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Using Breakout Groups as an Active Learning Technique in a Large Undergraduate Nutrition Classroom at the University of Guelph

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Abstract
Breakout groups have been widely used under many different conditions, but the lack of published information related to their use in undergraduate settings highlights the need for research related to their use in this context. This paper describes a study investigating the use of breakout groups in undergraduate education as it specifically relates to teaching a large 4th year undergraduate Nutrition class in a physically constrained lecture space. In total, 220 students completed a midterm survey and 229 completed a final survey designed to measure student satisfaction. Survey results were further analyzed to measure relationships between student perception of breakout group effectiveness and (1) gender and (2) cumulative GPA. Results of both surveys revealed that over 85% of students either agreed or strongly agreed that using breakout groups enhanced their learning experience, with females showing a significantly greater level of satisfaction and higher final course grade than males. Although not stratified by gender, a consistent finding between surveys was a lower perception of breakout group effectiveness by students with a cumulative GPA above 90%. The majority of respondents felt that despite the awkward room space, the breakout groups were easy to create and participate in, which suggests that breakout groups can be successfully used in a large undergraduate classroom despite physical constraints. The findings of this work are relevant given the applicability of breakout groups to a wide range of disciplines, and the relative ease of integration into a traditional lecture format.

Les enseignants ont recours aux petits groupes dans de nombreuses conditions différentes, cependant, le manque d’information publiée sur leur utilisation au premier cycle confirme la nécessité d’effectuer des recherches sur ce format dans ce contexte. Le présent article rend compte d’une étude portant sur l’utilisation des petits groupes au premier cycle dans le cadre particulier d’un cours magistral de 4e année sur la nutrition dans un espace physiquement limité. Au total, 220 étudiants ont participé à un sondage à la moitié du trimestre et 229 ont répondu à un sondage à la fin du trimestre visant à mesurer le niveau de satisfaction. Les chercheurs ont ensuite analysé les données de manière à mesurer les relations entre la perception que les étudiants avaient de l’efficacité des petits groupes et 1) le sexe, et 2) la moyenne pondérée cumulative (MPC). Les résultats des deux sondages révèlent que plus de 85 % des étudiants étaient soit d’accord, soit tout à fait d’accord avec le fait que les petits groupes amélioraient leur apprentissage, les femmes manifestant un degré de satisfaction significativement plus élevé que les hommes. Elles avaient aussi de meilleures notes finales. Sans prendre en compte la stratification selon le sexe, le résultat constant d’un sondage à l’autre démontre que les étudiants dont la MPC était supérieure à 90 % avaient une perception moins élevée de l’efficacité des petits groupes. La majorité des répondants pensaient que malgré l’espace inconfortable de la pièce, il était facile de créer de petits groupes et d’y participer, ce qui suggère qu’il est possible d’utiliser ce type de groupe avec succès dans les grands auditoriums malgré les contraintes physiques. Les résultats de cette étude sont pertinents étant donné l’utilisation des petits groupes à une grande variété de disciplines et leur relative facilité d’intégration au cours magistral.

Keywords
active learning, breakout group, group-based learning, SoTL, higher education, nutrition

This research paper/rapport de recherche is available in The Canadian Journal for the Scholarship of Teaching and Learning: https://ir.lib.uwo.ca/cjsotl_rceaa/vol3/iss2/6
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“Active learning” is a broad term that includes a variety of different methods teachers can apply to the classroom (Prince, 2004). A general breakdown of active learning reveals three inter-related subsets: (a) collaborative learning, (b) cooperative learning, and (c) problem-based learning (PBL) (Prince, 2004), all of which are methods of instruction that aim to engage students in the learning process. While active learning could constitute a number of specific methods, the key is that students are active in doing things that require thought and reflection (Bonwell, 1991), as opposed to sitting and listening passively. Although it may be argued that students are actively engaged in their learning by simply listening or taking notes, research has shown that students must write, read, discuss, and engage themselves actively in problem solving if they are to most efficiently learn the material (Chickering & Gamson, 1987). Techniques that aim to involve students in the learning process by fostering critical thinking skills and supporting the use of self-directed learning are important constituents of active learning models (Brown, 2000; Gokhale, 1995). Specific active learning techniques, including the use of breakout groups, also called breakout sessions, which involve a smaller group of participants discussing one or more problems and generating a response, have been described in the literature (for examples, see Prince, 2004; Wood, 2004). As an active learning technique, breakout groups may be of value to instructors in higher learning across an array of disciplines.

Breakout groups are employed across a wide range of settings, with most published reports describing their use in conferences (e.g., Wood, 2003), workshops (e.g., Pritchard, 2002) and professional training courses (e.g., Brownell & Welch, 2000). Used mainly in research studies as a way to garner feedback from participants (Wood, 2003), the majority of published literature pertaining to the use of breakout groups describes the feedback generated during the breakout sessions rather than specific elements of the breakout groups themselves (e.g., Baldwin, 1997). Literature describing the use of breakout groups in teaching settings report generally positive impressions of the breakout activities, with typical sessions in education ranging from 5 to 15 minutes in duration and involving students working in large and small groups, dyads, or individually (Sebastian, Egan, Welch, & Page, 1996; Welch 2000; Welch & Sheridan, 2000).

Although breakout groups are likely widely used in undergraduate classrooms, the literature about their use in this setting is sparse. The dearth of published information related to the use of breakout groups in undergraduate settings highlights the need for research related to factors that affect their use in this context, as well as on optimal timing and length of breakout groups in practice. Specifically, it is of interest to determine whether there is an effect of gender and cumulative Grade Point Average (GPA) on the perceived effectiveness of using breakout groups. This would help provide educators with background data necessary for rationalizing the use of breakout groups in classes containing populations of students for whom the technique is deemed most appropriate. At this point in time, very little has been published regarding gender response to the use of breakout groups. Understanding how different genders respond to such a group-based learning activity could not only aid teachers in determining what strategies could prove useful for their class makeup given variable class composition, but also help educators better understand potential differences between gender for learning preference in higher education. While it has been suggested that females may respond more positively to group work than males due to their socially collaborative nature (Daniels, Creese, Hey,
Leonard, & Smith, 2001), studies on pedagogy preference in higher education between genders have so far shown little difference (Shaw & Marlow, 1999; Slater, Lujan, & DiCarlo, 2007). Additionally, GPA is an important variable to include when assessing learning strategies not only to account for drastic changes in performance but to also control for trends that may in fact be quite apart from gender.

Another unknown element regarding the use of breakout groups in an undergraduate setting is the effect of the physical space in which the technique is being used. Workshops and conferences for student seminars or event attendees are usually held in spaces that are specifically designed to allow for participants to move around and organize into smaller groups. Undergraduate lecture halls, on the other hand, are often cramped and do not allow students to move around easily. The possible influence of physical constraint on using breakout groups should not be minimized, as learning space is thought to be an important determinant of learning outcome, with recommendations for features such as movable furniture and inclusion of breakout spaces being an essential feature of the 21st-century learning space (Magney & Sorensen, 2011).

This study seeks to fill the gap in the research on the use of breakout groups in undergraduate education as it specifically relates to teaching a large class in a physically constrained lecture space, and to investigate the effect of gender and cumulative GPA on the perceived effectiveness of the use of this teaching technique. As well, feedback will be gathered related to the subjective impressions of timing and length of breakout groups in practice.

**Methods**

In this study, breakout groups were used in a class of 280 students that was held in an old lecture hall filled almost to capacity, with students seated on a main and a balcony level. The balcony was inaccessible except by a narrow staircase. As well, in the absence of formal seminar or tutorial sessions, these temporary breakout groups had to be created and dissipated quickly and on the spot in the classroom, leading to potential difficulties with student participation and interaction. The course in question was Functional Foods & Nutraceuticals (NUTR 4090) at the University of Guelph, a fourth year undergraduate course. During the lecture period, the professor presented a question or concept for debate, at which point students were instructed to form small groups (suggested as a minimum of two and a maximum of five students) within the lecture hall to discuss the issue and formulate potential answers. While students often chose to form groups with others nearby, they were encouraged to consider moving around the room and sitting with new groups of people to provide fresh perspective. The results of the student discussions as well as instructor feedback were then discussed as a class after the allotted time period. Two of the breakout groups incorporated popular media. This study was approved by the Human Ethics Board at the University of Guelph.

**Participants**

All of the students enrolled in NUTR 4090 in the winter 2011 semester were invited to participate in the study. Out of 280 students, 220 completed the midterm survey and 229 completed the final survey. Of the students who completed the midterm survey,
180 were female and 40 were male, whereas 184 females and 45 males completed the final survey. Approximately 33% of the students who responded to the midterm and final survey were in third year, ~55% were in fourth year, ~10% were in fifth year or higher, and ~1% were graduate students.

**Procedure**

The NUTR 4090 course was divided naturally into a first and second half, with each half consisting of six weeks. Classes were offered twice per week for 1 hour 20 minutes each, for a total of 12 lectures in each half of the semester. The lecturer, who used a combination of traditional lectures and breakout groups, taught the first half. Breakout groups were administered in classes 3, 5, 8, and 10. The second half of the semester consisted of a series of guest lectures. The guest lecturers used only traditional lectures, and there were no breakout group experiences during the latter half of the semester. For continuity with the second half, three guest lectures were incorporated into the first half of the semester. Surveys were administered at the completion of the midterm examination (held during the 12th class) and after completion of the last class lecture.

Students were given instructions to form breakout groups consisting of anywhere from two to five students, with the suggestion that three to four students was optimal due to the limited room size and the physical immobility of the chairs. The instructor introduced each breakout group topic and described the questions that should be addressed during the small group discussion. Topics covered a wide range of discipline-specific subjects. Groups were given approximately 10 minutes of in-class time to generate answers to the assigned questions. Following this, a class discussion was facilitated by the instructor who went through each point of breakout group discussion sequentially and asked for individual participation. It was necessary to repeat student comments into the microphone so that the rest of the class can hear as even students in the balcony seating area participated. Summaries of ideas generated were written down and shown to the class using a document camera. Large group discussions ranged from 10-25 minutes, depending on the level of class participation.

**Surveys**

The midterm survey was administered following the completion of the midterm examination. The survey was offered online and could be accessed directly through the course website. It was accessible for a period of two weeks (since the first week coincided with the reading week vacation). Students were given a 1% bonus mark on the midterm examination as an incentive to complete the survey. The survey questions were as follows, and corresponded with a 5-point Likert answer scale consisting of responses ranging from Strongly Disagree to Strongly Agree:

1) I feel that using breakout groups in this class enhanced my understanding of the subject matter.
2) I feel that using breakout groups in this class helped me to analyze, synthesize and evaluate the course subject matter.
3) I feel that the topics of discussion in the breakout groups were interesting.
4) I feel that the topics of discussion in the breakout groups were relevant to the study of functional foods & nutraceuticals.
5) The breakout groups were easy to create.
6) The breakout groups were easy to participate in.
7) The breakout groups enhanced my communication skills.
8) I enjoyed breakout groups and was happy to take time out of lecture to engage in them.
9) Using breakout groups used up too much time for the learning that it accomplished.
10) I would have enjoyed more time spent in breakout groups.
11) I feel that using a combination of breakout groups and lectures results in a more engaging classroom.
12) Overall, I feel that using breakout groups in this class enhanced my learning experience.

The end-of-semester survey was administered following the completion of the last class. The survey was offered online and could be accessed directly through the course website. It was accessible for a period of one week. Students were given a 1% bonus mark on the midterm examination as an incentive to complete the survey. The survey questions were as follows, and corresponded with a 5-point Likert answer scale consisting of responses ranging from Strongly Disagree to Strongly Agree:

1) I preferred the guest lectures to the classes with breakout groups.
2) I would have enjoyed more classes with guest lectures.
3) I would have enjoyed the classes with guest lectures more if they used breakout groups.
4) I found the course content to be as expected.
5) I found the course difficulty to be as expected.
6) I found the course layout was logical and flowed well.
7) Looking back, I feel the breakout groups used during the first six weeks of class improved my understanding of the course material.
8) Looking back, I feel the breakout groups used during the first six weeks of class allowed me to perform better in this course.
9) I feel that using breakout groups increased my retention of the material learnt during the first six weeks of class.
10) Overall, I feel that using breakout groups in this class enhanced my learning experience.

Both midterm and final surveys additionally contained the same short answer and multiple-choice questions:

1) What is your gender?
2) What is your program of study?
3) What year of study are you currently in? (a) 3 (b) 4 (c) 5 or more (not graduate) (d) graduate
4) What is your cumulative GPA over your entire university career? (a) < 60 (b) 60-69 (c) 70-79 (d) 80-89 (e) 90-100
5) How many breakout groups were you present for? (a) 1 (b) 2 (c) 3 (d) 4 (e) none
6) On average, how many other people were involved in your breakout groups? (a) I was by myself (b) 1 (c) 2 (d) 3 (d) 4
7) In your opinion, what were the major advantages/disadvantages to using breakout groups?
8) Do you have any further comments related to the use of breakout groups?

Additionally, included at the end of both surveys were questions regarding the advantages and disadvantages of using breakout groups. Student responses highlighted several commonly perceived advantages and disadvantages. Along with the directed questions was a space for students to add any additional comments they wished to provide.

Statistical Analysis

All statistical analyses were performed using SPSS, version 18.0 for Windows. The non-parametric Mann-Whitney test was used to investigate the effect of gender on overall student satisfaction by analyzing the relationship between student responses to the final survey question on both the midterm and final surveys, which read “Overall, I feel that using breakout groups in this class enhanced my learning experience”. The non-parametric Kruskal-Wallis test was similarly used to investigate the effect of gender and GPA on overall student satisfaction. Final course grade was compared between males and females using a two-tailed t test. The p value was set at $p<0.05$.

Results

The results of the Likert scale questions on the midterm and final surveys are shown in Table 1 and 2 respectively. A two-tailed Mann-Whitney test revealed a significant effect of gender on overall student satisfaction on both the midterm ($p=0.047$; $N=220$) and final survey ($p=0.044$; $N=229$), with a greater proportion of females responding that they “strongly agreed” with the final survey question (“Overall, I feel that using breakout groups in this class enhanced my learning experience”). Figure 1 illustrates the student responses displayed by each gender on the midterm (Figure 1A) and final (Figure 1B) surveys. Analysis of final course grade on the basis of gender found a similar effect of gender, with females earning a significantly higher mean course grade than males (females $84.40\% \pm 0.32$, males $81.92 \pm 0.81$, $p<0.001$). A significant effect of overall GPA ($p = 0.031$) was observed on the midterm survey, with mean rankings of 138.50 for <60, 123.38 for 60-69, 103.83 for 70-79, 114.34 for 80-89, and 56.00 for 90+. The mean rankings for the final survey were 54.25 for <60, 113.30 for 60-69, 121.27 for 70-79, 110.73 for 80-89, and 79.67 for 90+ ($p=0.24$). Student comments regarding advantages and disadvantages are summarized in table 3, and additional comments are summarized in Table 4.
Table 1
Midterm Survey Results for the Likert Questions as Measured by Percentage (N = 220).

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel that using breakout groups in this class enhanced my understanding of the subject matter.</td>
<td>0.45</td>
<td>2.27</td>
<td>9.09</td>
<td>58.64</td>
<td>29.55</td>
</tr>
<tr>
<td>2. I feel that using breakout groups in this class helped me to analyze, synthesize, and evaluate the course subject material.</td>
<td>0.45</td>
<td>2.27</td>
<td>8.18</td>
<td>50.91</td>
<td>38.18</td>
</tr>
<tr>
<td>3. I feel that the topics of discussion in the breakout groups were interesting.</td>
<td>0.45</td>
<td>0.91</td>
<td>9.09</td>
<td>55.91</td>
<td>33.64</td>
</tr>
<tr>
<td>4. I feel that the topics of discussion in the breakout groups were relevant to the study of functional foods and nutraceuticals.</td>
<td>0.45</td>
<td>0</td>
<td>4.09</td>
<td>36.36</td>
<td>59.09</td>
</tr>
<tr>
<td>5. The breakout groups were easy to create.</td>
<td>1.36</td>
<td>6.82</td>
<td>18.64</td>
<td>46.36</td>
<td>26.82</td>
</tr>
<tr>
<td>6. The breakout groups were easy to participate in.</td>
<td>1.36</td>
<td>5.91</td>
<td>23.18</td>
<td>42.27</td>
<td>27.27</td>
</tr>
<tr>
<td>7. The breakout groups enhanced my communication skills.</td>
<td>0.91</td>
<td>17.27</td>
<td>48.18</td>
<td>21.82</td>
<td>11.82</td>
</tr>
<tr>
<td>8. I enjoyed breakout groups and was happy to take time out of lecture to engage in them.</td>
<td>0.91</td>
<td>7.76</td>
<td>19.18</td>
<td>45.66</td>
<td>26.48</td>
</tr>
<tr>
<td>9. Breakout groups used up too much time for the learning they accomplished.</td>
<td>21.36</td>
<td>53.18</td>
<td>10.91</td>
<td>10.45</td>
<td>4.09</td>
</tr>
<tr>
<td>10. I would have enjoyed more time spent in breakout groups.</td>
<td>3.67</td>
<td>30.73</td>
<td>43.12</td>
<td>16.06</td>
<td>6.42</td>
</tr>
<tr>
<td>11. I feel that using a combination of breakout groups and lectures results in a more engaging classroom.</td>
<td>0.92</td>
<td>1.38</td>
<td>9.68</td>
<td>47.93</td>
<td>40.09</td>
</tr>
<tr>
<td>12. Overall, I feel that using breakout groups in this class enhanced my learning experience.</td>
<td>0.91</td>
<td>2.73</td>
<td>10.91</td>
<td>53.64</td>
<td>31.82</td>
</tr>
</tbody>
</table>
Table 2
Final Survey Results for the Likert Questions as Measured by Percentage (N = 229)

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I preferred the guest lectures to the classes with breakout groups.</td>
<td>11.84</td>
<td>34.65</td>
<td>29.82</td>
<td>17.11</td>
<td>6.58</td>
</tr>
<tr>
<td>2. I would have enjoyed more classes with guest lectures.</td>
<td>10.48</td>
<td>42.36</td>
<td>32.75</td>
<td>12.66</td>
<td>1.75</td>
</tr>
<tr>
<td>3. I would have enjoyed the classes with guest lectures more if they used</td>
<td>8.37</td>
<td>37</td>
<td>23.35</td>
<td>25.99</td>
<td>5.29</td>
</tr>
<tr>
<td>breakout groups.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I found the course content to be as expected.</td>
<td>3.54</td>
<td>12.39</td>
<td>14.6</td>
<td>57.96</td>
<td>11.5</td>
</tr>
<tr>
<td>5. I found the course difficulty to be as expected.</td>
<td>1.75</td>
<td>13.97</td>
<td>19.21</td>
<td>58.08</td>
<td>6.99</td>
</tr>
<tr>
<td>6. I found the course layout was logical and flowed well.</td>
<td>3.07</td>
<td>11.84</td>
<td>19.74</td>
<td>52.63</td>
<td>12.72</td>
</tr>
<tr>
<td>7. Looking back, I feel the breakout groups used during the first six</td>
<td>2.62</td>
<td>4.37</td>
<td>9.61</td>
<td>46.72</td>
<td>36.68</td>
</tr>
<tr>
<td>weeks of class improved my understanding of the course material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Looking back, I feel the breakout groups used during the first six</td>
<td>3.95</td>
<td>5.7</td>
<td>12.72</td>
<td>49.56</td>
<td>28.07</td>
</tr>
<tr>
<td>weeks of class allowed me to perform better in this course.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I feel that using breakout groups increased my retention of the</td>
<td>3.07</td>
<td>3.95</td>
<td>11.4</td>
<td>50</td>
<td>31.58</td>
</tr>
<tr>
<td>material learnt during the first six weeks of class.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Overall, I feel that using breakout groups in this class enhanced my</td>
<td>3.06</td>
<td>3.49</td>
<td>12.66</td>
<td>52.4</td>
<td>28.38</td>
</tr>
<tr>
<td>learning experience.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Student response displayed by gender to the survey question "overall, I feel that using breakout groups in this class enhanced my learning experience." (A) Question 12 from the midterm survey (N = 220). (B) Question 10 from the final survey (N = 229).
Table 3
Advantages and Disadvantages of Using Breakout Groups

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Helped summarize and apply lecture material</td>
<td>• Awkward room to move around in</td>
</tr>
<tr>
<td>• Illustrates the big picture</td>
<td>• Some people not willing to participate</td>
</tr>
<tr>
<td>• Makes class more interesting/breaks up class</td>
<td>• Students sitting spaced out</td>
</tr>
<tr>
<td>• Interaction with peers/hearing other opinions</td>
<td>• Sitting with friends encourages conversation</td>
</tr>
<tr>
<td>• Helps prepare for exams – easy to study from, forced studying in class, reduced study load come midterm</td>
<td>• Sometimes not enough time/too much time spent on them</td>
</tr>
<tr>
<td>• Forces you to engage in class</td>
<td>• Hard to hear during large group discussions</td>
</tr>
</tbody>
</table>

Additionally, the end of each survey included an area where students could provide further comments describing the effectiveness of using breakout groups as an active learning strategy in a large undergraduate nutrition classroom. Examples of specific feedback are provided below.

Table 4
Examples of Categorically Themed Comments Regarding Breakout Group Use in the Classroom

| Critical Analysis | “Overall I thought they were effective, especially in this type of class that is less focused on memorization of facts and more on having opinions and analyzing information.” |
|                   | “I think they are a great idea. I believe they are extremely suitable for a 4th year class where we are expected to be able to discuss and verbalize our opinions and support them.” |
| Interaction with other students | “I honestly was not looking forward to the breakout groups. I thought it was a waste of time for us to discuss something that we would end up discussing with the professor anyways. I was surprised however, because did end up finding the groups helpful and a unique way to learn.” |
|                   | “I really enjoyed the dynamics of this class, especially with the use of breakout groups. It made the university classroom experience feel less ‘presented’, and more ‘involved’. I felt more integrated into the class and the material, as opposed to just listening and then leaving.” |
Table 4 (Continued)

| Retention of Material | “Breakout groups greatly helped with my retention of the course material. While the breakout groups were sometimes disorganized, [the instructor] always made sure to bring the class together for a final discussion, which ultimately put everything into an understandable context. The breakout groups contributed to helping me understand the course material beyond the context of the classroom.” |
| Exam Preparation | “[The instructor] did a wonderful job presenting the breakout groups and had, for most of them, interesting topics. For the not-so-interesting topics, it made it easier to understand and reinforce to prepare for the midterm exam. Wish these were in more classes!!” |
| Generating Topic Interest | “Really enjoyed them! It is very interesting to bring relevant, present day Canadian issues to the classroom.” |
| | “I liked the idea. It made class interesting and applying concepts immediately always helps in learning. Had these topics been given outside of class time I wouldn’t have done them, so it was good to include them in class time.” |

Discussion

Despite a lack of support staff, dedicated time outside of class, and room restrictions, the students in a large undergraduate class in this study subjectively reported a very positive impression of using breakout groups in conjunction with traditional lectures. The perception of females was more positive than that of males, and this was accompanied by a better performance by females as measured by final course grade. An effect of GPA was also seen on the midterm survey, and students with a cumulative GPA above 90% viewed the use of breakout groups more negatively on both the midterm and final surveys, although the final survey results were non-significant.

An important finding of this study was that there was a significant effect of cumulative GPA on student’s perception of overall effectiveness, although this finding was not replicated in the final survey. The lack of replication may be due to the fact that there was a slight decrease in perceived effectiveness on the final survey from the midterm survey (described below) and/or a result of a slight difference in the students who responded to each survey. However, a consistent finding between midterm and final surveys was a more negative impression of the use of breakout groups by students with a cumulative GPA above 90%. Students in this grade category showed the lowest mean ranking of all categories on the midterm survey and the second lowest mean ranking on the final survey. The lowest mean ranking on the final survey was shown by students in the below 60% category, but these results are confounded by the fact that there were only two students in that group. The observation that the highest achieving academic students were not receptive to the use of breakout groups is interesting. It has been observed that undergraduate students had a reduced impression of teaching effectiveness in an active versus a traditional teaching cohort, and that students resist active learning techniques...
when they do not feel that they provide them with required information (Walker, Cotner, Baepler, & Decker, 2008). Very high achieving students may be wary of active learning techniques such as breakout groups because of a concern that they will fail to provide them with the learning opportunities necessary to be successful in the class. Moreover, established learning habits (such as reliance on didactic teaching) can be difficult to change (Clark, 2000), and students with highly successful habits may be particularly reluctant to do so. To minimize resistance, it has been suggested that instructors take the time to explain the type of approach that will be used in the class and the potential benefits to use (Griffiths & Ursick, 2004). This approach was taken in the present study, although it does not appear to have been enough to positively influence students with the highest cumulative GPA.

Another important finding of this study was the effect of gender on breakout group perception. As previously mentioned, there is a lack of information in the published literature related to the effect of variables such as gender in relation to the use of breakout groups. The main finding of this study was that there was a significant effect of gender on students' perception of overall effectiveness, with a greater proportion of females indicating that they felt strongly that the use of breakout groups enhanced their learning experience. For the first midterm survey, over 30% of the female response indicated a strong agreement with the effectiveness of the breakout group use, compared to just above 20% for males, for whom a comparatively larger percent responded neutrally. In the results of the second midterm survey, this difference grows as males who strongly agree drops to just above 10% while females remain above 30%. It has been suggested that females should respond more favorably to group work than males based on cultural and evolutionary roles, where males typically engage in competition and exhibit individuality versus females who spend time in collaboration and fostering codependency (Daniels, Creese, Hey, Leonard, & Smith, 2001). However, studies looking at gender preference for modes of learning in higher education have shown that there does not appear to be a difference. While females have been shown to prefer a broader range of stimuli than males, both genders appreciate variety in their educational experience (Shaw & Marlow, 1999; Slater, Lujan, & DiCarlo, 2007). Importantly, this subjective measurement of perceived effectiveness was supported by the performance of females in this study, with females showing an almost 3.5% greater mean course grade than males. It is tempting to speculate that the correlation of these two observations suggests that the use of breakout groups may, in fact, have quantitatively enhance the learning experience to a greater extent in females.

In addition to findings regarding the effects of class composition on breakout group perception, there is also a lack of published literature regarding the use of breakout groups in physically constrained spaces. This study sought to address this gap by using breakout groups in an old lecture hall that requires students to sit tightly together in a balcony and on a main level, leaving little room to move around. Somewhat surprisingly, the majority (approximately 70%) of students surveyed felt that the breakout groups were easy to create and participate in. That being said, when prompted to provide specific feedback related to disadvantages of the use of breakout groups, many students mentioned the space as being problematic, with most comments being related to difficulty moving around to form groups. The survey questions related to these aspects of the study...
were specifically designed to address the issue of physical space, and the results indicate that it was not a limiting factor in the successful use of breakout groups.

The vast majority of students surveyed in this study felt that the topics of discussion in the breakout groups were interesting and relevant to the study of functional foods and nutraceuticals. Surveys on the use of popular media in the classroom have not only shown how widespread its use is, but also how positively it has been received as a pedagogical tool, and the motivational potential of using popular culture in the classroom is evident at many levels of education (Mraz, Heron, & Wood, 2003). However, choice and application of media should be taken into consideration to avoid sending the wrong messages (Hobbs, 1998). The area of functional foods and nutraceuticals is widely reported in the popular media, and the universal relevance of nutrition means that students are exposed to these products throughout their daily lives in many different environments (for examples, see archives of CBC Marketplace videos at www.cbc.ca/marketplace/). One of the main objectives of this course is to separate fact from fiction, and to analyze whether the information presented to the public in the popular press is supported by the scientific literature, as well as to analyze the scientific mechanisms that underlie the formulation of these food and supplement products. The ability to incorporate popular media into class and into the breakout groups may have the effect of catching student’s interest, and is something that would not necessarily translate across all disciplines. However, it should be noted that only two of the breakout groups incorporated popular media, so the observed findings could not be solely attributed to this factor. Nonetheless, the “interest” factor of these breakout groups should not be underestimated as being an important predictor of overall effectiveness, and could be investigated in future research.

In the present study, the first survey measuring perception was administered immediately following the use of breakout groups and the second study measuring perception was administered six weeks later. Comparing results between the two surveys reveals a slight decrease in student perception of overall effectiveness. The percentage of students who “strongly agreed” with the overall effectiveness of breakout groups dropped from 31.82% on the midterm survey to 28.38% on the final survey, and those who “agreed” dropped from 53.64% to 52.4% respectively. This could account for the loss of statistical significance seen with overall GPA on the midterm survey but not the final survey. Other studies have shown an increase in course satisfaction correlating with the introduction of PBL mid-course (Casey, Magrane, & Lesnick, 2005; Curtis, Indyk, & Taylor, 2000), as well as increased satisfaction with the learning experience when enrolled in a PBL-based class compared to non-PBL controls of the same course (Selçuk, 2010). However, no studies appear to show changes in perceived effectiveness from during use of PBL techniques to use of non-PBL techniques.

A final observation of the present study was that students had a positive perception of the distribution of breakout groups across time. This is relevant due to the lack of published literature related to the optimal use of breakout groups in undergraduate education. Several students reported that they felt that the number and length of the breakout groups was ideal, and said they would not want to see more (or less) of them. A total of four breakout groups were incorporated into 11 lectures, which provided a balance of one breakout group every three lectures, with an average duration of approximately 10 minutes for each. Other proven techniques have been shown as having
similarly short time requirements, such as partnering and clarifying class notes, which could take around two minutes (Ruhl, Hughes, & Schloss, 1987), or small groups dubbed “buzz groups” taking several minutes (Gibbs, 1988). Indeed, it has been shown that the effectiveness of active learning techniques lies in the nature of the engagement rather than simply spending more time on the topic (Redish, Saul, & Steinberg, 1997). Generally speaking, these small group discussions been able to proceed in a more optimal environment – for example, with several teaching assistants available to circulate and facilitate the discussions, in a less crowded room, or in the context of a tutorial sized class – it is possible that more and longer breakout groups could have been used successfully. The breakout group topics addressed in publications related to conferences (Wood, 2003), workshops (Pritchard, 2002) and professional training courses (Brownell & Welch, 2000) tend to describe topics that would take considerably longer to cover but participants in those experiences are also older and more mature, and the discussions are likely taking place in spaces that are better suited to breakout group discussions. Given the limitations of a constrained classroom and a course structure that includes large numbers of undergraduates, it may be important to use the breakout groups as an adjunct to, rather than a replacement of, traditional lectures, and to keep the length relatively short.

**Limitations and Future Directions**

There are several limitations to the present study that should be considered. First, when interpreting the gender differences, it must be considered that there were significantly more females than males in the class and who responded to the surveys, with a female to male ratio of 179 to 41 on the midterm survey and 183 to 46 on the final survey. As well, it should be noted that, due to the larger sample size of females compared to males, there is a greater degree of accuracy with the female results, whereas the male response may not as accurately represent males in general. This must be taken into consideration when suggesting gender effects. Second, there were a small number of students (N=6) in the category of cumulative GPA above 90%, so the finding that these students had a more negative perception of the use of breakout groups is limited by small sample size. Third, as with many educational action projects, this study does not have a control group, so it is not possible to determine cause/effect relationships. And fourth, the duration of the study was relatively short, with breakout groups only used over a period of six weeks.

An important focus of future research should be to determine whether the gender and GPA effects observed in this study are replicable. It should also be determined whether similar findings are observed at other levels of undergraduate and graduate education. The successful use of breakout groups in a large fourth year undergraduate classroom may not be seen at lower levels of higher education, as they require students to have the maturity required to stay focused while working independently with minimal supervision. The effect of class size, as well as grade level, should be clearly delineated so that instructors in higher education learn how to use this technique most effectively.

For many university and college educators, the desire to integrate active learning techniques into their teaching practice is challenged by limitations such as a lecture-only format, limited teaching assistant resources, and awkward room spaces, so it is important
to identify strategies that can be used successfully within these confines. This study demonstrates that breakout groups can be successfully used in a large classroom despite such constraints. The findings of this work are relevant given the applicability of breakout groups to a wide range of disciplines, and the relative ease of integration into a traditional lecture format.

References


