Graduate Research Papers   Graduate College

2016

Effects of gamification on motivation and engagement in secondary curriculum

Matthew J. Molumby
University of Northern Iowa

Let us know how access to this document benefits you

Recommended Citation

Effects of gamification on motivation and engagement in secondary curriculum

Abstract

This literature review investigates the ways and means schools have attempted to influence motivation through the process of gamification in secondary curriculum. This literature review analyzed 31 peer-reviewed empirical studies that sought to understand the links between motivation and engagement with gamified lessons. This review attempts to analyze and synthesize the studies that are related to the definitions of gamification and beyond, the successful implementation along with the failures for motivation and engagement, and a whole system that afford school districts a more deliberate approach to gamification in the high school curriculum. The reviewer has attempted to chronicle studies to advance the dialogue concerning gamification and the research that is connected with both the successes and failures of gamification practitioners and the secondary classroom. Recommendations for adopting gamification are suggested.

Effects of Gamification on Motivation and Engagement in Secondary Curriculum

A Graduate Review

Submitted to the

Division of Instructional Technology

Department of Curriculum and Instruction

In Partial Fulfillment

Of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Matthew J. Molumby

May 2016

This Review by: Matthew J. Molumby

Titled: Effects of Gamification on Motivation in Secondary Curriculum

has been approved as meeting the research requirement for the

Degree of Master of Arts.

Ping Gao

5/6/16
_____
Date Approved

_____
Graduate Faculty Reader

Leigh E. Zeitz

5/6/16
_____
Date Approved

_____
Graduate Faculty Reader

Jill Uhlenberg

5-6-16
_____
Date Approved

_____
Head, Department of Curriculum and Instruction

Abstract

This literature review investigates the ways and means schools have attempted to influence

motivation through the process of gamification in secondary curriculum. This literature review

analyzed 31 peer-reviewed empirical studies that sought to understand the links between

motivation and engagement with gamified lessons. This review attempts to analyze and

synthesize the studies that are related to the definitions of gamification and beyond, the

successful implementation along with the failures for motivation and engagement, and a whole

system that afford school districts a more deliberate approach to gamification in the high school

curriculum. The reviewer has attempted to chronicle studies to advance the dialogue concerning

gamification and the research that is connected with both the successes and failures of

gamification practitioners and the secondary classroom. Recommendations for adopting

gamification are suggested.

Keywords: Gamification, Gaming, Gamified Learning, Badging

Table of Contents

Effects of Gamification on Motivation in Secondary Curriculum

The direction of education faces significant motivation and innovation challenges pertaining to student motivation in the 21st century learning. Educators compete for the attention of students when it comes to information, understanding, and research. Gamification, or the application of game components into non-game areas, shows great promise in appealing to the shifting attitudes of students in our schools (Hamari, Koivisto, & Sarsa, 2014). Students in a culture of behavioral stimuli (stemming from rapid response technology) react positively to rewards, points, or badges that essentially have no other benefit than the motivation that comes from accomplishing a task. The value of this motivation and engagement speaks to the innovation and creativity that can thrive in the safe environment of gamification. Gamification should be researched in order to define its role in education, as this role must be intentionally designed to maximize the value of the learning that takes place.

Competition is not a new concept in education. Education thrives on the motivation behind competition. If a teacher asks a group of 7th graders to, "raise your hands, raise them a little higher. Now, who can raise your hands the highest," he or she has just added incentive, and a new level of motivation that comes from introducing gaming components into a non-game event. "Raise your hand." Motivation comes from within. The direction of student success is in direct proportion to the intrinsic value placed on 'owning' an individual's determined importance placed on education.

The use of game design and game elements in other contexts is an old topic in education. According to Hamari, Koivisto, and Sarsa (2014), "Gamification has been a trending topic and a

subject of much hype as a means of supporting user engagement and enhancing positive patterns in service use, such as increasing user activity, social interaction, or quality and productivity of actions." (p. 83). It is further discussed throughout this review that, "These desired use patterns are considered to emerge as a result of positive, intrinsically motivating, "gameful" experiences brought about by game/motivational affordances implemented into a service" (p.84).

In order to understand the intricacies concerning this research, an educator must consider the effects of educational games on high school secondary curriculum to answer one primary question: 1) How does gamification affect high school students' motivation and engagement? The other two questions are: 2) How is gamification defined and applied? 3) How should gamification be used as a system? Because there are limited studies about the gamification for secondary education, the studies conducted at the college level are included to draw a reference,

This review will help explore deeper levels of meaning regarding the process of gamification in the secondary classroom. This review may be beneficial to those researchers, administrators and educators who attempt to find the link between knowledge acquisition and the engagement fostered by intrinsic motivations. Through gaming elements, educators may find the processes expanded through reviews and research.

This review will address questions concerning gamification pertaining to the effects of gamification on motivation and engagement in the secondary curriculum. Although closely related, motivation will be analyzed as the reason for acting, and engagement refers to the degree of attention and interest. The research will hopefully provide insight into the educational outcome based on academic success in a secondary curriculum.

Methodology

Google Scholar, ERIC, and the University of Northern Iowa Rod Library's 'OneSearch!' database were used to locate the sources for this literature review. Key-words used to find information from which database were: Student Motivation, Reward System, Middle School, High School, and Gamification. The searches resulted in 793 scholarly articles. ERIC Search descriptors (ERIC Thesaurus): Gamification, Student Motivation, Educational Games, Educational Technology, Engagement, and Intrinsic Motivation. Google Scholar terms: Gamification, Gaming, Educational Games, Badging, Engagement, and Achievement. The criteria for the reviews selected ranged from availability of articles in English, the year the study was conducted (limited to research done during or after the year 2000), and the quality of the peer-reviewed journal articles as they pertained to the motivation, engagement, achievement and secondary education.

The other criteria included interpretations of gamification, observations linked to gamification, or audio/visual materials associated with technology used in conjunction with gamification. This type of exploration exposed burgeoning questions of validity in regard to research within each review. The research methodology was the other criteria. The research methods for the studies included both qualitative and quantitative, methods mixed methods, literature review, and case studies. The conclusions and recommendations included open-ended questions, group interviews, observations, and formative assessments that contain surveys. Each of these data points helped better anticipate the potential direction of change or explanation within each study. Close examination of the data influenced the exploration and implementation of gamification when researching the question of motivation and student achievement. Most of the studies for this review were conducted within the last five years and advanced enough to

involve preliminary exploratory analysis. This analysis provided the data, understanding, and

concepts incorporated throughout the research process, and the next step of possible

implementation, or innovation. Based on the above-mentioned criteria, 31 peer review articles

were included in this literature review and were sorted by topic and coded by theme.

Analysis and Discussion

The effects of gamification in the secondary curriculum when applied to motivation, present an

exploratory opportunity to view options districts have to influence motivation. Many studies,

such as Sáez-López, Miller, Vázquez-Cano, and Domínguez-Garrido, (2015), and Nah,

Telaprolu, Rallapalli, and Venkata. (2013), use a probing set of questions and conditions to

expand the range of issues facing the implementation of gamification elements into classroom

practice. The structures of several reviews posit numerous points of possible motivational

elements as well as the shortcomings of gamification in the secondary curriculum. The studies

reviewed seem to possess several different types of instructional treatments via computer-

assisted instruction and competition-based game playing. There should be narrow definitions of

the research design which helps with detailed and innovative study in the future. The

experimentation represented in these studies supports effects of motivation when applied to

gamification. However, the studies herein also expand research that promotes promising leads

for further integration of gamification in the secondary curriculum. It is understood that from

these studies, great theoretical and practical application could be gained from understanding

learners' behaviors, motivation, learning styles and preferences concerning gamification and

motivation. The three major themes emerged from the review of 31 peer reviewed articles: 1) the

links between gamification and motivation and engagement, 2) the definition of gamification and

beyond, and 3) the gamification as a system.

Links between Gamification and Motivation and Engagement

Several studies found positive links between gamification and student learning

motivation (Eseryel, Law, Ifenthaler, Ge & Miller, 2014; Rockwell, Graves, Graves, & Chartier,

2011; Stott & Neustaedter, 2013). For example, motivation and gamification become linked as

Eseryel, Law, Ifenthaler, Ge and Miller (2014) argue, "complex problem solving and associated

cognitive processing and motivational requirements are most impacted by gameplay; and that

interactivity captures the most salient features of gameplay as it relates to complex problem

solving and motivation." (p. 46). A rural high school in the Midwest of the United States was

used as the subject for this experimental study. All of the ninth-grade students in the school took

part in the study where motivation was separated into two categories, understanding and problem

solution activities. All complex structured problem-solving developed parallel interest in the

understanding of a problem and the student directed solutions. Students were in turn, motivated

by prior experience with games or game like elements.

Gamification-related motivation and curriculum were explained in *Gamification,*

Research and Writing. "The Game of Writing (GWrit) project has developed a prototype of an

online writing environment that allows us to experiment with different models with gamification

in writing" (Rockwell, Graves, Graves, & Chartier, 2011). English and Film Studies department

students from the University of Alberta were used as the subjects in introductory writing courses.

The study also included data collecting, the theory relationships, and stating predictions based on

those theories. All of these approaches seem to benefit the three findings being explored within

the project design: game instruction, prior experience, and purpose. Finally, theory identification

and examination come from a theory-based pattern, which denotes a "grounded" or data centric

collection that is sensitive to the individuals participating in the study.

Encouragement and motivation go hand in hand when it comes to the expanded definition of gamification. Stott and Neustaedter (2013) state that game design in curriculum allows for a "freedom to fail" mentality within educational design. The student has the freedom to test theories and hypotheses "in-game", while still creating this environment of learning that encourages growth through trial and error. "Game design often encourages players to experiment without fear of causing irreversible damage by giving them multiple lives, or allowing them to start again at the most recent 'checkpoint'" (Stott & Neustaedter, 2013, p. 5).

Gamification Defined and Applied

The hurdle to the implementation process hinges on the systematic mapping of "serious gamification".

Serious gamification is a system of game like elements designed for non-recreational environments and for educational purposes. The term "serious" is employed because these games can focus on areas as diverse as economics, education, health, industry, military, engineering, and politics. (de Sousa Borges, Durelli, Reis, & Isotani, 2014, p. 217)

The influence of motivation through gamification is derived from a sense of simulation and virtual practice. Situations that can be applied to simulated realities help create a gaming environment that relates to a genuine experience. Information is the focus when applying "serious gamification" to education. Within the educational community, entertainment is considered secondary to the process by which information is disseminated. "Video Games or Digital Games are systems in which users are engaged in resolving abstract conflicts and challenges, under predetermined rules" (de Sousa Borges, et al 2014). It is with the adaptation of

a 'gamified' system that abstract ideas gain focus and understanding through an entertaining medium.

The study by de Sousa Borges, et al. (2014) include a clear example of processing the razor's edge that all educators tread when implementing the idea of gaming into the classroom. According to the study, the researchers "set out to ascertain what aspect of gamification applied to education has been most investigated by researchers..." (p. 16). The questions posed dealt with the three elements of gamification present in secondary education: motivation, relevance, and purpose. In the case of student motivation, "What gamification approaches have been most investigated in the field of computer-supported collaborative learning?" For relevance, "In what educational contexts and levels has gamification been most investigated?" Finally, for purpose, "What types of studies have been most investigated in gamification and education?" (de Sousa Borges, Durelli, Reis, & Isotani, 2014).

Categories of researched motivation within the classroom revealed that, "gamified systems that implement challenging activities can contribute to the improvement of learning" (2014). Moreover, "studies in this category describe approaches or strategies to arouse and maintain students' interest in learning a given subject." (2014). Curriculum is then impacted by the motivation presented in the first two positions. Studies within the research posited evidence that student motivation, when used in tandem with a well-defined gamified system, require more data for the inclusion or exclusion of possible significant impact. "To properly understand the impact (positive or negative) and implications of using gamification in educational contexts there is a need for more research and empirical data" (Durelli, Reis, & Isotani, 2014).

Conception of a Gamified System

The abstract concept of motivation was explored by several innovative studies. Tsung-Yen Chuang and Wei-Fan Chen (2009) conducted research exemplifying, "statistical results clearly showing a significant difference between computer-assisted instruction and computer based video game playing in students' learning achievement." (p. 7). Participants in the study were from a middle/high socio-economic standard school district in Tainan City, Taiwan. The data for the research into computer based gaming was split into three parts consisting of multiple choice, matching, and application games. This comparable data collection indicated the fledgling process of gamification in the classroom as standard practice. Chuang and Chen noted that the research is new, but that the application of gaming practices can have a clear benefit over typical computing instruction as opposed to the online gaming function for students. Computer-based video game playing is effective for improving critical thinking and higher-level cognition. The study noted several benefits that include higher student participation, rapid student response times, and overall higher achievement levels when compared to typical instruction covering the same topic. Higher-order thinking questions that involve more conceptual or abstract analysis were also improved.

This study does seem generalizable and applicable to other individuals and settings when applied to the same makeup and size of the sample. Beyond the parameters of the study however, the research seems to suggest more of a quantitative theory of future studies that could be more applicable to the widespread research question at hand, "How might some of the motivating aspects of computer-based video games be harnessed to facilitate learning?" and, "How might motivational components of popular computer-based video games be integrated into instructional design?" (Chuang & Chen 2009). These questions seem to posit a more extensive research study

that could be implemented over the course of several studies or inceptions. Chuang and Chen even suggest that with a larger number of participants a methodological weakness could be overcome, "…one methodological weakness of this experiment is that a sufficiently larger number of participants would be better so that the statistical test of effect size would have a higher partial Eta-squared value." Other practical limitations are also given including an "improved major cognition factor arising from playing computer-based video games.", and the application of "basic computer tools and Internet-browsing resources… a prerequisite for participating in this study" (p. 9). With the inclusion of the limitation section and the call for a more extensive study conducted within certain parameters involving the initial research questions, potential threats to external validity are minimized because these limitations are noted and discussed.

The researchers did a good job of making most aspects of the conditions the same in the experimental and control groups. The study seemed to possess two different types of instructional treatments via computer-assisted instruction versus computer-based video game playing. There seems to be narrow definitions of the research design which helps with detailed and innovative future study. The experimentation supports and expands research that promotes promising leads for further revision. Chuang and Chen (2009) reinforce this position with the conclusion, "future research should continue to investigate the impact of computer-based video games along with different instructional strategies on varied children's learning achievements, such as facts, concepts, comprehension, problem-solving, or critical-thinking skills." (p. 9). It is understood that from this study, great theoretical and practical application could be gained from understanding learners' individual differences, learning styles, and preferences in learning inclinations.

Another comparable study which alters the equation, "to game, or not to game," comes from the International Society on Technology in Education. Research derived from this study found that, "the majority of candidate responses suggested that intrinsic motivation and curiosity fueled player interest" (Sardone & Devlin-Scherer, 2010). The participants for this study came from a mixed-methods background with 21 undergraduate university students majoring in education. The goal was to determine their ability to recognize the motivational factors behind digital gaming and gamification. Conclusions were mixed, lending substance to the summation that more studies were needed to quantify motivational quality in a secondary curriculum.

Abramovich, Schunn, and Higashi (2013), attempted to assess the value of badging (a strong identifier of gamification) within education. How does an individual measure motivation? The study used 36 seventh graders and 15 eighth graders at a charter school serving a low-income suburb of a large east coast city in North America. The badging study sought to determine whether badge interaction with learning motivation was different for students with different levels of skills. A pretest of proportional reasoning was used to focus on the exact skills taught in the tutorials (Weaver & Junker, 2004). The system of badges used after the pretest decreased the overall motivational goals. The badging system suggested both positive and negative effects. Positive patterns influenced "low-performing" students, while negative patterns aroused in conceptualizing badges as only being extrinsic rewards and therefore only bad for learning (Abramovich, Schunn, & Higashi, 2013).

In order to understand more about the type of motivation that is present in the initial question of this review, research covering self-determination theory and the facilitation of intrinsic motivation was evidenced by Ryan & Deci. Ryan and Deci (2000), acted as observers when researching the idea of reaching certain life goals. When juxtaposed with the idea of

badging and gamification, emphasis on need and fulfillment are strong. Ryan, et al., suggested, "there are many factors that lead people to emphasize certain life goals that may not be need fulfilling" (2000). Materialistic or fleeting satisfactions can actually detract from motivation, engagement, and achievement. Their study debated the psychology of human beings and their behaviorist tendencies. They suggested that the proclivity of humans to maintain motivation could benefit from games, but the games themselves were only integral to individuals who valued the material. Gamification has to go beyond the ephemeral, and lead a learner to basic psychological needs and self-determining intrinsic goals.

The data used to test the research dealing with motivation was obtained in order to continue the ongoing analysis of motivation through self-determination theory. Sørebø, and Hæhre (2012) used a qualitative survey method that used mail questionnaires distributed to 430 teachers of 12 university colleges to theorize autonomous behavior of learning. The study suggested that there is a "perceived autonomy ...assumed to be a redeemer for an internalization process where motivation moves from external to internal" (p. 357). This study made a case against badging, but strengthened a need for autonomy when applying gamification in a curriculum.

Finally, Deterding, Dixon, Khaled, and Nacke (2011) "contrast 'gamification' against other related concepts via the two dimensions of playing/gaming and parts/whole." In this study, researchers classified gamification as a passing trend or rigorous curriculum, which promotes experience and engagement over "playful design". Once again, conclusions pointed to more empirical data needed before a true conceptualization of this phenomenon can be validated. In the short term, the researchers suggest gamification is a "constitutive social and experiential

dimension" (p. 3). In the long term, gamification presents the education with new concepts and research yet to be determined, but that show promise for possible integration.

Engagement

In addition to the motivation that dimensions of a gamified experience can give to a student, engagement toward topic and method are influenced. Engagement can be quantified in many ways, which is reflected in several of the studies indicating engagement using elements of gamification.

Twenty years ago the methods of teaching changed in a way to make relevant the information of a new generation of students. Ten years later the education shifted again to include the children of the previous generation. Education has shifted socially, economically, and systemically since the advent of the previous generation's conception. The new generation of students is growing up in a "world of games and game-based learning" (Schwartz, 2013). As Banas and Polly (2016) state that, "the part that is being overlooked, particularly in our field [education], is the concept of games-as-work. More and more people are becoming professional gamers – building avatars or game characters of sorts and selling these for real money or bitcoins" (p. 2). Engaging in the application as well as the creation of online games and gamified lessons creates a new precedent encouraging motivation through gamification if not new or alternative ways of education (Banas & Polly, 2016).

In support of Banas and Polly, Kopcha, Ding, Neumann, and Choi (2014) seem to put together a very accessible way at looking at developing success as an educator, making the leap beyond the traditional classroom, and understanding some of the benefits and pitfalls before one undertakes this adventure. The researchers state, "Student perceptions of their course experience suggest that they held positive attitudes about their own learning and motivation after

participating in the gamified course" (p. 67). Students can be very hands-on types of learners, so in order to engage the new learner, the gamified lessons may just be the intrinsic motivator that teachers need. Gamification in curriculum seems to be just as important as flexibility, which is a hard balance for some people. It is easy to see a new teacher just entering the field of teaching, less equipped to deal with the type of insight that a seasoned educator must have in order to be successful. In contrast, the new teacher may have the technological experience to gamify a lesson in order to support the needs of a new generation of learner.

One initial insight that has been a great aid in this research comes in the form of *Understanding Gamification* by Kim (2015). Kim's understanding of gamification gives a great start to an educator just entering into the field of gamified teaching. If there is one thing that must be reinvented quickly in education, it would have to be the scaffolding and instruction new teachers receive as they are introduced to district. There is so much that a teacher must master right away, and without some basic structure new teachers can get bogged down with unknown components of the school district. This includes the types of tools and technology that is at their disposal. Kim suggests new insights regarding such minimum requirements, or basic checklists for success using gamification to motivate and engage.

One such checklist can be found in Table 1, which introduces seven types of knowledge, along with gamification elements and examples for each type of gamification.

Table 1:

Kim/Kapp Gamification Learning Content

- "Declarative Knowledge" Gamification elements: "Stories/Narrative, Sorting, Matching, Replayability" Examples: "Trivia, Hangman, Drag and Drop"

- "Conceptual Knowledge" Gamification elements: "Matching and sorting,
  Experiencing the concept" Examples: "Whack a Mole, You Bet!"

- "Rules-Based Knowledge" Gamification elements: "Experience consequences"
  Examples: "Board games, Simulated work tasks"

- "Procedural Knowledge" Gamification elements: "Software challenges, Practice"
  Examples: "Data Miner, Software scenarios"

- "Soft Skills" • Gamification elements: "Social Simulator" Examples: "Leadership
  simulation"

- "Affective Knowledge" Gamification elements: "Immersion, Providing success,
  Encouragement from celebrity-type figures" Examples: "Darfur Is Dying"

- "Psychomotor Domain" Gamification elements: "Demonstration, Haptic devices"
  Examples: "Virtual Surgery Simulator". (p. 1)

When identifying the type of learning and engagement needed, how do you anticipate all of the

types of learners that you have in the classroom before they are introduced to an educator? Kim

(2015) suggests that the idea of lesson planning with gamification before you get to know the

students requires that an educator be familiar with the type of gamer the students identify

themselves as. Students shift demeanor, attitude, and aptitude year to year... sometimes day to

day. How does a teacher anticipate this effectively? The educator must monitor engagement

between individual student and their desired gamified type.

Maybe it is the narrative nature of teaching styles, maybe it is the narrative methods of a

classroom, but the incredibly individualized nature of learning lends itself to the individualized

nature of games in the 21st century. Gamification as an engagement tool focuses on the "what

did you get out of this experience" frame of thinking, though the idea of gamification as a

culminating activity is only one small part of an engaged and truly gamified experience. How many times do students stop, think, and say, "Why did I just do that? It is a very important part of the gamified process." If people have time to think, and the ability to get the real information in the first place, they need to be also able to act on the decision they come up with" This quote by Ray Bradbury regarding a fictional time of hasty arguments and constant information, reminds that no matter how much content a student is exposed to, it remains the reflection, or digestion of that information the most important aspect of truly understanding a concept. Tell a student something as many times as you like, if he or she does not stop to understand why you are telling him or her the information, that same information will need to be repeated at a later date.

As students engage in a gamified lesson using individual lesson design, students are intrinsically motivated to take ownership of their own education. Dorling and McCaffery (2012) support this idea of reflection applied to the individualized learning taking place in gamification of a lesson. Dorling and McCaffery cite gamified lessons that are structured so players can confront "layers" of goals. That is, they have long-term goals inherent in the gaming or narrative of the game, i.e. completing the game, and the medium-term goal of completing specific levels in-game. The short-term goal of completing missions within the levels recreates the formative assessments of "skill checks" and "practice and apply" aspects of lessons.

It is important that frequent feedback is given at all times when applied to gamification. Dorling and McCaffery (2012) state that "an important part of providing feedback to users in games is to let them know how much progress they've made. It's also important to measure progress at multiple levels." (p. 5). Progress in this gamified process is usually implicit and incremental on the part of the student, which why it is important to reward the student by means

of progress report of badges. Badging, as stated above, is just one way of monitoring student progress and engagement. If progress is presented in a way which is interesting, students feel rewarded, and thus, engaged. Incremental rewards are better than one big one. Rewarding effort and not just success is also important to gamification. Rewards scaled to macro and micro levels of instruction promote the type of engagement that is intrinsic to individualized student success. "Rewards should be scaled in proportion to the effort, or risk, that it takes to get the reward." (p. 5). When the educator remains engaged in the planning of the gamified lesson, the student reaps more than just the initial "reward". They are rewarded through the knowledge gained through the experience of learning, as well as the completion of a lesson.

Prior knowledge and active knowledge are important to glean from the student, though the research itself brings up a good point. The feedback only benefits the student if the question or activity provided seeks to truly understand what, how, or why the student understands the material in the way that they do. It is as Dorling and McCaffery (2015) conclude, "gamification as a solution offers the opportunity for better user engagement, faster feedback of achievement and more visible progress indicators of process improvement" (p. 6). This push to student centered learning is at the forefront of current 21st century thinking, and works great with gamification as an aspect of learning.

One such study that supports the findings and hypotheses of both Kim (2015) and Dorling, and McCaffery (2014), is that of Eseryel1 et al. (2014). These researchers performed a study which included a massively multiplayer online game (MMOG), a type of game that possesses specialized instruction to address complex problem-solving skill development. Put into context, game-based learning which includes complex parameters, suggests a complex if not nuanced form of instruction. The study, which included a year-long implementation of the

McLarin's Adventures MMOG and a week of summative assessment. The summative assessment

included participants' constructed solutions to the posttest of complex problem scenarios and

annotated causal representation of the completed scales of the motivation inventory. Figure 1

shows the scales of motivation inventory provided by the researchers.

Figure 1:

Influence of Motivation and Cognitive Structure on Problem Representation
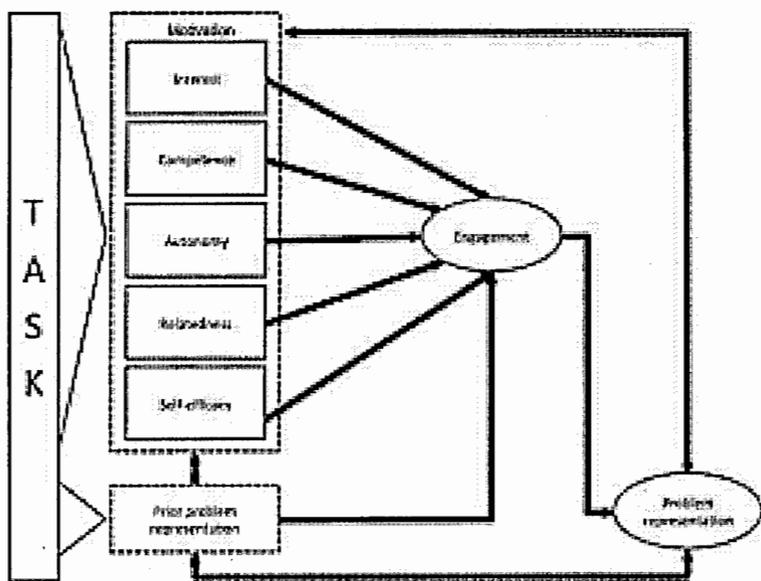
(rectangular shapes depict initial influences variables; oval shapes depict outcome variables;

single arrows depict one-way causal relationship in the direct of the arrow, bi-arrows depict two-

way causal relationships (p. 45)

The secondary classroom in which this experimental study was conducted included a

rural high school in the Midwest of the United States. All of the ninth-grade students in the

school (ten classrooms) took part in our study as part of the secondary education system. The

purpose of this study was to identify the best method to promote engagement through a specific

type of gamified instruction. The results were complex but did show causality between

gamification employed within a lesson and the engagement observed in conjunction with the curriculum. Table 2 shows the regression analysis for variables predicting engagement.

Table 2:

Regression analysis for variables predicting engagement

Engagement (ENG)	B	SE B	β
Step 1.			
Interest (INT)	-5.92	2.28	-.303*
Step 2.			
Interest (INT)	-6.23	2.32	-.319**
Competence (COM)	-3.43	1.78	-.221*
Autonomy (AUT)	3.07	4.05	.105
Relatedness (REL)	1.33	3.68	.049
Self-efficacy (MCS)	.42	.17	.284*

Note. * $p < .05$, ** $p < .01$

The results of Table 2 indicate that participant's self-efficacy (MCS) was a significant predictor for student engagement during gameplay (ENG). In contrast, interest (INT) and competence (COM) negatively predicted the participant's engagement during gameplay (ENG) (Eseryel, et al., 2014, p. 48). Interesting findings considering that interest and self-efficacy seem to be connected when taken at face value.

The conclusion to the idea of type of gamification linked to the type of learner suggest a more complex issue. This is due in part to the challenges associated with critical thinking and problem solving. The fact remains that student motivation and engagement have definite impact on students' educational development and competencies based on gamified learning. If the

instructions are clear and the purpose well defined, students are more likely to be engaged in a lesson that relies on gamification. Furthermore, Eseryel, et al, (2014) stand as a study supporting Kim and Dorling and McCaffery, whose proponents and findings of suggest, "that while games may be complex problems to be solved by students, playing educational games do not necessarily lead to improved problem representations" (p. 50). However, the need for empirically-validated gamified design support motivation and engagement using "game-based learning to design effective situated learning environments that can engage learners and support their development of complex problem-solving competencies" (p. 50). The results of this study and its impact on motivation should clearly support the claims to include gamified representations of lessons within current educational design. Approaches to educate both students and teachers in gamification is paramount in order to sustain high-level engagement during learning (Kim, 2013; Dorling & McCaffery, 2012; Eseryel, et al., 2014).

Gamification: A Systemic Guide

Darina Dicheva, Christo Dichev, Gennady Agre and Galia Angelova (2014) conducted a separate study based on the need for gamification in an educational setting. The question explored: Is gamification a trend or a new paradigm in educational quality? Eseryel, et al.'s study (2014) connected to engagement and motivation supports key findings in the Dicheva, et al.'s study concerning traditional schooling and the addition of gamification. The researchers found that, "Although teachers continuously seek novel instructional approaches, it is largely agreed that today's schools face major problems around student motivation and engagement" (p. 75). The research questions that lead this study included, "What educational contexts has gamification been applied to?" and "What game elements have been used in gamifying educational systems?" (p.76).

The findings surrounding the first question were performed using a concept-centric review focusing on categories related by context, use, and game elements employed in the educational environment. The study provided information "allowing the classification of the current research and work in the field. Table 3 includes the context types and game elements coded throughout the report.

Table 3

Categorization Criteria

- Game elements

- Context: type of application

- Context: education level

- Context: academic subject

- Implementation

- Reported results from evaluation

In their paper, Dicheva, et al., (2015) reviewed the 34 literature review publications on education included many subsequent contextual identifiers of gamification, including gaming, gamified instruction, badging, game dynamic, motivational affordance, and game design elements (2015, p. 3).

What is the major result of their study? The most popular set of gamification design principles in educational context, visual status, social engagement, freedom of choice, freedom to fail, and rapid feedback. The principles of goals and personalization were rare comparatively. So, what educational contexts has gamification been applied to? As already stated, the idea of gamification may differ semantically, but the context to which the myriad of concepts applied remains positively aligned with motivation and engagement. The identification of a common

vocabulary connected with gamification and the holistic nature of implementation lead the

researchers to the conclusion that, "there are many publications on the use of gamification in

education but the majority describe only some game mechanisms and dynamics" (p. 83). The

possible use of gamification in an educational context still lacks, "empirical research on the

effectiveness of incorporating game elements in learning environments (p. 83). However, the

research also found, "Although proper evaluation is mostly missing, the majority of the authors

of the reviewed papers share the opinion that gamification has the potential to improve learning

if it is well designed and used correctly" (p. 83). Gamification, therefore, seems to be the key to

productive non-traditional classroom interactions. There is nothing more frustrating than lack of

motivation or engagement simply because a gamified dynamic is not employed with fidelity in

the classroom. With gamification, the motivation and engagement can be managed and mapped.

This could take seconds, hours, or days depending on the type of curriculum, method of

implementation, and the medium used in context. Dicheva, et al. (2012) suggest that, "While the

concept of gamification may look simple, the analyzed work demonstrates that gamifying

learning effectively is not" (p. 84). There must be made a conscious effort as to the type of

gamification involved in an educational context. The researchers pointed out technology seems

to be a consistent medium that meets all game-like elements necessary to balance the social

aspect of gamification in the classroom, with the rigor and relevance needed for the learning

experience.

Does gamification work?", the literature review by Hamari, Koivisto, and Sarsa (2014)

pushes for further reflection within the scope of gamification and its defined measures on

motivation. This budding union of data provides an educator/researcher with new opportunities

of discovery. The position that, "gamification does work, but some caveats exist," creates new

avenues of educational design. "Gamification as an academic topic of study is relatively young, and there are few well-established theoretical frameworks or unified discourses." (p. 3026). The study is compared with the findings of de Sousa Borges et al., (2014), "many of the studies used qualitative methods. As the research on gamification progresses, care should be taken to ensure that future results are more comparable" (p. 3026).

Conclusions and Recommendations

Questions abound. How can we add elements of gaming with fidelity? Should elements of gaming be added into the traditional educational setting? How does one measure with accuracy the intrinsic motivation that comes from engaged students? And the most important, how is student motivation impacted and measured? In order to answer these questions, an educator must look at the available research, which is relatively recent and formative.

Gamification: Key Findings

Gamification, or the application of game components into non-game areas, shows great promise in appealing to the shifting attitudes of students in our schools. This literature review shows that gamification is one possible avenue to positively motivate student' learning (Banas, & Polly, 2016; Dicheva et al, 2015; Dorling, & McCaffery, 2012; Eseryel et al., 2014; Leaning, 2015), engage students for active learning and eventually impact their learning outcomes. Therefore, the design that must go into adding gamification should be carefully selected and foster the modes of identification present in the initial question. The application of gamification is a systematic endeavor either in one school building or in the whole school district. Consider opportunities that will lead educators to what directly affects motivation. Studies that include implementing gaming as a technology application work best when students with a wide range of skills precipitate varying forms of gamification. Gamification is a precision instrument and must

be applied to specific situations rather than be used as a blanket term to describe one element of

education improvement (Jagoda, p. 2013).

Pairing elements of gaming with education shows both a positive and negative range of

applications (Kopcha, Ding, Neumann, & Choi,. 2016). Technology that supports the type of

gamification processes that can reach desirable student achievement has yet to be pinpointed by

current research, though positive aspects of gamification have been documented in specific

situations. Digital games, simulations, and social game interactions are growing by leaps and

bounds, giving hope that more extensive studies will be conducted. Evidence of improvements in

motivation and engagement decrease in counter-productive motivational goal from using

gamified instruction or educational badges (Abramovich, Schunn, & Higashi 2013; Banas, &

Polly 2016, January; Dicheva, Dichev, Agre, & Angelova, 2015; Hamari, Koivisto, & Sarsa

2014; Kwon, Halavais, & Havener, 2015; de Sousa Borges, Durelli, Reis, & Isotani, 2014,)

Recommendations

Based on the conclusions from this literature review, three major recommendations can

be made. The first recommendation is about teaching practice. Many of today's digital-native

students have high expectations for engagement – the games they play, shows they watch, etc. all

have high production value, and education must keep up in order to stay relevant and engaging.

Engagement that is intrinsic can be achieved through gamification, though extrinsic motivation

such as badging tends to decrease overall motivation and engagement for some learners. Finally,

implementation of gamification that works for individuals should be the overall goal when

implementing serious gaming, or gamification into secondary curriculum. Gamification comes

down to the confidence and experience that can be instilled within a student. As educators, we

must move away from finding contentment with curriculum that works, and become more focused on developing curriculum that works better.

The second recommendation is about future research. More accessible research should be performed and made available to all possible educational shareholders. Motivation can be measured through specific types of qualitative data. The research recommends more empirical research and study on the effector of multiple levels of gamification. As the research here relates the effects of gamification on motivation and engagement, the context of gamification on secondary curriculum seems to come across as positive. According to the type and context of gamified elements, if there is one section that appears light on detail, it would have to be the new and ever shifting trends in technology (Holland, & Holland, 2014). There does not seem to be a concrete definition connected to gamification and the elements of a gamified system. The narrowing of definition is evident in that the research mentions a process of "'game- like' elements, such as rewards, points, and top score leaderboards in non-game activities and environments" (Abrams & Walsh, 2014, p. 49). There are also patterns that are associated with a particular theme which relates to an emergent theory between the process of gamification and motivation and engagement. There are also distinctions among cases that are rated using several data sources, including self-reports of gaming and self-efficacy.

More research needs to be done about the K-12 educational setting in general, secondary education in particular. Fact checking was engaged in all 31 articles in this literature review, but it will only be through reflection, monitoring and discussions that educators and researchers will see real conceptual realization in the field of gamification. The future research should be methodically sound, such as using mixed methods to collect written documentation of all participants, and a survey of participants' self-reports of self-efficacy for learning in the

classroom. There also needs to be multiple types of data used. Data prepared, explored, and coded through the lens of gamification and its impact on motivation and engagement. Researchers and educators can then come up with reliable curriculum based on larger patterns which validate their findings through distinctions among well researched and methodical gamified instruction. The concept of gamification as a reliable feature of motivation and engagement seems complete and realistic to the position of themes discussed and interpretations rendered.

Beyond the parameters of the study however, the research surrounding gamification seems to suggest more of a qualitative theory of future studies that could be more applicable to the widespread research. The value of gamification as it is applied to motivation and engagement speaks to the innovation and creativity that can thrive in the safe learning environment. The idea of gamification should be researched in order to define its role in education, as this role must be intentionally designed to maximize the value of the learning that takes place. The third recommendation is about policy making.

Although the idea of gamification remains a generally new topic for research and educational practice within the classroom, the concept does not seem to be a passing trend. Gamification has been observed aiding the motivational techniques as well as the engagement foundation in the classroom. The studies seem to suggest policy surrounding the idea of gamified curriculum will be needed, whether or not the direction of education has caught up to the technology in the classroom. Motivation and engagement influence overall student success within the classroom, therefore, gamification must be addressed in to incorporate all avenues of rigorous practice in a curriculum.

In summary, this literature review sought the ways and means schools have attempted to influence motivation and engagement through the process of gamification in secondary curriculum. The studies explored expand the definition of gamification, the successful implementation along with the short-comings, and techniques that afford school districts a more deliberate approach to the gamification process in high school curriculum. The reviewer has chronicled studies to advance the dialogue concerning gamification and the research that is connects gamification practitioners and the secondary classroom. The idea of gamification does seem generalizable and applicable to students and individuals within certain settings when properly and pedagogically applied in education.

References

Abramovich, S., Schunn, C., & Higashi, R. M. (2013). Are badges useful in education?: It depends upon the type of badge and expertise of learner. *Educational Technology Research & Development*, *61*(2), 217-232.

Abrams, S. S., & Walsh, S. (2014). Gamified vocabulary. *Journal of Adolescent & Adult Literacy*, *58*(1), 49-58. doi: 10.1002/jaal.315

Banas, J. R., & Polly, D. (2016, January). Instructional design and technology trends in teacher education: An AECT teacher education division special issue of techtrends. *TechTrends: Linking Research & Practice to Improve Learning*. pp. 2-3. doi: 10.1007/s11528-015-0007-2.

Chuang, T. Y., & Chen, W. F. (2009). Effect of computer-based video games on children: An experimental study. *Educational Technology & Society*, 12 (2), 1–10.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining gamification. In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9-15). ACM.

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study. *Journal Of Educational Technology & Society*, 18(3), 75-88.

Dorling, A., & McCaffery, F. (2012). The gamification of SPICE. In *Software Process Improvement and Capability Determination* (pp. 295-301). Springer Berlin Heidelberg.

Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An investigation of the

interrelationships between motivation, engagement, and complex problem solving in

game-based learning. *Educational Technology & Society, 17*(1), 42-53.

Finseth, C. (2015). Theorycrafting the classroom: constructing the introductory technical

communication course as a game. *Journal Of Technical Writing & Communication, 45*(3),

243-260. doi: 10.1177/0047281615578846

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? – A literature review of

empirical studies on gamification. *In proceedings of the 47th Hawaii International

Conference on System Sciences, Hawaii, USA, January* 6-9, 2014.

Herzig, P., Ameling, M., Wolf, B., & Schill, A. (2015). Implementing gamification:

Requirements and gamification platforms. In *Gamification in Education and Business* (pp.

431-450). Springer International Publishing.

Holland, J. & Holland, J. (2014). Implications of shifting technology in education. *Techtrends:

Linking Research & Practice To Improve Learning, 58*(3), 16-25. doi: 10.1007/s11528-

014-0748-3

Jagoda, P. (2013). Gamification and other forms of play. *Boundary 2, 40*(2), 113-144. doi:

10.1215/01903659-2151821

Kim, B. (2015). Designing gamification in the right way. *Library Technology Reports, 51*(2), 29-

35.

Kopcha, T. J., Ding, L., Neumann, K. L., & Choi, I. (2016). Teaching technology integration to

K-12 educators: A 'gamified' approach. *Techtrends: Linking Research & Practice To

Improve Learning, 60*(1), 62-69. doi: 10.1007/s11528-015-0018-z

Kwon, K. H., Halavais, A., & Havener, S. (2015). Tweeting badges: User motivations for

displaying achievement in publicly networked environments.*Cyberpsychology, Behavior*

& Social Networking, 18(2), 93-100. doi :10.1089/cyber.2014.0438

Leaning, M. (2015). A study of the use of games and gamification to enhance student

engagement, experience and achievement on a theory-based course of an undergraduate

media degree. *Journal Of Media Practice, 16*(2), 155-170. doi:

10.1080/14682753.2015.1041807

Nah, F. F. H., Telaprolu, V. R., Rallapalli, S., & Venkata, P. R. (2013). Gamification of

education using computer games. In *Human Interface and the Management of*

Information. Information and Interaction for Learning, Culture, Collaboration and

Business, (pp. 99-107). Springer Berlin Heidelberg.

Park, H. J. & Bae, J. H. (2014). Study and research of gamification design. *International Journal*

of Software Engineering & Its Applications,8(8), 19-27.

Rockwell, G., Graves, R., Graves, H., & Chartier, R. (2011) Gamification, research and writing.

Ryan, R. M. & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic

motivation, social development, and wellbeing. *American Psychologist, 55*(1), 68-78.

Sáez-López, Miller, J-M., Vázquez-Cano,J. & Domínguez-Garrido, E. (2015). Exploring

application, attitudes and integration of video games: MinecraftEdu in middle school.

Journal Of Educational Technology & Society, 18(3), 114-128.

Sailer, M., Hense, J., Mandl, H. & Klevers, M. (2013). Psychological perspectives on motivation

through gamification. *IxD&A, 19*, 28-37.

Sardone, N. B. & Devlin-Scherer, R. (2010) Teacher candidate responses to digital games: 21st-
century skills development. *Journal of Research on Technology in Education, 42*(4), 409-
425.

Singer, L. & Schneider, K. (2012, June). It was a bit of a race: Gamification of version control.
In *games and software engineering (GAS), 2012 2nd International Workshop on* (pp. 5-8).
IEEE.

Sørebø, Ø. & Hæhre, R. (2012). Investigating students' perceived discipline relevance
subsequent to playing educational computer games: A personal interest and self-
determination theory approach. *Scandinavian Journal of Educational Research, 56*(4),
345-362. doi:10.1080/00313831.2011.594609

de Sousa Borges, S., Durelli, V. H., Reis, H. M., & Isotani, S. (2014, March). A systematic
mapping on gamification applied to education. In *Proceedings of the 29th Annual ACM
Symposium on Applied Computing* (pp. 216-222). Association of Computing Machinery.

Stott, A., & Neustaedter, C. (2013). Analysis of gamification in education.*Surrey, BC, Canada.*

Su, and Cheng, C-H., (2015), A mobile gamification learning system for improving the learning
motivation and achievements. *Journal of Computer Assisted Learning,* 31, 268–286. doi:
10.1111/jcal.12088

Urrutia, K. (2014). Gamification and algebra 1: will a gamified classroom increase student
achievement and motivation? (Doctoral dissertation, California State University, Chico).
Walden University (n.d.). Basics of synthesis. Retrieved from
http://academicguides.waldenu.edu/writingcenter/evidence/synthesis