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Game-based Learning in the University Classroom

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Summary
Gamification focuses on the application of game mechanics and gameful thinking in non-game contexts to engage users in solving problems or carrying out tasks. This interactive workshop will explore the theoretical and psychological relationship between games and learning, with particular focus on Bloom's taxonomy of learning and the relation between its affective domain and gamified learning. The workshop then introduces various elements of gameful design and a variety of gamification methods that can be used in a university classroom. Participants will learn strategies to incorporate gamification into a variety of learning environments and will have the opportunity to design game-based learning events that can be used in undergraduate lectures. Individuals from all disciplines can participate and benefit from techniques to identify and learn from a diverse set of strategies and methods that can be adopted to use in different disciplines and levels of teaching. Finally, the workshop provides an opportunity for participants to dive deeper and discuss strengths, weaknesses, and possible threats in gamified learning.

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SUMMARY
Gamification focuses on the application of game mechanics and gameful thinking in non-game contexts to engage users in solving problems or carrying out tasks. This interactive workshop will explore the theoretical and psychological relationship between games and learning, with particular focus on Bloom's taxonomy of learning and the relation between its affective domain and gamified learning. The workshop then introduces various elements of gameful design and a variety of gamification methods that can be used in a university classroom. Participants will learn strategies to incorporate gamification into a variety of learning environments and will have the opportunity to design game-based learning events that can be used in undergraduate lectures. Individuals from all disciplines can participate and benefit from techniques to identify and learn from a diverse set of strategies and methods that can be adopted to use in different disciplines and levels of teaching. Finally, the workshop provides an opportunity for participants to dive deeper and discuss strengths, weaknesses, and possible threats in gamified learning.

KEYWORDS: game-based learning, gamification, active learning

LEARNING OUTCOMES
By the end of this workshop, participants will be able to:
- identify the psychological ties between game-play and pedagogy and its role in higher education;
- utilize the elements of games and game-based strategies to create interactive in-class activities; and
- develop necessary steps to create learning modules using various elements of game design.

REFERENCE SUMMARIES
Aldrich, C. (2009). *The complete guide to simulations and serious games: how the most valuable content will be created in the age beyond Gutenberg to Google*. San Francisco, CA: Pfeiffer.

This book is focused on technology-based educational gaming environments; however, much of the conceptual discussion is also applicable to non-technology-based gaming. Aldrich's evaluation of "big skills", which are the most valued non-technical skills that are rarely taught, establishes a gap in formal education that gamification can help in filling. From a non-technology perspective, *Part Five: Formal Learning Program* is the most directly useful section. The author discusses the importance and types of goals that can be reached through gamification and presents "critical development steps" that guide the reader through the preparation, execution and evaluation of gamification strategies. This book is an excellent reference guide for an instructor designing games-based activities.

Huang, W. H. Y., & Soman, D. (2013). Gamification of education. *Research Report Series: Behavioural Economics in Action*. Toronto, ON: Rotman School of Management. Retrieved from: http://inside.rotman.utoronto.ca/behaviouraleconomicsinaction/files/2013/09/Guide GamificationEducationDec2013.pdf

This report provides an explanation of the game mechanics and the required steps for gamifying a concept. With the use of examples and case studies, the authors argue that gamification in education could lead to higher motivation and student performance through the element of fun and other

psychological and engaging factors. The second part of this paper discusses successful examples of gamifying undergraduate courses as well as successful examples of industry practices in employee training.

Kapp, K. (2013, March). Once again, games can and do teach! *Learning Solutions Magazine.* Retrieved from http://www.learningsolutionsmag.com/articles/1113/once-again-games-can-and-do-teach

This article outlines the results of empirical research that demonstrates gaps in current education and emphasizes the need for games in the classroom. The article is well rooted in the literature and the author presents the argument clearly and concisely. A taxonomy detailing the (1) type of knowledge, (2) instructional strategies and (3) game elements are presented. By organizing the taxonomy with eight different types of knowledge (declarative, conceptual, rules-based, procedural, problem-solving, soft skills, and affective), it provides a great resource for an instructor developing classroom strategies and game elements to support those strategies. The taxonomy provided in this paper is insightful. In this workshop, there is a mini-jigsaw activity where participants will be asked to match the eight different types of knowledge with the examples of games that are provided.

Landers, R. N., Bauer, K. N., Callan, R. C., & Armstrong, M. B. (2015). Psychological theory and the gamification of learning. In T. Reiners & L. C. Wood (Eds.), *Gamification in education and business* (pp. 165-186). Cham: Springer International Publishing.

In this chapter, the authors focus on explaining the effects of gamification through well-developed concepts in the psychology literature. Authors first review two psychological theories that are most relevant to gamification: learning theory and motivational theory. The learning outcomes of gamification are then analyzed in two learning frameworks: the theory of gamified instructional design and classical conditioning theories of learning. With regards to motivational theories, the authors describe the gamification concepts and impacts through the lenses of expectancy-based theory, goal setting theory, and the theory of self-determination. Overall, the chapter provides a brief but fruitful explanation of relevant psychological theories and ties these theories to components in gamified education. Moreover, the authors identify recent studies in the literature and propose new research directions that can ultimately shed light on some of the unknown (positive or negative) psychological factors in gamifying the classrooms. This chapter is an excellent resource for any instructor interested in the underlying psychological theories of gamification.

Richter, G., Raban, D. R., & Rafaeli, S. (2015). Studying gamification: the effect of rewards and incentives on motivation. In T. Reiners & L. C. Wood (Eds.), *Gamification in education and business* (pp. 21-46). Cham: Springer International Publishing.

This book chapter provides a brief survey on various models of motivation in games and their relation to different elements in game design. The authors discuss motivational models as a spectrum of rewards, ranging from intrinsic motivations to social and extrinsic factors. The chapter discusses game reward elements (points, grades, ranks, ladderboards, etc.) and intrinsic and extrinsic motivations according to few characteristics such as immediacy, tangibility, and progression. This chapter is essential supplementary reading to any instructor using rewards-based gamification to increase student motivation.

CONTENT AND ORGANIZATION

Duration (min)	Subject	Activity	Purpose
20	Opening Activity	The facilitator leads an ice-breaking game. Participants are asked to: • Step 1: Think of one truth and one lie about yourself. • Step 2: Introduce yourself [Truth and Lie] to your neighbor on your right. • Step 3: Introduce your partner to the class, guessing the true fact about him/her. The class shows who think the statement is true or false by show of hands.	An ice-breaking activity for participants to get to know each other while showcasing a sample introduction game. This will be later tied to the concept of "Fun Theory".
	Pre-assessment	*Brainstorming* • Facilitator asks participants their opinions about games and participants provide examples of everyday activities as games.	Initiate the discussion about games and encourage participants to think of various everyday life activities as games. "What activities come to your mind when you hear the word 'Game'?"
	Introduction to Games	*Think-Pair-Share* • Facilitator uses a Think-Pair-Share model and asks participants "What other games have real-life themes?" to explore game themes. *Lecture* • Facilitator briefly justifies the use of gamification in education, making connections to education system. • Games are used in education systems that are designed for teaching pre-school and elementary classes. However, in higher education, educators often forget that our inner child is curious to learn and constantly calls for fun. (Lean et al. 2006; Rojas et al. 2013)	Identify games that have real-life themes (e.g., chess, monopoly, and other examples of board games). Promote the use of games and their role in creating engaging and fun activities. Distinguish between technology-based and traditional games, and provide some samples.
5	Why Games?	*Video (optional)* – 1:48 in length • Facilitator shows a short video demonstrating 'fun theory' to demonstrate how undesired tasks can	Familiarize the participants with the impact of gameful design and activities.

		be fun with gameful elements added. URL:https://www.youtube.com/watch?v=2lXh2n0aPyw (Thefuntheory.com, 2009) *Lecture* • Facilitator presents the definition of gameful design, its relation to other active learning techniques and explores the theoretical and psychological ties of game-based learning. • "Gamification is the use of game thinking and game mechanics in non-game contexts to engage users in solving problems." (Zichermann, 2011) • Refer to handout (Appendix A, page 1) on how game-based learning is situated in active learning.	Discuss the definition of "Gamification", and introduce games as indirect tools for active learning.

5	Theoretical Ties	*Lecture*
		• Facilitator describes Bloom's taxonomy of learning and introduces the *affective* and *psychomtor* domains of Bloom's taxonomy
		
		• Facilitator maps each domain to a particular part of game-play:
		    ○ Cognitive: problem-solving, solving a puzzle, group strategies,
		    ○ Affective: emotions, desires, excitement, arousal, etc.,
		    ○ Psychomotor: game mechanisms, responses, adaptation.
		• Refer to handout in Appendix A
		
		• Sample papers on the impact of games in various domains of taxonomy of learning: Landers et al., 2015; Richter et al., 2015; Lazzaro, 2004
			Provide theoretical and psychological justifications of how various elements of games are tightly coupled with learning taxonomies.

25	How to Develop Gamified	*Open Question* • What elements make an activity a	Enable participants to come up with the elements that

Learning Modules?	game?	convert an activity to a game.
	Lecture • Facilitator presents the elements of gameful design based on Huang et al. (2013): achievable goals (objectives), structures (rules and roles), clear roles and mechanics, uncertainty and randomness (unpredictability of outcomes).	Discuss the elements of games. Students are encouraged to think deeply about how Bloom's taxonomy of learning connects to games and gameful design in education.
	Think-Pair-Share • Facilitator presents game mechanics and asks pairs how game mechanics translate into pedagogical elements. • Game mechanics: points, turns, auctions (bidding), movements, resource management, roles (Kapp 2012, Huang 2013)	
	Lecture • Facilitator introduces the level of complexity and how it will affect learning and explains the importance in having some element of randomness. • Ways to include randomness: dice, coins, draws, etc. • The game should not be completely linear in terms of expectations because it could get boring, but at the same time, it should not be too complicated because that causes confusion or demotivation. (Giannetto et al. 2013)	
	Lecture Facilitator presents modular versus immersive game design as follows: • Immersive design: the whole class is designed as a game; students gain points or badges. • Modular design: includes individual modules; the modules could be independent of each other. • Modular design is easier to implement, as not all the tasks/activities should contribute to the same theme.	Develop an understanding of the two major approaches for in-class gamified activities. *Note*: based on investigating the game design literature in education, we classify all game-based methods to two major categories: immersive design and modular design.

		Modular design is more practical.
		• Combination of both: part of the learners' activities could be towards an immersive experience and other activities are independent of the goal.
		
		Lecture
		• Facilitator discusses advantages and disadvantages of point-based learning.
		• Relays discussion into one focused on extrinsic versus intrinsic motivation. (Landers et al., 2015)
		
		Lecture
		• Facilitator presents keys to successful gamification: Meaning, Mastery, Autonomy (Deterding, 2011).
		• Facilitator presents steps for gamifying a concept, how to identify elements that can be gamified:
		  - Understanding the target audience,
		  - Defining learning objectives,
		  - Structuring the experience,
		  - Identifying resources,
		  - Applying gamified elements.
		• Refer to handout in Appendix A.
		
		Mini-jigsaw Activity
		• Have participants read the information about different "types of knowledge" to consider when designing games drawn from Table 1 of Kapp (2013).
		• Divide the participants into expert groups and have each group discuss the strengths and weaknesses of a specific knowledge. Create new groups so that experts representing each type of knowledge can share their findings with others.
		• See handout in Appendix B.
			Familiarize the participants with intrinsic and extrinsic motivations by discussing advantages and disadvantages of point-based learning (pointification).
			
			Identify main components that are required for planning a gameful activity.
			
			Discuss various types of knowledge with instructional strategies and possible game types. Examples of some known games are also provided.

25	Educational game design	*Design a game* • Facilitator gives groups the same single topic and asks them to develop a gameful activity using the elements of games.	Develop a game-based module on a given topic. Groups receive some elements that they have to work with to create a

		• Example: dividing two numbers and finding the remainder. *Note*: The facilitator may choose a different example depending on the target audience and background.
		
		• Groups get different items to develop an activity. Items included are 1) dice, 2) a set of cards, 3) a few coins, 4) piece of paper (to use however), 5) monopoly pieces.
		• Groups share their designed activities with the class.
		
		Group Discussion
		• Groups share the commonalities and differences in approaches to class.
		• Groups discuss discipline specific techniques and activities. Gradually guide the participants to discuss advantages and disadvantages by asking Socratic questions:
		  ○ How would you suggest applying this method to your discipline? Why?
		  ○ How would you apply game techniques to a simple concept in your field?
			modular or a full game. The purpose is to reinforce the game elements and see their use in teaching a simple topic.
			
			Dive deeper into discipline-specific approaches or concerns.

10	Post-assessment	*Online game-play* • Facilitator asks participants to pair up and in pairs log onto Kahoot.it. They can log in through any mobile device, tablets, or computers. • Groups participate in an online competition to answer a few questions about game-based learning. • See sample questions in Appendix C.	Introduce a simple use of competitive games/ladder boards in student-response systems. Showcase an example of tools that are available for gamifying a concept, particularly for pre or post assessment.
	Conclusion	*Lecture* • Facilitator provides tips for games design in higher education. • Facilitator emphasizes caution and threats to using gamification in the classroom. (Refer back to the discussions on psychological ties as well as discipline-specific ideas that participants developed in the previous	Summarize the key messages of this workshop and review some common threats and cautions. Conclude the workshop by reviewing the learning outcomes and open for

		section). • Emphasize the need for clear instruction and a clear relationship between action and rewards. (Refer back to extrinsic and intrinsic rewards). • Re-visit learning outcomes. • Invite any last questions or comments.	questions.
Total Time: 90 minutes			

PRESENTATION STRATEGIES

This workshop is intended for any level of instructor who is interested in understanding game-based learning and how to integrate game-based learning strategies into their teaching activities. The workshop is designed to be highly interactive and allows for ample discussion and interaction between participants in both small and large groups. However, the ideal number of participants in this workshop is between 15 and 25. The workshop is purposefully non-discipline-specific and encourages individuals from different fields to discuss techniques, opportunities and potential barriers in implementing game-based learning strategies. This interdisciplinary knowledge exchange allows instructors to learn from successes and challenges in other fields and can inspire the novel adaptation of approaches and even cross-collaboration.

As games are the central focus of this workshop, it is important to cultivate a fun, upbeat and inclusive learning environment. A comfortable atmosphere should be established by providing examples of personal experiences using game-based learning and by welcoming questions, comments and relevant anecdotes throughout the workshop. The opening activity gives an opportunity for the participants to get engaged, have fun and get to know one another. It is crucial to create a welcoming and fun environment to encourage exchange of experiences. Throughout the activity breakdown, appropriate questions and strategies are provided to derive the in-class discussions; however, the facilitator may add additional questions or anecdotes to complement the ones provided and generate more discussion. As with much of the workshop, the facilitator will need to keep the activity moving along, keep it focused and maintain an energetic atmosphere. The facilitator will need to guide the participants in a discussion bridging the wider theme of games to game-based learning. Didactic lecturing will be necessary to deliver concepts such as gameful design and the theoretical and psychological ties between gaming and learning. Clear instruction is crucial for the design-a-game activity. Once the groups have a firm understanding of the activity, the facilitator should move from group to group asking questions and making comments. This approach not only allows for participants to get clarification on instruction, but also gives an opportunity for smaller group interaction with the facilitator and to provide targeted encouragement. Furthermore, this interaction provides a more comfortable setting for participants who may not be comfortable asking questions during a full group discussion.

Supporting materials required for the workshop include a whiteboard, handouts, jigsaw activity, and game items (e.g., dice, cards, coins, game tokens).

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APPENDIX A: Handout

Workshop Goals

By the end of this workshop, participants will be able to:
1. Identify the psychological ties between game-play and pedagogy and its role in higher education;
2. Utilize the elements of games and game-based strategies to create interactive in-class activities;
3. Develop necessary steps to create learning modules using various elements of game design.

Why Game-Based Learning?

Definition of Gameful Design
- Gamification is the use of game thinking and game mechanics in non-game contexts to engage users in solving problems (Zichermann, 2011).

Games and Active Learning
- Active learning engages students in two aspects - doing things and thinking about the things they are doing (Bonwell and Eison, 1991).
- Game is structured playing, usually undertaken for enjoyment and sometimes used as an educational tool.

Theoretical and Psychological Ties[1]

The Bloom's taxonomy of learning (1956), in its generic view, considers three different, but interdependent, domains: Cognitive domain, Affective domain, and Psychomotor. Maslow's hierarchy of needs (1943) expands the ties between learning and psychological needs and define various levels for social and psychological motivations. Lastly, Simpson's psychomotor objectives (1971) discusses the levels for adapting and learning new skills.

These domains can be addressed by game design for learning as follows:
- **Cognitive Domain**: solve a problem, solve a puzzle, goal-oriented team work
- **Affective Domain**: emotions, desire, excitement, arousal, sadness, happiness, fear, etc.
- **Psychomotor Domain**: mechanisms, game play, responses, adaptation, etc.

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[1] Facilitator Note: Consider printing and sharing the image at the following link that provides a useful visual of the cognitive, affective, and psychomotor domains: http://www.epicski.com/a/the-complete-encyclopedia-of-skiing-epicski-skiing-glossary (scroll down to section titled: "CAP Model—Cognition, Affection, Psychomotor")

How to Gamify a Learning Component (Kapp 2012, Huang 2013)

Elements of Gameful Design
- Achievable Goals (objectives)
- Structure of the game (Rules, Roles)
- Clear game mechanisms and rules
- Element of randomness (unpredictability of outcomes)
- More…

Game Mechanics
- Points
- Turns
- Auction (bidding)
- Movements
- Resource management/coordination
- Roles

Game Design

Immersive
- Holistic approach
- Whole classroom experience is designed with a game "theme"
- (Almost) every action progresses the learner

Modular
- Each element is independent
- Simple to more sophisticated tasks
- Adding an element of game to any activity
- Not necessarily point based

Point-based Learning (Pointification)

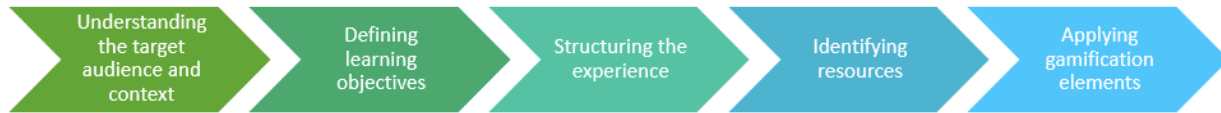| Advantages	Disadvantages

Keys to Successful Gamification (Deterding, 2011)
- ***Meaning****:* must understand users, what drives them and how to use game mechanics to encourage positive emotions and relate the system to them in some personal manner.
- ***Mastery****:* idea the user has of accomplishing interesting and appropriately difficult challenges, and the corresponding positive feedback, encourages users and gives them a feeling of accomplishment.

- *Autonomy*: user must feel autonomous or will feel forced to perform a task which counteracts benefits of enjoyment and intrinsic motivation.

Applying Gamification

According to Huang and Soman (2013), applying gamification in educational contexts includes the following steps:

Taxonomy of Gamification

See article by Kapp (2013)[2] at this link: http://www.learningsolutionsmag.com/articles/1113/once-again-games-can-and-%20do-teach

Tips for Games in Education
- Clear instructions (mechanism, rules)
- Minimum to none failure
- Achievable goals (objectives)
- Fairness (equal chances of winning)

Cautions and Threats
- Time management
- Clear instructions
- Clear relationship between actions and rewards
- Not necessarily resource dependent

Additional Resources

Gamification of Sports Management
> http://www.reimagine-education.com/the-winners-individual/17/Career+Exploration

In-Class Geoscience Games
> http://serc.carleton.edu/introgeo/games/index.html

Wiki: Gamification Examples
> https://badgeville.com/wiki/education

Carleton Gamification Learning Module
> http://carleton.ca/cuopen/modules/module-11-resources-gamification/

How Gamification Reshapes Learning
> http://elearningindustry.com/how-gamification-reshapes-learning#cover

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[2] Facilitator Note: Consider printing and sharing Table 1 provided in the Kapp (2013) article titled, Taxonomy: type of knowledge, instructional strategies, and game elements.

APPENDIX B: Jigsaw Activity

Print Table 1 from the article by Kapp (2013) at this link:
http://www.learningsolutionsmag.com/articles/1113/once-again-games-can-and-%20do-teach

Distribute table and one "type of knowledge" below. Encourage each group to fill out the table in their own words and generate additional examples.

Type of Knowledge	Definition	Instructional Strategies	Game Type	Example
Declarative				

Strengths: _____

_____

Weaknesses: _____

_____

Type of Knowledge	Definition	Instructional Strategies	Game Type	Example
Conceptual				

Strengths: _____

_____

Weaknesses: _____

_____

Type of Knowledge	Definition	Instructional Strategies	Game Type	Example
Rules-based				

Strengths: _____

_____

Weaknesses: _____

_____

Type of Knowledge	Definition	Instructional Strategies	Game Type	Example
Procedural				

Strengths: _____

_____

Weaknesses: _____

_____

Type of Knowledge	Definition	Instructional Strategies	Game Type	Example
Problem-solving				

Strengths: _____

_____

Weaknesses: _____

_____

APPENDIX C: Post-assessment Online Game-play

[Note that questions can be replaced with another set of questions.]

Question 1: Gameful activities do involve the following learning domains:

    A) Cognitive   B) Psychomotor   C) Affective   D) All of the above

Question 2: Alice is planning to incorporate games into her teaching by randomizing the **grades**. Agree?

    A) Absolutely!   B) Never!

Question 3: Which one is an example of **problem-solving** games?

    A) Hangman   B) Story games   C) Quest games   D) Hockey

Question 4: Which one of the below is one of the keys to design successful gamified learning module?

    A) Meaningful activities relevant to the subject matter.
    B) Mastery of a topic through appropriate tasks.
    C) Autonomy of the students in carrying out tasks.
    D) All of the above.