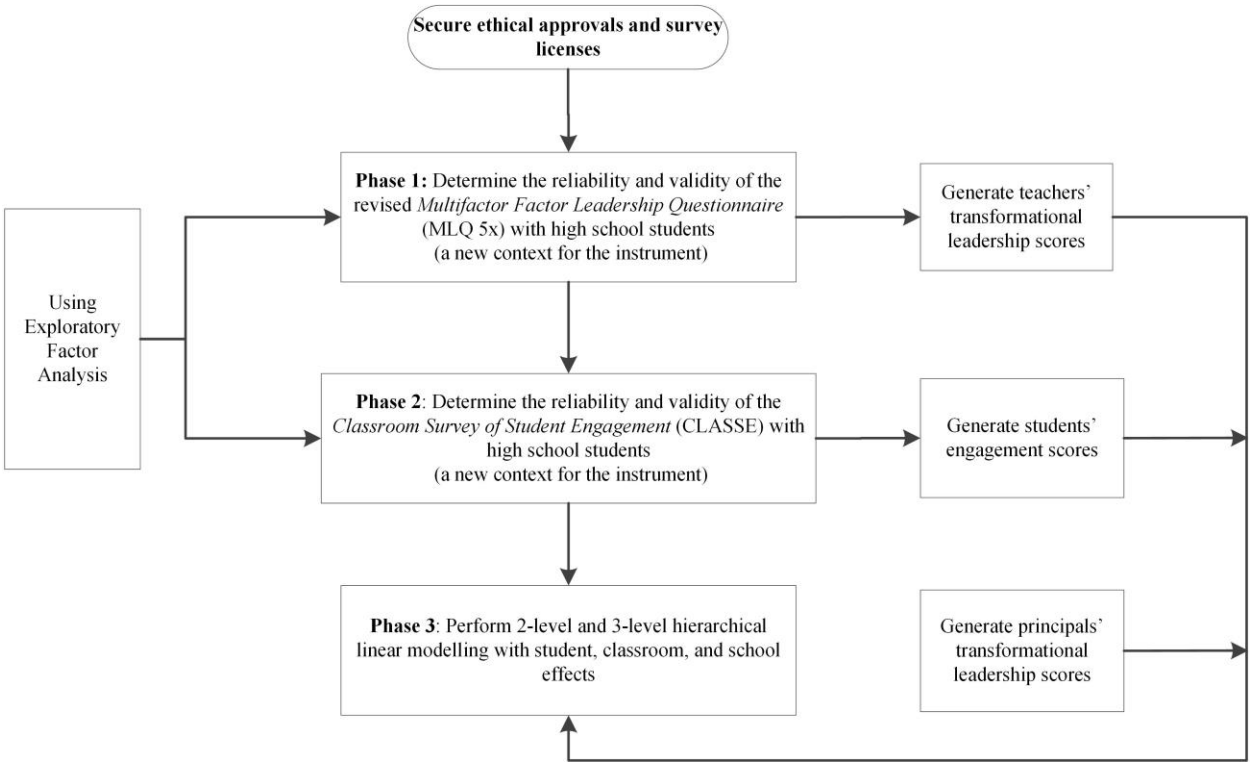


Figure 1. Study design schematic diagram.

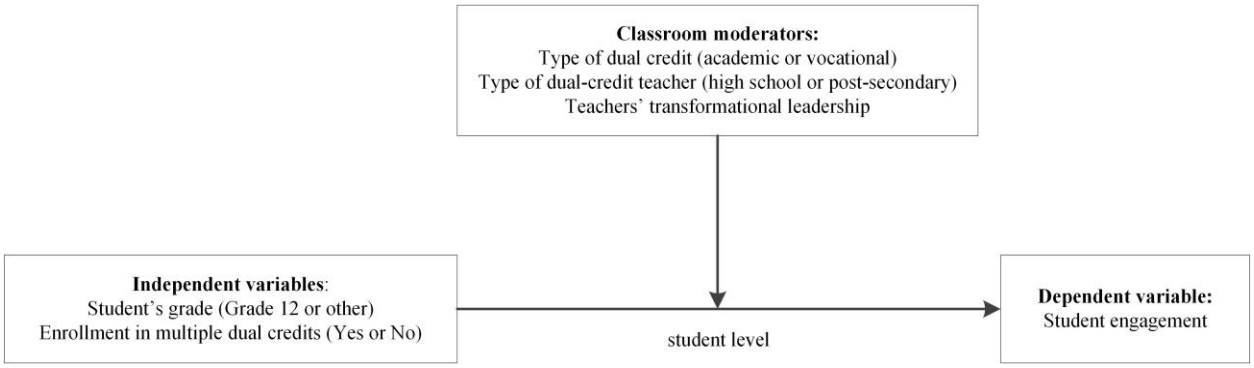


Figure 2. Two-level hierarchical linear modelling schematic diagram.

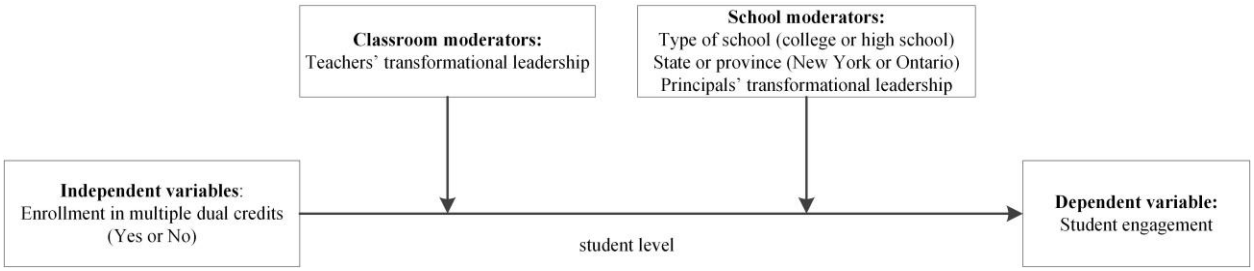


Figure 3. Three-level hierarchical linear modelling schematic diagram.

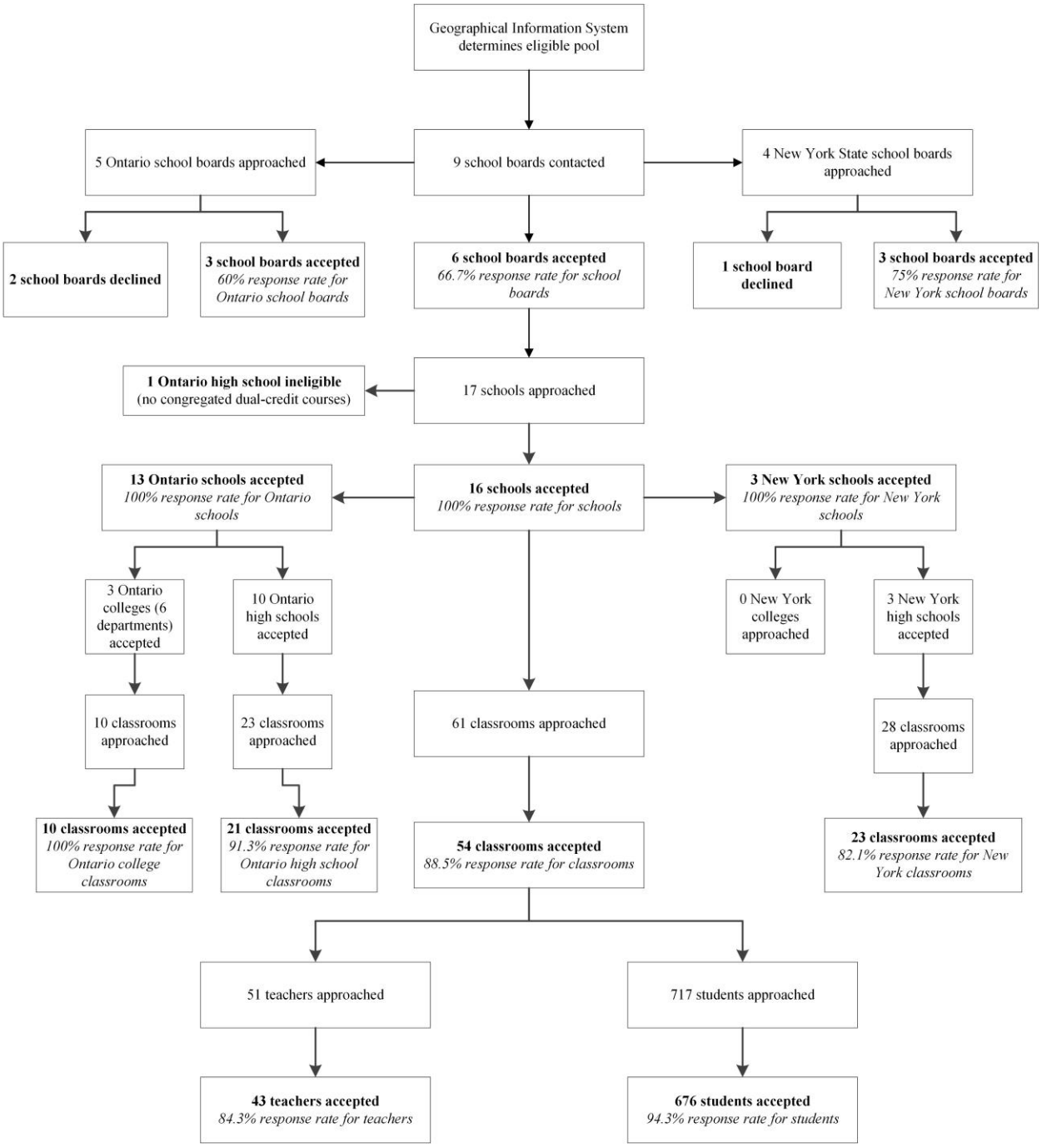


Figure 4. Flow of study participants in the survey study.

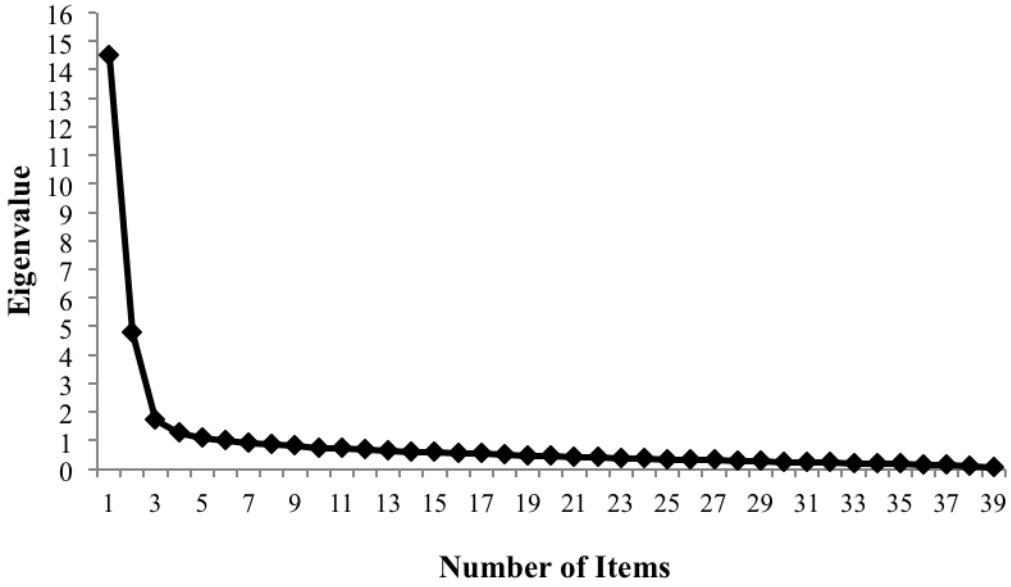


Figure 5. Scree plot for EFA on the MLQ 5x student leadership data set.

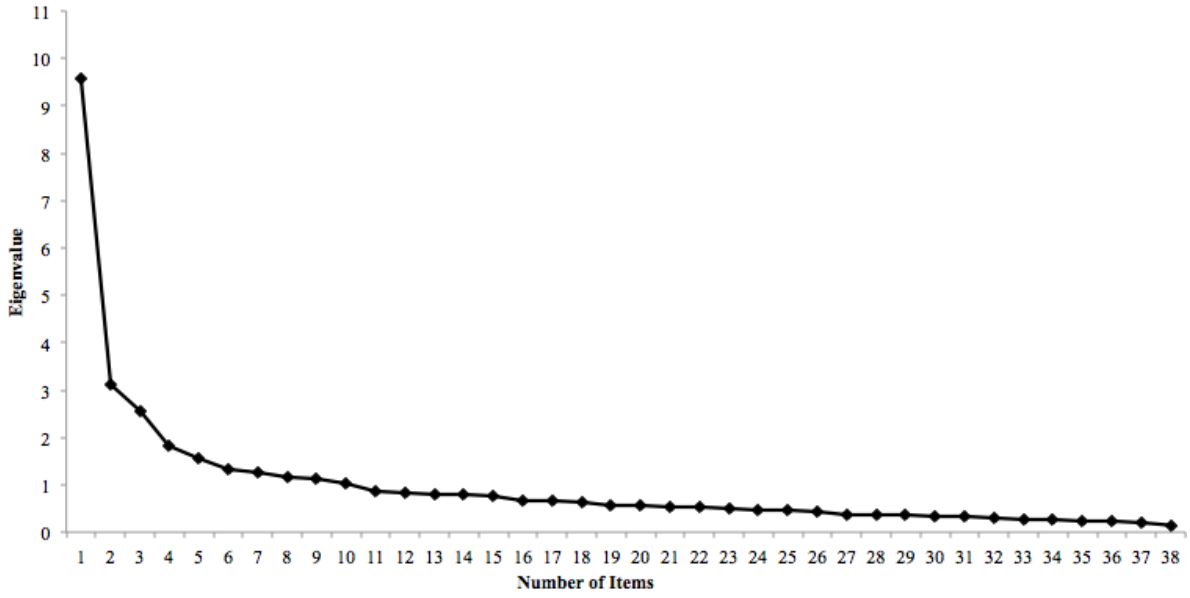


Figure 6. Scree plot for EFA on the student CLASSE data set (all items).

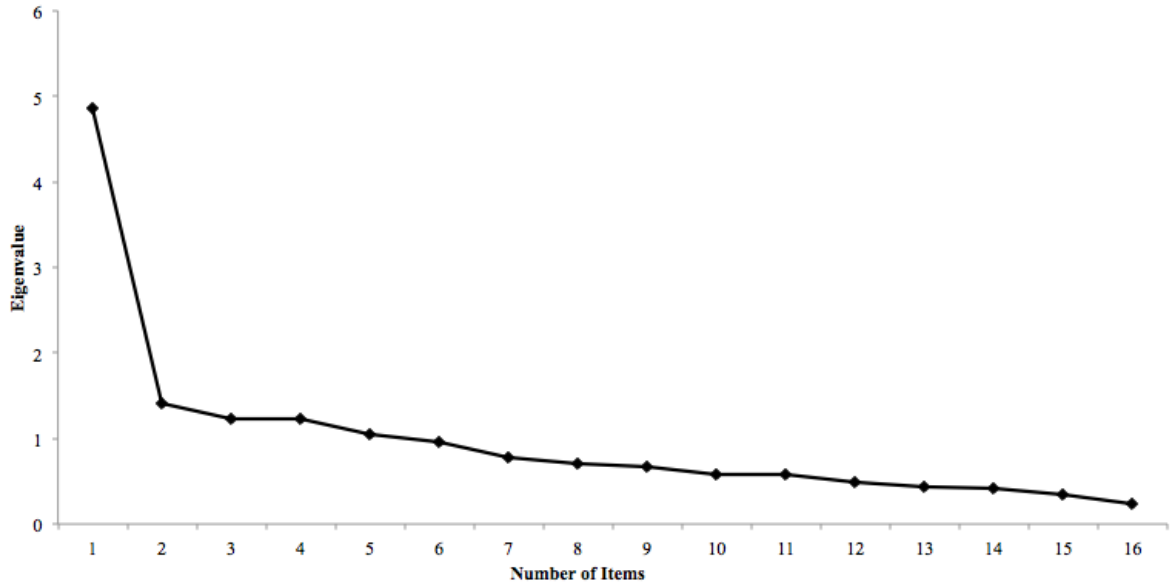


Figure 7. Scree plot for EFA on items from the "Scale of Educationally Purposeful Activities" on the student CLASSE data set (16 items)

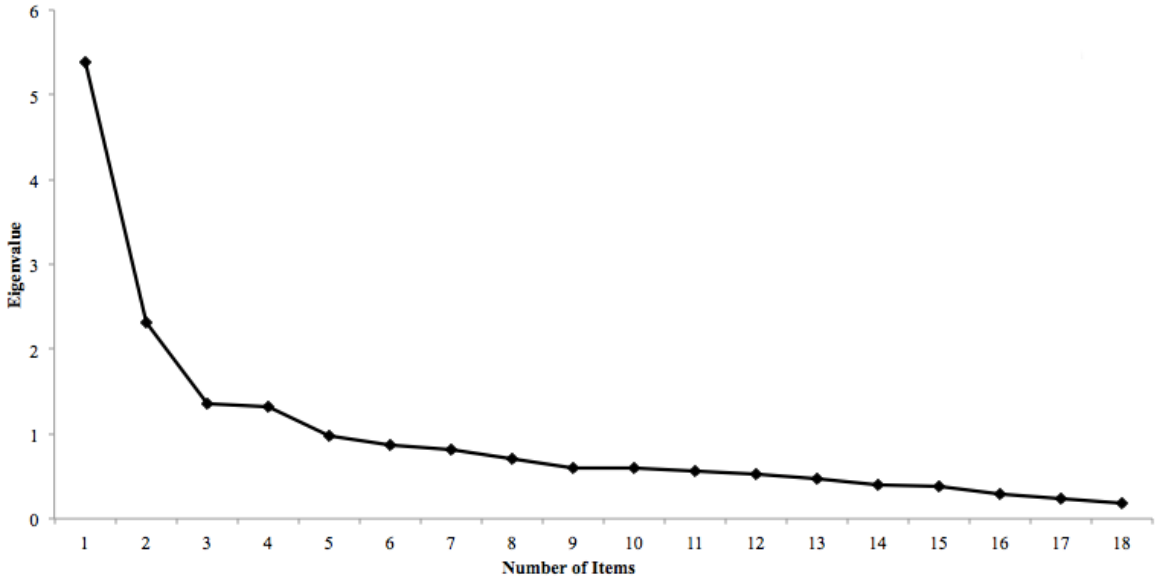


Figure 8. Scree plot for EFA on the student CLASSE data set (18 final selected items).

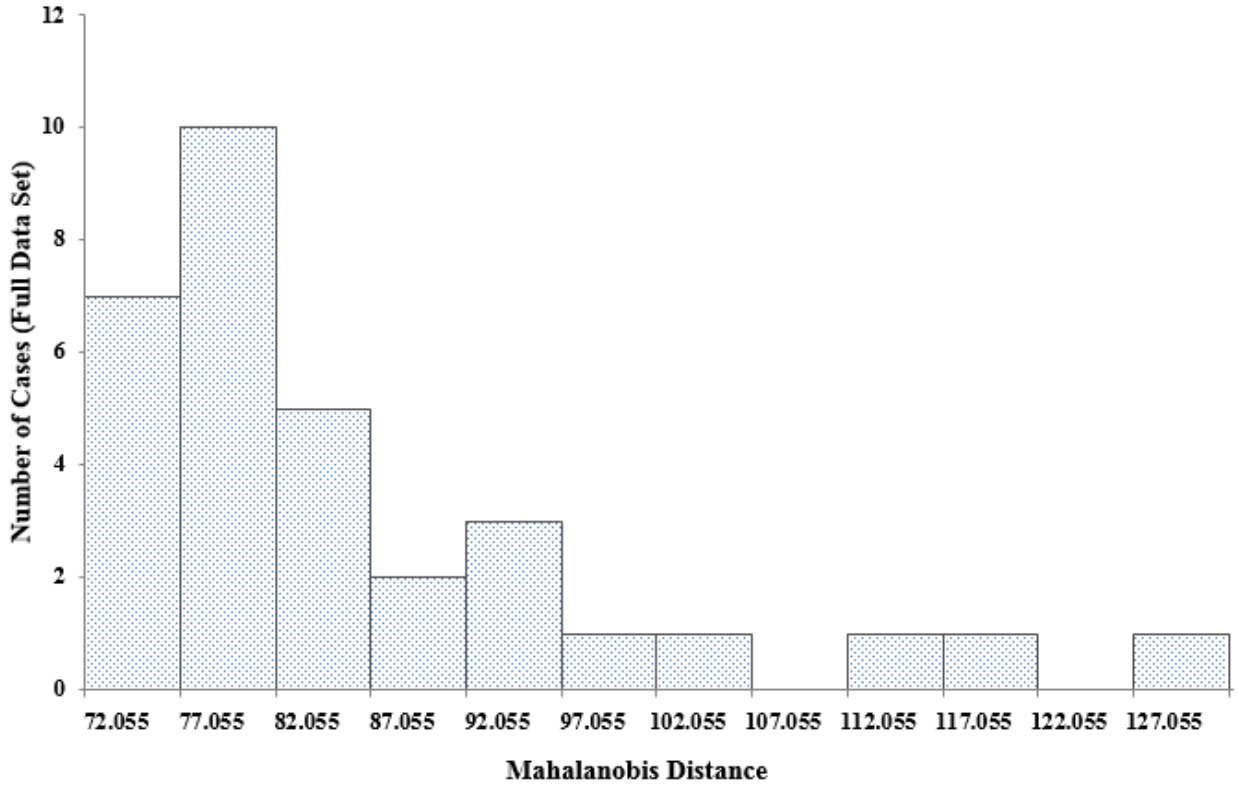


Figure 9. Frequency distribution of Mahalanobis's distance for potential multivariate outliers at the .001 level of significance for student responses (n = 668) to the MLQ 5x.

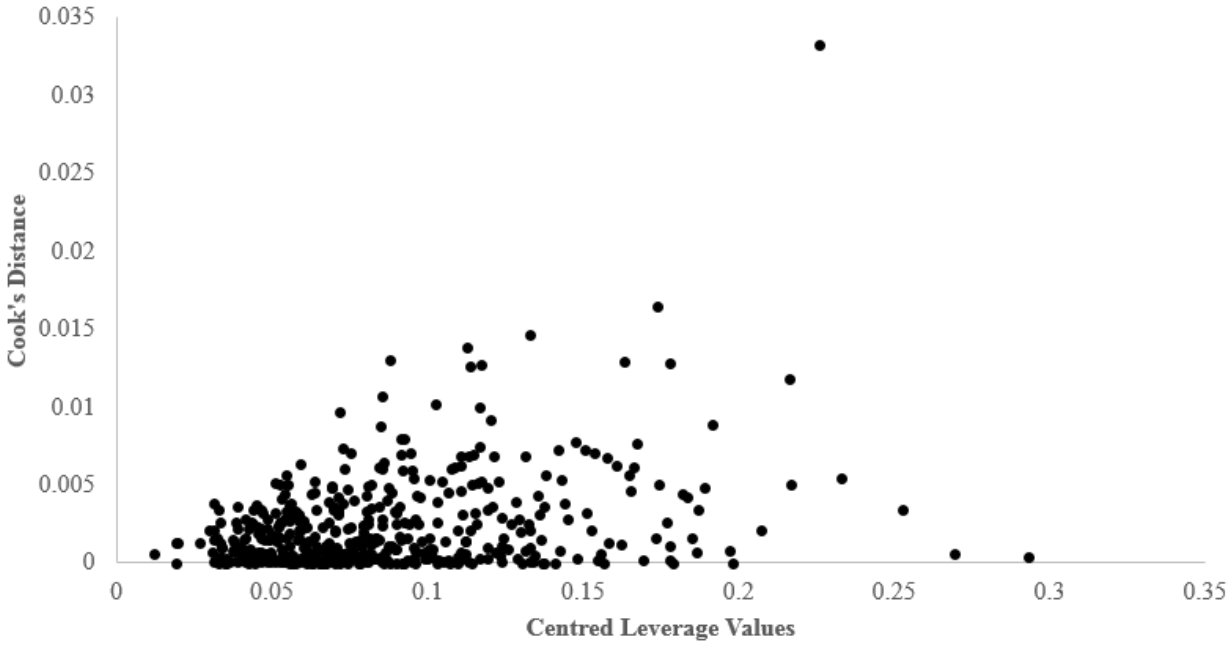


Figure 10. Scatterplot comparing Cook's distance to centred leveraged values for student responses (n = 668) to the MLQ 5x.

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