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Improving Differentiated Digital Game-Based Learning

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IMPROVING DIFFERENTIATED DIGITAL GAME-BASED LEARNING

(A GROUNDED THEORY QUALITATIVE STUDY)

by

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DEDICATION

This paper is dedicated to my wife, Dr. Melisa Marsh, for her unflagging support and positivity as I worked on it. Her guidance through the process was critical, as was her willingness to give up our time together so I could research and write this paper. I cannot tell you how much your words of kindness have meant to me, energizing me when I was tired, encouraging me when I was frustrated. I love you with all my heart, and I cannot express enough how much you have helped me.

I would like to thank my mother, Amy Nicolson, for all her help and enthusiasm during the writing process. She asked about my research and was always excited to read the drafts, even when I myself was not.

Similarly, I would like to thank my father, David Rily Marsh. His support and interest in my work kept the drive to complete it alive at times where it might otherwise have died on the vine.

It might sound strange, but I would finally like to dedicate this paper to my dog, London. She has sat dutifully at my feet for a great amount of its authorship, waiting for moments for my hand to fall from the keyboard to her head. In petting her I was, in reality, comforting myself.

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ABSTRACT

Purpose. This paper will explore the implementation of digital game-based learning, while also specifically engaging in performance-based differentiation of digital game-based learning activities to align with student assessment data.

Background. Over the course of the study the aim is to clarify implementation and use of digital game-based learning and come to a better understanding of which games students enjoy and why they enjoy them. The research will explore ways that the educator provides differentiated and personalized instruction to students to offset the increases in class size and increased access to digital tools within the classroom. The overview of the literature review will recognize that digital resources, including those for gaming, are widely available to teachers and have provided effective interventions to address learners' individual needs. Student interaction with technology is ever-increasing, and methods to engage student learning mandate an examination of varied digital teaching techniques. Digital game-based learning, differentiation, and data application all play a role in the method. The nature of digital game-based learning – its level-based scaffolding, the reduced impact of failure on student achievement, the ability for the teacher to design different games for different needs – all lend to its increased use as an instructional modality.

Keywords: differentiation, digital instruction, game-based learning, data application, grounded research

IMPROVING DIFFERENTIATED DIGITAL GAME-BASED LEARNING

CHAPTER 1

INTRODUCTION

Statement of the Grounded Theory Problem

I am a high school language teacher. Every day I have seen that my students have a wide

variety of skills and abilities, and they need instruction that can both help them assess their own

learning needs and then address those needs. I wanted to be a teacher who effectively harnesses

the affordances of digital technology to help students learn. James Gee (2004) observes that

modern learners require "diverse experiences that they can then use to transform and adapt

themselves for fast-changing circumstances throughout their lives." Increasingly, education has

become about learning plasticity - the ability to learn and relearn information as it changes. The

changing nature of technology has forced the professional and educational world to transform

more in the last two decades than in the previous century (Prensky, 2001). I knew, from my own

experiences, that playing games could be fun and educational. Embracing the growing

capabilities of digital gaming is one way educators like myself could create challenging and

rigorous learning environments without the restraints of traditional brick-and-mortar schooling. As Gee (2004) noted, the plasticity of learning is central to success, and I myself have been forced to relearn a great deal just in the last decade as I have attempted to streamline technology to create a dynamic learning environment that met students where they were.

Over the course of years I had increasingly turned to digital game-based learning to address my own observations about what students required, and I began to use a combination of assessments to help students discover their own learning (metacognition). I then provided games with different levels of difficulty based on how comfortable they were with the material (differentiation). I called the process differentiated digital game-based learning (DDGBL), a subset of traditional game-based learning. I have been using differentiated digital game-based learning in my classroom for the last four years. However, I knew the process was far from perfect, and I had little assurance that the system would work. I felt that I needed to do further research into my own practice of DDGBL to learn how to facilitate learning in my classroom.

In this grounded theory study of differentiated digital game-based learning, I arrived at a better understanding of student opinions about DDGBL and to learn how implementation of DDGBL could be improved. I thought that by collecting and analyzing data from the students participating in DDGBL I could reveal the relationships between the students and the gaming experience. Examining these relationships could potentially show me key areas to improve the four critical elements of DDGBL: assessment, feedback, grouping, and gaming. Glaser and Stauss (1967) introduced the idea of theoretical sampling and laid the groundwork for generating, collecting, coding, and analyzing data to help develop deeper understanding of a phenomenon using grounded theory. I decided that conducting a series of interviews with

students who had multiple years of experience with the process could not only provide novel insight, but also critique.

Framework of the Problem.

To understand the philosophical underpinnings of DDGBL, it is critical to excavate the philosophical and theoretical basis of my pedagogy. My interpretive framework is one of constructivism. The ontological reality of my teaching experience is that my students are generally motivated and have buy-in to the value of my instruction because I teach an elective course. The students have chosen the class. Epistemologically, I am interested in finding better ways for my students to improve their command of the English language and increase literacy as a general modality (whether that be reading English, Latin, Greek, or any other language). I want to help students acquire fluency in approaching text transcending single languages and help them develop strategies to approach unfamiliar diction/structure. Each student learns differently, and increasing literacy is a skill which is best achieved using authentic experiences which relate to a student's personal instructional needs. Mine is a constructivist paradigm, based on the amalgamation of the individual realities of my students to find interpretive commonality while never losing sight of what works best for my students at any given time.

In my current classroom I use daily warm-ups, immediate feedback, and self-assessment to break students into game-based learning groups based on exhibited content knowledge. This course structure aligns with a constructivist framework: the focus is discovering best practices and moving beyond the constraints of specific content areas in a variety of curricular areas. Discovering how students learn, and helping teachers find ways of quickly assessing and supplying students' learning needs daily parallels my goals as a teacher and a researcher. I believe that immediacy, the idea of knowing what mistakes you made and how to correct them

within moments of making them, is the cornerstone of helping students learn. This converges with differentiated instruction, allowing students to have content curtailed to their needs, and digital gaming as a learning modality, since it allows immediate individual feedback a teacher can rarely provide.

Theoretical Framework

As a constructivist it is impossible to approach research of any sort, including qualitative research, with the goal of coming to a final and exhaustive conclusion about the subject. Instead, my focus was to translate what I have experienced into a narrative. A. P. Cheater (1987) noted that "we cannot rid ourselves of this subjectivity, nor should we wish to; but we ought, perhaps, to pay it very much more attention" (172). Any impetus to come up with a conclusion sidesteps issues of subjectivity. Because my focus is to construct a narrative and to eschew the positivist idea of developing a conclusive report, the focus of qualitative research is transformed: after all, post modern knowledge is a thing to be questioned, not developed. Rogers, *et al*. (2018) note three main strengths in qualitative research "(a) the degree to which rigor is developed, (b) the theoretical thoroughness underpinning or framing the research, and (c) the interpretative voice as a legitimate social and cultural backing." Postmodernism has moved the goalposts on research: instead of measuring to record a permanent state of being, the research measures to establish methods of measurement and to record the process of measuring in hopes of coming to new realizations about both process and product. My own research is also an attempt to document the ephemeral experiences of my own students and to tell their story, in hopes that narrative can help other teachers (and myself) develop a more robust DDGBL curriculum.

If there can be no definitive conclusion at the end of the research, it might make the process seem futile, but that is not the case. Roger, *et al*. (2018) recognize "subjective data can

and does contribute towards new epistemologies, even as quantitative researchers believe their research is the only way." In fact, a post-modern framework makes the nature of the data in a quantitative study suspect: researchers prune their data to make it work within the confines of their research question. Qualitative data, on the other hand, precisely because it is subjective, extends the conversation about the research questions in hopes of creating a new understanding of the problem, but not necessarily searching for a solution. I was not hoping to find permanent fixes to my own DDGBL instruction, instead the goal was to create a discourse where students who had intimate knowledge of the process could give honest feedback in a consequence-free environment, and to use their observations to hone my own practice. In the process my hope was to come to insight about game-based learning broadly, and specifically about implementations of differentiated game-based learning.

DDGBL CRITICAL ELEMENT	EXPLANATION
Assessment	A short (20 question) multiple choice warm-up activity reviewing content from the previous day's lesson. Originally this was done via pencil/paper but from 2020 onwards used the Illuminate platform to host the questions and give feedback.
Review	An explanation of the answers from the warm-up with opportunities for students to ask questions and defend their answers if they feel the answers were incorrect.
Grouping	Assignment of students to different learning groups based on their performance from the assessment. Students were broken down into three groups: needs improvement (group 1), satisfactory (group 2), and excels (group 3). Originally students were assigned based on score, but later iterations students self-selected where they felt they belonged.
Gaming	Playing one from three different games that addressed their personal learning needs. Group 1 game dealt with fundamental concepts. Group 2 games combined new concepts with previous course content. Group 3 addressed concepts which were beyond

	the scope of the lesson.

Table 1.1 *Differentiated Digital Game-Based Learning Structure*

Context of the Grounded Theory Problem

To explore the DDGBL experience with my students, I decided to implement a

qualitative, grounded theory study of DDGBL seeking to improve the use of this practice in my

own classroom. The research included students with a minimum of two years of instruction

where I used DDGBL weekly, paired with persistent journaling of observations, followed by

individual interviews. The goal was to engage stakeholders in a discussion about DDGBL as a

method and routes to improve its implementation in a high school language classroom.

The school where I conducted the study was largely white, suburban, and wealthy. As of

2021 the student body makeup was 48 percent male and 52 percent female, and the total minority

enrollment is 38 percent. The breakdown of students by race/ethnicity was 61.7% White; 11.7%

Asian/Pacific Islander; 10.2% Black; 12.8% Hispanic; 3.5% Multi-racial. 11% of the students

were economically disadvantaged, with 2% participating in the free/reduced lunch program. The

graduation rate was 95% and the AP® participation rate was 73 percent. The school district was

the 3rd largest in Georgia with 20 high schools. The district supplies students with devices (1-to-

1), so every student at the school has access to their own laptop.

DIMENSION	STUDENT BODY REPRESENTATION
Student Population	2,367 Students
Gender	52% Female; 48% Male

Race/Ethnicity	61.7% White; 12.8% Hispanic; 11.7% Asian/PI; 10.2% Black; 3.5 Other
Economic Status	11% Disadvantaged
Graduation Rate	95% Student Graduation
AP Participation	73% of Students Take 1+ Advanced Placement Exams

Table 1.2 *Host School Demographics*

My intention was for the study to benefit both the students currently taking the course as well as future students engaging in DDGBL activities. My own observations about DDGBL made me believe that students generally enjoyed the opportunity to play games in class, and students generally picked the appropriate difficulty for the games based on my own observation. However, I had no support for this belief outside of my own opinion, and students expressed frustrations with elements of the game such as lagging gameplay and difficulty with school-supplied wireless access and school-supplied devices. While these elements were outside my immediate control, issues such as those were important considerations in developing a successful DDGBL curriculum. Listening to these complaints helped me realize there might be other issues with the practice outside of the ones the students were publicly lamenting and provided me the opportunity to hone the practice through targeted interviews.

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Context of your Grounded Theory Study

Classroom Use, Student Affective Response, Differentiation

Informants
student-participants

Other documents
student game scores, warm-up assessment data

Data Gathering Methods
observation, persistent note-taking, participant interviews

Phenomenon that has not been covered in the literature
Differentiated Digital Game-Based Learning (DDGBL)

Strategies
Constant comparative analysis, Negative case analysis, Memo-writing

Process Support
Atlas.ti qualitative interview analysis tool

Questions
How can I improve my use of DDGBL?

Topics
DDGBL in the language learning classroom.

Hopscotch
Create your Research Design

Figure 1.1 Visual Representation of the Key elements of the study. Generated using Hopscotch (Jorrín-Abellán, 2016, 2019)

Digital Game-Based Learning

There were important questions I needed to ask myself: how can educators get students engaged in learning? How can a teacher create interactive learning which meets individual student needs? These are questions which educators have been asking since formal education started. Similarly various solutions have been there for a long time. Game play has consistently been used through the millennia to help students learn and enjoy learning (Prensky, 2001). However, the idea that games would be a nostrum for individualized instruction and engagement seemed too simplistic to me. I began to even ask the question: what is a game? There are a lot of

ways to define games, and games have been part of learning as long as learning has happened. Primitive children pretended to hunt each other, or pretended to cook food, in preparation for the tasks of adulthood (Hays, 2005). Games are fun, and good games are not only fun but often reflect skills needed for the player to thrive later in life (Dicheva et al, 2019). Gameplay has changed significantly in the last forty years, as the advent of computers and the proliferation of digital technologies made digital gaming less expensive and widely available (Squire, 2011). Therefore, it is no surprise that I gravitated towards gaming in my own classroom: the games have always been part of learning.

Increasingly digital platforms have been developed to emulate analog learning games, like flashcard games (Gee, 2004). However, the greatest growth has been the increased availability of multiplayer gaming, allowing individuals from all over the world to play the same game simultaneously (Dicheva et al, 2019). The learning curve in these games is often steep, and yet students who are reluctant learners play these games by choice, and keep playing (Effeney et al, 2013; Gestsdóttir, 2008). There are inherent elements of digital gameplay which prepare the player for learning, and which do so in a way which increases engagement as the play goes on (Gee, 2004; Prensky, 2001, Squire, 2011).

My goal was to provide examples of differentiated DGBL as used in my classroom as well as to suggest improvements in the use of DGBL in the future, using observations and interviews. I wanted to examine the history of previous research into DGBL, then explain the method and structure of experimentation within the classroom before examining worldview, context, participants, and the ways in which I collected the data. I wanted to understand data analysis strategies, strategies to ensure trustworthiness, and the ethical implications of the study.

As I have said, I identify as a constructivist, and thus I believe that different perceptions from different people can mediate a shared experience, creating a different one for each individual. As a result, I do not believe that the same lesson is experienced in the same way by all students. Understanding a variety of perspectives is critical to reaching a more objective and unifying approach to implementing any sort of learning activity, including DDGBL.

Grounded Theory Research Questions

RQ1: How can I improve the use of differentiated digital game-based learning for students learning the Latin language at a metropolitan Atlanta suburban high school?

RQ2: How can I align curriculum learning goals and student self-regulated learning in a better way using differentiated digital game-based learning?

Definitions of Terms

Game-Based Learning - the application of game or game-like content as part of course curriculum

Digital Game-Based Learning - The use of video games as an adjunct to other other curriculum tools in order to achieve learning goals.

Differentiation - the process of assigning students different class materials based on individual needs and learning goals.

Differentiated Digital Game-Based Learning (DDGBL) - The application of different games (varying by content, format, difficulty, etc.) to learners within the classroom based on individual, data-driven learning needs.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The Evolution of Educational Gaming

Game play has consistently been used through the millennia to help students learn and enjoy learning. Games are fun, and good games often reflect skills needed for the player to thrive later in life (Prensky, 2001). Delattre & Fournier (2019) note that games such as backgammon and Connect Four use strategic thinking to determine the winner, despite there being at least some element of chance built into the game such as who gets to go first.

Early Gaming

Gameplay has changed significantly in the last forty years as the advent of computers and the proliferation of digital technologies made digital gaming inexpensive and widely available (Prensky, 2001). Games have been used as a teaching tool as long as skills and practices have been valued: Roman *rhetors* would provide rules for mock debates to help the sons of patricians prepared for politics and law; Victorian spelling bees made learning how to write vocabulary more engaging; in the 1940s Scrabble took the same basic concept as the crossword puzzle and applied it to a board game. The development of the computer in the latter half of the 20th century created a new domain to create games. The earliest home video game offering was Pong (Atari, 1972). Moore (1982) notes that for digital gaming Pong operated as an opportunity to make technology available to the consumer. Suddenly rudimentary, wood-paneled computers were available for the home enthusiast. With the growing popularity of digital gaming and the new access afforded by personal computers, educational institutions began to experiment with digital

learning at schools. Papert (1993) observes that, because of the paucity of computers available in the early 1980's the computer as a classroom tool was the domain largely of teachers who had an enthusiasm for this unfamiliar technology. Because there were no specific computer curricula, computers were there largely to allow students to experiment with computer programming, to use rudimentary learning materials, and to play games. This was the nascence of digital game-based learning: a few teacher-enthusiasts allowing their students access to new technology with little agenda beyond exploring what that technology could do. The impetus for computer use varied by classroom, instructor, and even student, falling roughly into two camps: hedonic (games played just for fun) and utilitarian (games played for a specific purpose). Dicheva (2019) explains these two designations, noting utilitarian games were ones that might improve participation and learning, while hedonic games were designed to primarily supply pleasure.

The Gaming Industry

By the end of the 1980s educational gaming had gone from a curious hobby of a few teachers and students to a legitimate industry. Richards et al. (2013) recognizes that "games such as *Where in the World is Carmen Sandiego?, Math Blaster, Oregon Trail,* and *SimCity* have seen some success in the K-12 institutional market" (6). Students were playing digital games at school as part of the curriculum, enjoying themselves, and learning in the process. These games were also showing programmers that there was a market for digital game-based learning. Richards et al. (2013) explain how the commercial profitability and engaging nature of these games, combined with the advent of computer technology in the classroom, allowed for the creation of the "edutainment" industry. The edutainment industry attempted to use technology tools to develop more engaging learning materials which could be sold to institutional learning programs.

For a generation of students and teachers these games were an introduction to the capabilities of computer-based instruction in general, and the potential of digital game-based learning.

As computer access at schools became ubiquitous the availability of gaming titles increased, but the increase in quantity did not necessarily dictate an increase in quality. For every *SimCity* there are hundreds, perhaps thousands of games which do not live up to that potential (Prensky, 2001). Virvou & Manos (2005) make the important observation that "there are criticisms about the quality of the existing educational games, [specifically that] the marriage of education and game-like entertainment has produced some not-very-educational games and some not very-entertaining learning activities" (61). Educators became increasingly overwhelmed by the sheer number of titles available, with little guidance besides one or two published reviews about the quality of individual games. However, the line between games played for pleasure and games played to learn were becoming increasingly blurred. Many educators, raised on games, were becoming more open to using games as a teaching tool. Sometimes popular games were repurposed as educational resources. Thai et al. (2009) examine how New York schools implemented the use of *Dance Dance Revolution* to improve student motivation towards exercise, eventually expanding to become part of fitness programs in other states. What was originally designed as a hedonic game, played only for fun, had been transformed into a part of the fitness curriculum. This sort of creative appropriation defines some of the most successful attempts to integrate digital game-based learning. Development of educational technology tends to lag behind hedonic games (Hays, 2005). The ephemeral popularity of hedonic, for-profit game release demands these games be constantly changing in a way which is not reflective of the institutional learning environment. For example, *Fortnite* has new versions of its game available every season (approximately three months) to maintain the interest of its player base and

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profitability. However, I have found that there are compelling and interesting games available to educators, and the nature of ad-based internet gaming means that many of the games are free, as long as students and educators feel comfortable tolerating the advertisements along the edges of the screen. Students can learn vocabulary from classic arcade-style games such as those found on *Classtools.net* or more developed puzzle-style games on *Cram.com* and *Sporcle*. Perhaps the most promising digital game-based learning experiences lie in the expansive worlds of MMORPG and immersive virtual reality, but the expense of developing those games, compounded by the time and bandwidth requirements, still make those options unpopular among educators (Hays, 2005).

Transforming the Student Experience with Digital Game-Based Learning

There are many attractive features to digital game-based learning, but perhaps one of the most documented is the relationship between game-based learning and self-regulated learning or SRL (Gestsdóttir 2008; Zimmerman, 2008; Effeney et al. 2013; Zulkiply & Aziz 2019). When students are playing games, despite the game being selected by the instructor, they often feel that they are in control of the experience. Students get to make decisions, make mistakes, and learn from the mistakes privately, without needing direct instruction. There is an intrinsic desire to succeed. As a result, they can regulate their own learning within the gaming environment.

Several studies in the last decade have shown an increase in SRL when students are engaged in digital gaming. Zimmerman (2008) recognizes that digital resources are providing valuable new information regarding the impact of student learning as well as raising new questions for future study. Zulkiply & Aziz (2019) suggest that digital game-based learning creates a relationship between using metacognition and digital technology so that students understand and become more aware of their own learning processes. Gestsdóttir (2008) notes

that self-regulated learning is important to student development and improves the individual learner's relationship within the context of the classroom. Effeney et al. (2013) notes in their experiment with digital game-based learning the struggling students tended towards SRL strategies such as help-seeking from teachers or peers, while more successful students often attempted to overcome obstacles without engaging another party. Both grouped displayed elements of SRL. The experiments are taking place globally (Smagorinsky, 2006; Rinkl, 2017; Chen et al., 2018; Abrams, 2013), with a wide variety of participants ranging from pre-school to college students, but the results all point to increases in SRL when students participate in digital game-based learning activities.

Student Engagement

One of the central focuses of digital game-based learning research is increased student engagement (Chen et al., 2018). Prensky (2001) notes that playing games is more fun than listening to a lecture, and gaming holds more draw for many students than filling out a worksheet because it affords immediate feedback and the opportunity for scaffolding difficulty. Because well-designed games are fun to play, students often learn as they advance through game iterations not because they are compelled by their teacher to do so, but because they want to. Dicheva (2019) notes that the pleasure (or hedonic value) of the activity makes them want to play more. Kaltman (2019) claims that digital game-based learning is designed specifically to transform instruction to engage participants using video games. Digital game-based learning affords the teacher the opportunity to transform curriculum: if students are having fun learning, it makes the idea of learning more attractive, and makes it something learners want to do, instead of being something they are forced to do.

There are many elements of digital game-based learning which increase engagement in ways which are transformative of traditional, lecture-based instruction because of its narrative structure (Harrold, 2015). Almost every student in the classroom is familiar with the phenomenon of digital gaming. The current generation of students have had access to gaming since before they were in preschool, and many of them spend more time at home gaming than engaging with their families. This makes gaming a shared medium for many students, even if it seems somewhat foreign to their teachers, who often did not have the same immersive gaming experiences. Kaltman (2019) comments that "engagement is necessary for deep learning to occur, but standard instructional materials—textbooks, worksheets, and even novels—often fail to engage students, especially those who are disadvantaged and/or have learning disabilities" (43).

Digital learning games often have an element of competition within them, whether that contest lies between players or the opponent is the game itself. Casan (2018) claims "the emotions and feelings of engagement, competition, satisfaction after fulfilling their achievement, or discovery in the process of learning" are among the factors that contribute to increases in student task completion (1154). Abrams (2013) explains how errors in game play against digital opponents lead to greater development of the student as a self-assessor. While competing both against the game and other learners Chen & Chang (2020) note task improvement as well as post-test/delayed test improvement.

Student Gaming Access and the Flow State

The increase in multi-platform gaming-- which can occur via phone, console, or computer--has given more students more access to a wider variety of games than was available a decade ago. While not every student has a desktop or laptop computer at home, 94% of students

aged 3 to 18 have home internet access and some device they can use to access the internet (NCES 2020). As a result, internet-based tools in general, and specifically games, operate as shared texts for students, ones with which educators are often unfamiliar.

Perhaps the ultimate realization of digital game-based learning's potential to engage students is the concept of flow. Csikszetmihalyi (1990) observes how players experience reduced separation of self and action during game play, as the intensity of their interaction makes it seem spontaneous and automatic. This combination of a participant's activity and action is why Csikszetmihalyi calls this state of optimal activity "flow." Flow is a state of engagement which is so intense that the participant loses track of time and stops being cognizant of events around them. This is where deep learning can often occur. Chang et al. (2018) note participants attain a deeply immersed flow state generated from digital game-based learning experiences. Indigital game-based learning activities students may look up at the end of the class period, shocked that the class is already over. Tejedor-Garcia et al. (2020) add that pairing digital game-based learning challenges with student ability in a well-designed game helps students attain higher states of concentration and involvement. This is not to say that students are in a flow state because they are successful. In fact, some research (Tejedor-Garcia et al., 2020; Chang et al., 2018; Yang et al., 2018) suggests that the opposite is true: students move into that immersive learning state because they are failing and trying to find ways to improve.

Freedom to Fail

Digital game-based learning gives the student the opportunity, even the freedom, to fail in a low-consequence environment. As Moore (1983) notes, with many video games "you can get better at losing, but you can never win" (36). To put it in more modern parlance, deep immersive learning, as evidenced in the flow state which can be achieved by the best digital learning games,

allows students to move from familiarity with the problems and issues within the game towards expertise. Duckworth (2016) states that attaining expertise is connected to embracing feedback of any sort, but especially negative feedback, in order to improve future performance.

Game-based Learning and Teaching Pedagogy

In traditional classroom instruction students typically receive feedback on a weekly or perhaps even monthly basis (Prensky, 2001). Feedback is an essential tool for educators to help students come to a fuller understanding of their curriculum. Hattie & Gan (2017) note that feedback can improve student ability to identify mistakes and self-assessment by making learning visible. However, a single instructor cannot reasonably give thirty students individual instruction multiple times per class. Digital game-based learning, on the other hand, can give students dozens, perhaps hundreds, of feedback examples in twenty minutes of play time. In a game every mistake made by the player results in a correction, an alteration, and players are constantly self-assessing and using feedback from the game to improve their gameplay. Richards et al. (2013) explain that games challenge performance, develop collaborative behaviors, reward practice, and force learners to adapt in a variety of situations, aligning game play with theories of learning put forth by experts like Vygotsky (1967), who noted that children, when playing, always attempt to perform beyond their behavioral and developmental norms. When students play games, even hedonic games played purely for pleasure, their learning mirrors some of the best practices put forth by these experts (Dicheva, 2019).

Game-Based Learning and Immediate Feedback

What digital game-based learning offers, as an addendum to traditional instructional methods, is not just feedback, or even frequency of feedback. It seems as though one attractive attribute of digital game-based learning is the immediacy of its feedback (Prensky, 2001). If

students make a mistake on a quiz they may not realize that mistake, or get feedback about that mistake, until days later. At that point the learner is often more concerned with their grade on the assignment than on the mistake they made a few days ago. Too much time has passed: the moment where the greatest learning could happen has been lost. Privec (2006) observes that with digital game-based learning, however, the feedback is instantaneous, the students know within seconds what mistakes were made, and they get the opportunity to play again and make improvements on their gameplay. Duckworth (2016) observes that when instructors give immediate feedback on mistakes, combined with the low stakes freedom to fail afforded by the ability to try again, the participant can focus on learning from those mistakes rather than on the impact any mistakes make on an assessment of performance. Barr (2013) notes that with digital game-based learning students are afforded zero cost experimentation, with the instructor there to help with concept or technology issues when the student asks for it.

Applications of Game-Based Learning

A similar reappraisal of instructional format is helping in the professional world. Gee (2003) recognizes that richer learning experiences can be constructed through simulations than through lectures: digital game-based learning provides the opportunity to run simulations and prepare for eventualities at a pace which is difficult for non-digital instruction to match. Hays (2005) notes that game-based simulations can improve performance in a variety of tasks, when paired with a structured learning environment and debriefing of game performance by the instructor. The development of digital game-based learning simulations, while costly, has research-based support as a method of improving performance with the freedom to make mistakes without consequence.

Evolution and Variance on Digital Game-Based Learning

As digital instruction evolves there are a variety of considerations that must be explored, including the implementation of digital game-based learning platforms as part of the digital learning experience. Cognizance of the growing popularity of game-based learning, how digital design impacts learning goals, the availability of resources, and the affective impact of digital instruction are all critical to developing effective digital learning which maximizes student learning without putting the roles of designer, developer, implementer, and referee all in the lap of teachers who have not been adequately trained to encompass all those roles (Prenskey, 2001). Currently digital game-based learning requires teachers who implement the strategy to oversee production, advisement and coaching for these activities in an environment where teachers are often still expected to be knowledge dispensers and enforcers of rules (Squire, 2011).

Digital resources are becoming more plentiful, and student familiarity with digital resources is becoming an underlying assumption of the modern classroom (Lengyel, 2020). Students often have access to a variety of screen-based devices at home which are under their own, personal control, and struggle when those same options are restricted in a school setting (Thai et al., 2009). The implementation of digital game-based learning affords greater engagement for students and leverages the research-based discoveries about learning from the last several decades (Squire, 2011). Wolfe & Flewitt (2010) emphasize that "understanding the role of digital technologies in the processes of . . .literacy development is crucial to ensure that all children have equal access to opportunities to learn in schools today" (389). To complicate matters, teachers who eschew the presence of cell phones or similar digital tools in the classroom must enforce more stringent classroom management because of those restrictions. The cell phone provides the opportunity for distraction, but it also provides a tool for multiplatform game-based practice. Gamification involves taking elements of games (generally digital games) such as

tokens, points, and badges, and applying those elements to classroom lessons and activities to increase engagement (Squire, 2011). Digital game-based learning can be part of the gamified classroom, but it is not mandated.

Digital Gaming and Plasiticity

The implementation of multiplatform game-based learning as part of the curriculum aligns itself with the sort of learning that students are doing outside the classroom. Chu & Fowler (2020) state that "the use of computer games in education has been increasing in popularity during the past decade. Game-based learning environments are designed to teach specific knowledge content and skill-based learning outcomes using game elements" (3). The plasticity of digital gaming also means that the content within the game can be customized to the specific needs of the classroom. Increasingly free-to-make and free-to-play games allow teacher customization to align the material within the game with the specific learning goals of any individual unit: digital gaming as a concept can be applied to many systems and types: action, sports, adventure, strategy, puzzle, and simulation games can be categorized based on their genre and style (Lengyel, 2020). Many games, however, are a combination of several of these structures, and variations in goals, style, interactivity, and content can also be used to establish digital game-based learning paradigms (Thai et al, 2009). The malleability of digital gaming platforms means that it can meet the needs of the instructor while still creating engaging content for the learners.

Because digital learning is not teacher-centered it can also widen student access to learning materials outside the classroom. Cognitive science provides for the use of digital, computer-based practice at home for students as a means of expanding the learning experience beyond the walls of the school, such as Ted Talks in addition to the curriculum materials they

practice within the classroom (Steinberg, 2014). The expansion of learning opportunities beyond

the scope of the brick-and-mortar school means that students have chances to address their

learning goals even when the teacher is not present. The potential hedonic value of digital game-

based learning also means that some students will choose to play the games just because they are

fun, with any content knowledge gained as a happy accident (Dicheva, 2019). This is the

ultimate promise of digital game-based learning: students are having so much fun playing the

games that they forget they are learning content in the process.

Game Design

Central to designing games where students play for fun and learn by accident is

understanding fundamental game mechanics as well as the shared gaming preferences for

students. Bovermann & Bastiaens (2020) have qualified that students who learn online are better

engaged when instructional design includes their interests and preferences, requiring

customization of learning goals. One of the biggest issues in customizable gaming is that the

games which are easiest for a teacher to make, on platforms which are stable and popular, are

frequently not terribly fun to play (Virvou et al., 2005). While hangman, crossword puzzles, and

word-finds are all perfectly fine games, digital versions of them offer little more than the

worksheets which students already use in the classroom, and do not expand engagement or add

variety.

The burden then becomes to find those platforms which create dynamic gaming which

includes a higher level of engagement. There are many key elements to game design, but for

digital games perhaps one of the more important is the idea of scaffolding difficulty combined

with dynamic use of color and motion (Tejedor-Garcia et al., 2020). By isolating key concepts

and critical understandings within the course, teachers can implement gaming systems which

start with fundamental control of learning objectives, then increase the difficulty of the game using time constraints, speed of object movement, or inclusion of more complicated concepts within that singular objective. Well-designed DDGBL experiences focus on singular learning experiences with clearly stated goals and experiences: the sequencing of these individual learning units provides instructors the flexibility to assign games based on individual learning needs (Bradley & Boyle, 2004). While there are expansive games which encompass multiple learning standards, these games are typically expensive, require greater computing resources, and demand larger internet bandwidth, limiting the availability of the content and making it difficult for educators to curate the content to the specific needs of the learners (Squire, 2011).

Learning Resources

Consideration of learning resources, as well as their costs and the limits of implementation are substantial elements in selecting effective tools for digital instruction in general, perhaps even more so specifically for digital game-based learning. Barr (2013) suggests looking more closely at key concepts of DBGL such as external consultation, peer discussion, cross-platform learning (taking lessons from one game and applying it to a different one) and the freedom to fail. The variety of resources available will allow students to choose the source for individual, just-in-time interventions. The wider the variety in interventions available, the more likely a student will be able to use help-seeking to address any learning limitations. While having lots of ways to assist students is always important with digital learning and allows for deeper personalization of learning based on student's individual preferences, it can be a major determinant in gaming. Students are familiar with using YouTube tutorials or asking for help on Reddit to advance through games where they are struggling or get pointers for improving

performance when playing games at leisure. Those same tools, or some sort of equivalent, should be available for students who are using digital resources as a part of their education.

While many digital learning tools have numeric feedback criteria as part of their implementation, those same criteria are transformed with digital game-based learning. Players earn a score instead of earning a grade, and one of the drawbacks to game-based learning is that the score does not always translate easily into a grade, particularly since using games to grade student learning has a variety of problematic issues. Hedonicdigital game-based learning has its score divorced from traditional measurements of success. While there are ways to transform scores into grades, the reporting of those scores can be problematic as well. Many game-based learning platforms do not tie into Learning Management Systems and are not designed to do so. As a result, the onus of score reporting is frequently left to the player. Some of the best digital game-based learning platforms include a variety of data that teachers can use to adjust gaming. Cheville (2004) when referencing digital game-based learning says ideally teachers should be able to examine not only individual student mistakes, but also examine the data from a class-wide perspective. Unfortunately, just as many have little to no data outside of a numeric score, and no centralized method of proving that score outside of students taking screenshots on their device. Well-designed digital game-based learning resources should have score reporting capabilities which are sharable and confirmable (Prensky, 2001).

Student Affective Response to Gaming in the Classroom

As important as scoring reporting, from the teacher's perspective, is the affective impact of gaming from the student's perspective. Sykes (2006) observes how there are unique paralinguistic communications between the game and the participant, providing the potential for game performance to reflect the emotional state of the participant as well as heralding an

opportunity to alter the affective delivery of educational goals. Students frequently bristle at direct teacher interventions, particularly when critique is provided in front of their peers. However, interventions in game-based learning are private and individual, with peers unaware of the mistakes a student has made in the game unless they choose to share it as part of help-seeking. Kaltman (2019) observes how the elements which make struggling readers anxious such as being randomly called upon, lexical difficulty, or losing their place in the test can be ameliorated by text presentation and interaction in well-designed games.digital game-based learning makes negative feedback personal and private, and that privacy allows the student the freedom to fail without embarrassment, reducing the negative affective impact of that feedback.

Competition

Digital gaming does bring one element which is not present in other forms of digital learning, specifically competition. The research on the impact of competition within digital game-based learning is complicated, with different researchers finding opposing results. All games have an element of competition within them--that struggle is part of what makes the learning engaging--but the focus of that competition can vary (Yong, 2015). Some games pit learners against each other, while others allow learners to compete against the machine. Competition does allow for collaborative learning, as students may be grouped into teams against the machine or against each other. Chen & Chang (2020) observe that supplying a virtual opponent, as opposed to another student, improved performance of learning goals and improved practical curriculum task time.

This is not to say that player vs. player competition is not also effective, however. Byun & Joung (2018) discovered that participants playing in a competition mode led to an increase of

in-game performance when compared to collaborative play. Csikszentmihalyi (1990) qualifies this phenomenon by noting that students enjoy competition as a means to perfect skills, but that interest wanes when competition for its own sake becomes the main focus. Tejedor-Garcia et al. (2020) find that players perform better in more competitive gaming environments because winning has a positive effect on players' self-image and boosts confidence in their competence: defeating other participants in the game increases proficiency for highly motivated users on account of improved focus and greater effort applied towards the activity. The problem with student versus student competition is that it is beneficial largely for students who are already highly motivated, leaving students who are less motivated on the outskirts of learning. In the context of digital learning the broadest positive successes come from competition against the machine, but side contests of the highest performing students might be beneficial to further engage the most motivated students to supersede expectations.

Theories of Individual Instruction and Self-Regulated Learning

While there is significant research into how digital game-based learning impacts self-regulated learning (SRL), one of the greatest draws to gaming is that it allows students to move at their own pace and personalize instruction based on their individual needs. Koidl et al. (2010) claim that "personalization techniques offer the possibility to tailor each learner's experience of a Digital Educational Game (DEG) to their specific needs" (178). The instructor can adapt to each student's cognitive ability, gaming ability, and personal motivation by personalizing the difficulty to match the abilities of the learning. Most games can scaffold knowledge built into them: when a player is good at Pong the game speeds up to make it more challenging. This is the fundamental concept of digital game-based learning: as students display mastery the game is designed to become more challenging.

"Just-in-Time" Learning

One of the ways that gaming can personalize instruction is the implementation of just-in-time instruction, where students make mistakes and feedback/corrections are made available when the mistake is made (Privec, 2006). This is something that is not possible with many traditional instructional learning modalities: it requires a transformed curriculum which challenges traditional ideas about failure. The opportunity to practice in that environment is limited, and feedback often comes days or even weeks after mistakes are made. With video games, on the other hand, participants' mistakes lead to later success because the immediate feedback allows them to self-assess their learning and transform their practice to improve progress (Abrams 2013).

An adjusted reckoning of how classroom instruction is delivered is key to implementing a successful digital game-based learning program. The "sit and get" modality which was popular for a large part of the 20th century, where the sage-teacher stands at the front of the room expounding upon expert knowledge while students sit as empty vessels to be filled with said knowledge, does not align well with research-based instructional practice. Modern scholarship has moved toward collaborative learning (King, 1993). hooks (1989) recommends that "teachers use power in a way that is not coercive, dominating" and allowing students to move at their own pace with content curated to their needs moves the hegemony from the teacher to the student. The transition from fountain of knowledge to facilitator of learning can be challenging, but it aligns with the best-practices of modern educational research. Digital game-based learning is an appropriate pedagogical method which assists students to become active participants in the learning process (Sykes, 2006). The game is, on at least some level, undertaking roles which

have previously been the domain of the instructor, and therefore requires deeper consideration for evolving teacher practice.

Each student has the freedom to make mistakes, learn from those mistakes, and adjust gameplay, all within just a few seconds. This is a significant change in the timeline for feedback, and the immediacy of feedback afforded bydigital game-based learning allows students to discover their own areas of weakness more quickly. Bradley & Boyle (2004) observe that digital game-based learning permits students to discover if they are correct through immediate feedback. As a result, students who are faced with failure can be prompted to replay the resource and be allowed to repeat an unsuccessful assessment after playing the resource. This is not to say that all students respond positively to failure: in the arcade and at home in front of the console a player expresses frustration at unanticipated outcomes from the games. Different students react to setbacks in different ways. Effeney et al. (2013) recognize in their study that stronger students preferred to initiate correction on their own, while struggling students often used help-seeking from peers or instructors: both are elements of SRL, but the option to choose the method of SRL allows for greater personalization based on student preference.

Differentiated Digital Game-Based Learning: Challenges and Benefits

Digital game-based learning is not a panacea, and it cannot replace quality instruction, diligent class management, and the development of relationships between teachers and learners. There are several key considerations which operate as obstacles to implementing digital game-based learning in the classroom. The paucity of resources available to the instructor, resistance to new learning modalities by faculty and administrators, variations in student responses to gaming, and parent assumptions about video games all contribute to reduced use of gaming in institutionalized learning (Squire, 2011). However, the increase in free resources, greater

acceptance of digital gaming, and more student familiarity with game mechanics are all beginning to chip away at these obstacles.

Challenges: Resources

Teachers in institutional learning have little control over the purse strings which fund educational endeavors. While teachers can apply for grants from parent-teacher support groups, or request funds from the administration, cuts in education spending despite increased economic prosperity means that there are few remunerative opportunities for teachers. This issue manifests itself especially when attempting to initiate new digital game-based learning activities. Chu & Fowler (2020) report that digital game-based learning is beneficial, but the costs to develop complex assessments for a finite number of curricular goals are prohibitive. This is not to say that there are not free digital game-based learning resources available to teachers, but access to these is limited to the research done by the teacher themselves, with schools providing few tools to help develop games. Dicheva (2019) notes that the dearth of tools allowing teachers to design and implement digital game-based learning activities in the classroom slows down the progress towards a gamified classroom.

There are other resources, besides financial ones, that are in limited supply for teachers as well, making digital game-based learning prohibitive. Harold (2015) recognizes that playing games in a large class is prohibited by restrictions such as internet bandwidth, technical limitations and school policies. This frequently removes access to large-scale simulation activities or multiplayer social interaction gaming because of the amount of technology resources required to participate in such games. The limits to financial and technology resources is compounded by the difficulty of determining the quality of a resource in terms of student learning. Hays (2005) warns that if the use of games as an augment to instruction is not directly

tied to instructional goals then game-based learning will increase how much instruction costs without increasing the benefits of instructional time as well as reinforcing parent and staff opinions about the appropriateness of educational gameplay. Yet instructors have few tools available to determine the pedagogical value of a given game. The growth in access to gaming has actually exacerbated the issue. Virvou et al. (2005) criticize the quality of digital game-based learning activities because there are both games that fail to entertain and games that fail to teach within the current limited library of available game-based resources. Without training on gaming instructional theory, and with limited financial and technology resources, the implementation of digital game-based learning falls firmly upon the creativity, knowledge, and passion of individual instructors.

Challenges: Resistance

The financial and technology issues are compounded by faculty and student resistance to gaming as a teaching tool. Some of this is because gaming is a teaching tool which has a built-in assessment of learning but is not designed to operate in place of a graded assessment. Elbow (1993) suggests that some teachers are aware of the shortcomings of digitally produced grades based on digital game-based learning activities, but the temptations of the diagnostic feedback which these games supply make these shortcomings palatable. However, this is not always the case, and teachers are suspicious of using games because it moves the *locus* of control away from the instructor. Students can be disillusioned with digital game-based learning as well. Barr (2018) observes that students' opinions about the seriousness of course content can lead to significant resistance to the idea of being taught via digital game-based learning, because it is contrary to what they expect based on previous learning experience. Only successful

implementation of digital gaming within the school can change faculty and student affective responses to the idea of gaming.

Different students respond to digital game-based learning in different ways, making it challenging to institute new gaming modalities as part of general classroom instruction. Gentile et al. (2019) recognize that students with higher dispositions towards critical thinking search for and analyze game information more than less disposed students: the increased focus on game data improves performance. Students with lower dispositions towards critical thinking tend to respond to in-game challenges with help-seeking. While help-seeking is an important element within self-regulated learning (SRL) it moves the *locus* of control back to the instructor.

Additionally, when there is successful implementation of digital game-based learning the instructor may begin to rely on the game to provide feedback instead of giving just-in-time interventions in person. Virvou & Manos (2005) qualify that digital game-based learning should be an ancillary resource to direct instruction: "human teachers still have more abilities in explaining domain issues and diagnosing students' problems than any kind of software irrespective of its sophistication." Thus, even successful gaming needs to be a constant balancing act of teacher-student and student-platform interaction. Then there are issues with competition as a game mechanic. For some students the competition makes the game more engaging, more fun. Tejedor-Garcia et al. (2020) note that highly motivated users are more focused and apply more effort when there is a clear goal such as defeating an opponent. However, other students find in-game competition with other students distasteful. Personalization and differentiation are hallmarks of successful digital game-based learning but being aware of individual student responses is critical to developing those hallmarks.

Challenges: Equity

Perhaps the greatest issue with the institution of digital game-based learning as classroom practice are questions of equity and access. Harrold (2015) recognizes that even within the classroom there are significant obstacles to playing large-scale immersive games: those limitations are magnified when instructors attempt to implement digital game-based learning experiences outside the classroom. While playing games is fun, and digital games can be designed to reflect classroom learning, access to those games are limited by the socioeconomic status of individual students. NCES (2020) reports racial and ethnic disparities in internet access and device access for students ages 3 to 18. Equity and access to gaming is a consideration which is further complicated by disparities in gender. While women make up approximately 40% of the digital gaming participants they are often generalized as not being interested in gaming. According to Paaßen et al. (2017) the contradiction reflects gender stereotypes further complicated by sexism defining what qualifies as a game: "women allegedly only play casually, playing 'inferior games' (e.g., *Candy Crush Saga* or *Farmville*)" (425). The non-competitive nature of these games means they do not fall neatly into the paradigm of gaming created by male players.

Benefits

The nature of customizable digital gaming frequently involves a simplification of complex concepts to make them fit easily into the constraints of the game. Thus, games tend to perform well as a tool to help students learn fundamental concepts as seen in depth of knowledge (DoK) level 1 and 2 tasks. However, approaching DoK 3 and 4 tasks requires a more nuanced approach to the subject matter. This is where increased expense and time is needed on the part of the instructor and game developer to create immersive, complex experiences where the participants are required to think creatively to solve the game's challenges. This is further

complicated by contradictions on what exactly qualifies as digital game-based learning. Determining what qualifies as a digital learning game can be challenging. Byun & Joung (2018) recognize the expansion of Prensky's original boundaries of digital game-based learning into manifestations which are not strictly computer gaming such as simulations, game creation, and gamification. Regardless of the manifestation chosen, digital game-based learning is not a replacement for quality instruction, assessment, and feedback. Hay (2005) warns that successful educational gaming includes a process to debrief and provide feedback and tie learning goals to the gaming experience and curricular goals. Too often teachers, faced with inadequate resources, make uninformed or poorly considered decisions about which games best align with curriculum goals. Those missteps can be detrimental not only to student learning, but also to acceptance of digital game-based learning as a teaching tool.

Differentiated Digital Game-Based Learning Areas of Research

Student motivation and engagement are central to effective instruction, both of which are hallmarks of digital game-based learning. Differentiating student access to digital game-based learning activities could make the practice more personalized. Digital game-based learning research has been an increasingly popular area of research in the last five years (Tejedor-Garcia et al, 2020). The majority of these studies focus on digital game-based learning efficacy and engagement. However, there is a paucity of research on the simultaneous assignment of different games to students based on their data-determined learning needs. In fact, two years of research have not exposed any research specifically on DDGBL in a language-learning environment. As of November 2020 a KSU library search using the term "differentiated digital game-based learning" provided a single 2016 study comparing Asian and North American student preferences in the format and goals of digital game-based learning (Park & Wren, 2016). While there is an

inherent differentiation within the structure of digital game-based learning (Prensky, 2001), the assignment of different digital game-based learning activities based on student performance in an in-class assessment does not appear to have been explored.

Contributions of this Study to the Discussion

This study should be conducted because DDGBL is already a part of classroom practice, and expanded awareness of best practices and participant opinions about the method can help to refine the process for future classes. The purpose of the study is to improve the use of DDGBL as well as coming to a more nuanced understanding of student engagement with the pedagogical tools associated with DDGBL. Central to improving the use of DDGBL is a comprehension of how the participants react to its constraints and benefits, thus a qualitative study, using interviews of participants and the implementation of focus groups, provides insight beyond the persistent observations of the instructors, particularly in areas such as gaming platform preference. The focus is not on efficacy, and is specific to the practices within a high school language learning classroom, so the interview format is ideal. Quantitative data with such a specific group would be difficult to expand or replicate in other environments.

Implications of the Research

Grounded research is built around the idea that researchers can document a shared phenomenon by applying the constraints of rigorous academic discourse (Glaser and Stauss, 1967). The results of this study might provide data to improve DDGBL, or supply critical suggestions which transform the practice entirely. I am hoping this study can provide a springboard for further exploration of data-driven assignment of digital learning games, whether that manifests in the assessment area, the development of digital tools, or analysis of efficacy, or other key elements of DDGBL. Having research-based resources and a prescriptive list of

DDGBL tools will help practitioners who would like to institute or expand DDGBL within their own classrooms. Ideally this study might result in increased work by game-designers with educators to develop scaffolding game-based learning materials which can be curated to individual student's learning needs.

Central to this research is the improvement of my own practice. I already use DDGBL in my classroom, but the results of this research will refine, or perhaps even redefine, my usage. That is why qualitative research is a crucial element in coming to a better understanding of DDGBL broadly, as well as individual responses to my own iterations. A more nuanced understanding of how DDGBL influences student learning, and how it influences the structure of my class will allow me to make changes in the practice specifically for the benefit of my own students. The completion of this research could provide the same insight for other teachers hoping to implement a similar program for the benefit of their own students. The fundamental tool available to educators at the end of this research will be an explanation of different digital game-based learning platforms with an analysis of how those platforms can be transformed in DDGBL activities, compounded by the observations of students who participated in that initial transformation. There are significant limitations, however. The research is specific to high school students, examines only a six-week application of DDGBL, and the content is curated towards language learning. Perhaps most importantly, because grounded is designed to document responses within a specific phenomenon with specific constraints, those constraints may not reflect the reality in other phenomena with different or varied constraints..

The efficacy of digital game-based learning has been increasingly documented in the last two decades (Gee, 2004; Prensky, 2001, Squire, 2011; Tejedor-Garcia et al, 2020). While much of the early research was focused on science, mathematics and programming tasks, current

research has transitioned to other content areas in the last decade. Researchers such as Smagorinsky (2016) published discoveries about how digital game-based learning improves English language acquisitions for non-native speakers. While language does not always operate under the same constructs as math and science, the opportunities for students to practice and get feedback as a method of improving performance supersedes any singular content area. Rinkl (2017) notes that taking just-in-time feedback allows students to transition from simple skills to more complex ones by chunking single-step solutions into more demanding ones. When fundamental skills become automatic, the formation of procedural skills allows faster performance by the students with less demand on their memory.

While personalization of learning based on the feedback loop is a well-established benefit of digital game-based learning, very little research has been done on differentiated assignment of language-learning games. Most of the research deals with participants using the same digital games to learn, with personalization happening as a natural result of the participant's ability to excel at the content and gameplay. However, not all students need the same content, and differentiation of content can happen beyond the confines of a single game. By creating games with different levels of difficulty the content can be differentiated and the experience can be personalized.

For example, imagine a 9th grade English class is working on their vocabulary for a poetry unit. The students take a short pre-test at the beginning of the unit to determine their base knowledge on the content. Based on that data, the teacher develops three sets of learning games. The first one, which is for students who struggle with basic terminology, is based on critical knowledge. A second one is created for students in the middle of the range with the regular combination of critical knowledge and expanded knowledge. The final variation of the game is

designed for students who have already displayed mastery of the fundamental concepts on the pretests which stretches beyond the normal boundaries of the class curriculum. A program such as this requires considerable advance work on the part of the instructor, not only in designing an assessment, which will provide accurate data on each student's knowledge, but also to create or collect a library of games reflecting the needs of those learners. This is the ultimate realization of customizable game-based learning: not only can the experience within the game be personalized, but the content can be curated to meet the curricular needs of the course.

Perhaps one of the overlooked elements in the ELA curriculum is the opportunity to gamify existing digital curriculum tools and repurpose them to make them more entertaining and engaging. With the continued development of technology tools by companies like Pearson there are many pre-existing resources tied to the textbook that can be repurposed to increase engagement and personalization. As a caveat, I realize that the corporatization of English education is something of an issue for many educators. and therefore many teachers at my school eschew the district-supplied text and partnered digital materials. However, I refuse to throw the baby (well-designed parallel readings and activities) out with the bathwater (a disdain for sundry literary profiteering).

A transformative approach to these corporate textbook resources can create innovative and fun ways to engage with the texts within the book, particularly in the context of writing. Pearson provides interactive writing prompts tied to the specific content of their textbook (write a letter to your local newspaper as if you were in Selma, etc.), which automatically grade and give feedback to students once they write a prescribed assignment. While automated grading for writing needs to be approached with a critical eye, I gamify the experience by manipulating the settings for reattempts and repurposing the prompts so the students could try to "beat the

system." It is not uncommon to see students attempt 8 or more drafts of a one-page writing assignment. As a result, I get more drafts and writing feedback out of my students than most other teachers. I can personalize the experience by reducing the number of rewrite opportunities for high performers, while increasing them for struggling students. Thus a student who is a competent writer might only get three chances to beat the system and maximize the writing grade, while a lower performing student might get as many as 10 attempts. By redirecting the purpose of the automatic grading writing assignments I can transform a corporate ELA digital artifact into a differentiated digital game-based learning experience. What is surprising, once students understand that the machine "can be beat," even reluctant writers begin to carefully read the standardized feedback, ask for pointers on how to improve their score, and attempt to change their writing process. It is significant to note that I used this method in a team-taught 9th grade English class at a Title 1 school. The key here is to focus on relatively short writing assignments, so that students can produce multiple drafts within a single class session and while a sympathetic instructor is available to assuage those frustrated with the "game."

Personalized learning and differentiated instruction require that different students do different activities based on their learning needs. However, particularly during adolescence, alterity can be emotionally challenging. Students do not want to be isolated from their peers, nor do they want to be doing visibly different work.digital game-based learning can help to alleviate students' nervousness about being at a lower level than their peers. Kaltman (2019) finds that "typical scenarios that bring anxiety to struggling readers in traditional read aloud sessions— being called on to read at random intervals, fearing the text will be too difficult, fearing they may lose their place—are mitigated because of how the text is presented in good digital games" (45). Nervousness about the difficulty of the text can be reduced because well-designed games

scaffold the difficulty to meet the learner's needs. As ELA curricula across the country transition into increased use of digital texts, the idea of the video game as a self-contained text and a kick-starter for reluctant readers has begun to gain some traction.

CHAPTER 3

METHOD

Research Design and Methodologies

My purpose in this chapter is to establish the methodology for my research in this

qualitative grounded theory study examining how differentiated digital game-based learning

(DDGBL) can be improved. I am hoping that an examination of various implementations of

DDGBL curricula over the course of four years allows me to develop a better understanding of

the pros and cons of previous DDGBL implementations. Further, I hope it establishes a method

to develop recommendations from the data to understand both how I have practiced DDGBL in

the past as well as potential changes in the future. I examine the grounded theory and

constructivist approach applicable to this study further within the chapter in greater detail. Then I

examine the methodology, study participants, procedures, method of analysis, and ethical

concerns as part of the research plan. Those sections will be key elements of this chapter.

Research Question

I will attempt to develop a theory about answering the following question:

RQ1: How can I improve the use of differentiated digital game-based learning for students learning the Latin language at a metropolitan Atlanta suburban high school?

RQ2: How can I align curriculum learning goals and student self-regulated learning in a better way using differentiated digital game-based learning?

Selection of Methodology

I learned that a qualitative study would be the appropriate research method since the phenomenon's explanation through the perceptions of the recipients is the primary goal of the research. As a constructivist I feel it is impossible to approach research of any sort, including qualitative research, with the goal of coming to a final and exhaustive conclusion about the subject. Instead, my focus is to translate what has been experienced by both myself and the participants of this study into a narrative. A. P. Cheater (1987) noted that "we cannot rid ourselves of this subjectivity, nor should we wish to; but we ought, perhaps, to pay it very much more attention" (172). The impetus to come up with a conclusion sidesteps issues of subjectivity. Because my focus is to construct a narrative and to eschew the positivist idea of developing a conclusive report, the focus of qualitative research is transformed: I feel that postmodern knowledge is a thing to be questioned, not developed. Rogers, *et al*. (2018) note three main strengths in qualitative research are degree of rigor, completeness of theoretical framing and the sociocultural authenticity of the interpretation. Postmodernism moves the goalposts on research: instead of measuring to record a permanent state of being, the research measures to establish methods of measurement and to record the process of measuring in hopes of coming to new realizations about both process and product.

Both qualitative and quantitative researchers adjust their data, and omit certain findings or data points, to focus their research. This automatically brings questions of subjectivity and

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researcher bias into the research. However, the decision to exorcize red herrings and dead ends in the research does not make said research faulty. Roger et al. (2018) suggests that there is a scholarly way to collect and systematically document stories which provides a sturdy foundation for qualitative research. Thus, the key to developing and sidestepping issues of bias comes in a systematic attempt on my part to organize the stories and interviews in the qualitative data, and to make that systemization apparent to the reader of the research. Open and honest assessment and acknowledgement of my actions taken to the body of research allows critics to decide on their own if I am guilty of allowing bias to shape my interpretations.

Grounded Theory Methodology

I conducted a grounded theory study with the aim of improving differentiated digital game-based learning in high school language learning classes. I have been using differentiated DGBL for years, based on the assertion that students, after going over the answers to the warm-up, know if they "got" the concept or not. The assumption further expects that, once students have a basal metacognitive level, they can appreciate being given different levels of activities based on their needs, as evidenced by their performance. This is an assumption on my part, based on my own observations and preconceived ideas about learning. Subsequently, I was curious to learn about what students think of the process, whether they feel they learn by doing this, and whether the games which I created align with their own perspectives of their needs. I hoped to be able to build a codified series of prescriptive instructions to help students feel like the process has value and to build better games which align with the learner's own perceptions of their needs.

The Researcher

I was the primary researcher for this study. I am a language teacher at a suburban high school in the greater metropolitan area of a large city in the Southeastern corner of the United States. I have been using DDGBL in some form for almost a decade, but my adjustments have been largely intuitive, and not based on any outside data beyond my own observations. I identify as a constructivist, and I believe that different perceptions from different people can mediate a shared experience, creating a different one for each individual. As a result, I do not believe that the same lesson is experienced in the same way by all students. Understanding a variety of perspectives is critical to reaching a more objective and unifying approach to implementing any sort of learning activity, including DDGBL.

Study Participants

For the persistent observations I took daily notes on the practice, the responses, and any perceptions of student responses to digital game-based learning in general, and specifically in terms of differentiating the assignment of digital praxis. I then codified the notes into batches every four weeks, aligning the batches with the intended dates for interview batches. Those notes were reexamined and with recodifications at the end of the study. I amassed about twenty total weeks of observations, during the preparatory stage, the actualization of those preparations, and afterwards as I transcribed, coded, and analyzed participant interviews. This provided me with three sets of codified observational data to use in development of the study.

Data Collection Overview

Data for this study was collected from a series of interviews. I conducted 15 interviews from a variety of student levels: both the students who have been successful with differentiated DGBL and students that have struggled. I also varied the participants based on years of experience with DDGBL, varying from two to four years. Each interview took approximately 15

minutes. I grouped the interviews in batches of five, with an analysis of interview questions and initial open coding after each batch was completed. I altered the interview questions based on participant responses, and follow-up questions were codified. A list of the interview questions for each of the three batches are available in Appendix B. I maintained a digital journal of persistent observations during the examination period, which I used as a point of contrast and comparison for interview data.

I conducted the recordings of the interviews in two ways. For face-to-face interviews the researcher used the updated Recorder for Android. I then transcribed the audio recording via Otter.ai, which I then reviewed and corrected using the original audio recording. Other interviews were done virtually. I conducted these via Microsoft Teams. Teams offered both transcription and recording for the virtual interviews. I then read through these transcripts while listening to the audio to check for mistakes by the transcription software.

Once I had transcribed the interviews, I used ATLAS.ti (version 9, 2021, ATLAS.ti GmbH) to analyze and look for common patterns with the student responses. First, I used open coding, scanning the transcripts of the interviews and examining journal notes from persistent observation. Upon successful upload of the transcripts I labeled concepts, then defined and developed categories for those labels, looking for commonalities in theme or content. In particular, I examined engagement, indications of student learning, freedom to fail, immediacy of feedback, and metacognitive learning, where students become aware of what they do and do not know and begin, on their own, to develop strategies to address any deficits. These questions were guided by the research I discovered about digital game-based learning in the literature review. I then constructed thematic codes from the *in vivo* codes of the original documents, and from there began to build concepts and categories. Once the categories were defined and examples were

pulled from the line-by-line coding I identified patterns within those categories, eventually coalescing into a central concept. Upon identification of the central concept I used selective coding to establish the relationship between the open codes and the central tenet.

Data Procedures

I completed an application for approval from the Kennesaw State University Institutional Review Board (IRB). Upon receiving IRB approval, I contacted the central office for the school system where interviews would take place. I completed my application for school system approval, and, upon the granting of approval, I contacted potential participants. My initial contact with potential participants who had already left the school system and were over the age of 18 was done via email, including an Adult Participant Consent Form (Appendix D.3) I made initial contact with potential participants under the age of 18 via paper interest survey (Appendix D.1). I handed out the interest surveys in classes where DDGBL was being used as part of the curriculum. I then contacted potential participants who returned the paper via email including their parents to confirm their interest in the study (Appendix D.2). To those participants and guardians who agreed I sent copies of the Participant Assent form (Appendix D.5) and the Parental Consent (Appendix D.4) form. These forms can be found in Appendix D. Once initial interest was established, I organized participants into batches of five interviews. The first five interviews I conducted with adult participants who had already left the school system. For the next batch of five interviews I focused on participants who had engaged in the process for three or more years. The final batch of five interviews I conducted with participants who had used the process for two to three years. Participant consent forms (for those age 18 or old), assent forms (for those under the age of 18), and parental consent forms can be found in Appendix D and were prerequisites for participation in the research study.

I interviewed participants either face-to-face or using Microsoft (MS) Teams. Both the researcher and the participant were in private rooms. Interviews done face-to-face were recorded using the Pixel 3 Voice Recorder, while virtual interviews were recorded and transcribed via MS Teams embedded transcription and recording protocols. Interviews, found in Appendix B, included a request for verbal informed consent in addition to the consent and assent forms found in Appendix D. No interviews took place without both written and verbal consent on the part of the participant. Face-to-face interview recordings were transcribed via Otter.ai. I reviewed both MS Teams and Otter.ai transcriptions while listening to the recording, editing them to ensure accurate transcription.

Organizing Themes

Discovery of phenomena during the research process is a central element within grounded theory. Because the data is a precipitant of the data and theory, I added or modified interview questions between batches over the course of the interviews. When the first batch of five interviews were completed, several critical themes began to emerge, and I added clarifying questions and included more follow-up questions concerning those critical themes in subsequent interviews. The changes in the interview protocol can be found in Appendix B.

Persistent note-taking was a critical element in the observations about varying implementations of DDGBL. I created my notes using voice-to-text using the Pixel 3 recorder, and documented via Google Docs. Persistent note-taking took place during the virtual phase, hybrid phase, and face-to-face phase of the 2020-2021 school year. Observations from the 2021-2022 school year were exclusively about face-to-face implementations. I applied constant comparative analysis to the notes over the course of the implementation of DDGBL and this helped to minimize my bias over the course of the study. The persistent note-taking allows me to

be reminded of my previous thoughts and observations, helping me to create a framework for further exploration of a topic or theme. This reduces the imposition of myideas onto the development of theory and instead allows the data to be the primary driver. Thoughts and concerns about the study were documented during this persistent note-taking, as well as reflections upon the process, interpretations of research articles upon the process, as well as any of my ruminations about emerging theories, categories, codes, or themes.

Data Analysis

I coded transcripts in the same order as interviews took place, in batches of five at a time, giving me an opportunity to develop and explore themes within each batch, and adjust the interview questions to reflect new findings in the data.

Step	Coding Type
1	Open Coding
2	Selective Coding
3	Theoretical Coding

Table 3.1 *Coding Sequence*

Open Coding

My initial phase of coding was open coding, where I reviewed the transcripts line by line. I coded each line of the transcribed interviews using keywords or phrases to describe the data. Examining the transcriptions of the interviews in this way allowed me to conduct an in-depth initial examination of the data for each interview. This method also instilled the core concepts of grounded theory, allowing the data to be the groundspring for any theory. While many codes emerged from open coding, that majority fell into 13 key codes, including concepts such as

"enjoyment" "metacognition" and "improvement". These key concepts coalesced to become selective codes.

Selective Coding

Once I completed open coding I began the process of selective coding. Because there were no new open codes, core categories began to emerge from the open codes, condensing around 13 key concepts. Some of these selective codes occurred more times than others over the course of the transcriptions. These high-frequency selective codes I identified as critical themes, also known as theoretical codes. Less frequent selective codes that shared common elements, or were often found to be closely connected, I then condensed to create additional theoretical codes.

There were significantly fewer selective codes than open codes. While initial analysis provided as many as 20 open codes, further iterations and analyses of those codes found several that were redundant, allowing them to be combined with other selective codes and to whittle the final number of selective codes down to the central 13. These codes can be found in Appendix C. Initial selective codes do not always best represent the core concept within the data, and the high number of open codes led to additional selective codes that were, in fact, duplications of ideas from other selective codes. By combining the duplicate concepts within fewer codes it was easier for me to develop theoretical codes which accurately reflected the observations made by the participants in the interviews. The relationships within the selective codes, and a careful consideration of said relationships, helped me distinguish between open, selective, and theoretical codes.

Theoretical Coding

The process of open coding revealed themes from high frequency open codes which eventually transitioned through selective coding into theoretical coding. A few critical open

codes transitioned without any significant changes. I combined other open codes to create

selective codes, then I combined those with germane selective codes to create theoretical codes.

After the distillation of open and selective codes five critical themes emerged from the interview

transcripts. These critical themes can be found in Appendix C. The coding process was iterative,

meaning that results were viewed and reviewed constantly throughout the coding process. An

examination of code density - how often those particular codes appear in open and selective

coding - was also an important consideration in developing the theoretical codes. Constant

comparative analysis allowed me to conduct a deep excavation of data from the interview

transcriptions as well as a condensation of codes around the critical themes.

Use of Atlas.ti

I used Atlas.ti (version 9, 2021, ATLAS.ti GmbH) to analyze and look for common

patterns within the participant responses. I engaged Atlas.ti to do specific word and phrase

searches within the transcribed interviews, looking for patterns and high-frequency vocabulary. I

assigned constructed codes from the *in vivo* codes of the original documents, and from there

began to build concepts and categories. I defined categories and pulled examples for those

categories from the line-by-line coding. Then I identified patterns within those categories,

eventually coalescing into a central concept. Once I identified the central concept I used selective

coding to establish the relationship between the open codes and the central tenet.

Credibility

I assured the credibility of my qualitative research through a couple of important

considerations done at the outset of this study on digital game-based learning. One of the key

elements proposed by researchers such as Peshkin (1988) and Rogers et al. (2018) is the idea of

persistent observation, where the researcher maintains the process of observing the subjects for

an extended period of time and in shortly-spaced, consecutive sessions. Contiguous sessions

allow a consistency in the observation process which a more "staccato" process does not allow.

As a result, I completed daily or almost-daily observations of the subjects in the study. Over the

course of the 30-day unit the students engaged in 15 differentiated digital game-based learning

activities, with an additional 15 non-differentiated DGBL ones. Additionally, I used prolonged

engagement to assure credibility for the study. Shenton (2004) recognizes that many

"recommend 'prolonged engagement' between the investigator and the participants in order for

the former to gain an adequate understanding of an organization and to establish a relationship of

trust between the parties." Grounded theory lends itself especially well to prolonged engagement,

since the research deals with the exploration of a recurring phenomenon. The participants in the

study used differentiated DGBL for at least one year, averaging one application of DDGBL per

week. The study included interviews from 15 participants, five from each sub-group to allow for

purposive sampling. My interview process included member-checking, where data, analytic

categories, interpretations and conclusions were tested with members of those groups from

whom the data were originally obtained. Shenton (2004): "although much qualitative research

involves the use of purposive sampling, a random approach may negate charges of researcher

bias in the selection of participants" (63). I involved students in Latin 2, Latin 3, AP Latin, and

students who have already graduated in the study in order to get data from students with a variety

of experiences. Casting a wide net allowed me to gather the greatest representation for the

variations of experiences with DDGBL.

    As important as recognizing researcher bias within the study, it is important to let the

subjects of the study know that their participation is fully voluntary. There are immediate

concerns about bias in the interview process. Because I, the researcher, am also the course

instructor, and thus an authority figure for many of the subjects, whose grade is determined by the researcher. For this reason, I made it explicit to students, parents, and administrators that any participation was voluntary, and that there was neither reward nor penalty for participation. Shenton (2004) notes that participants should clearly understand they have the right to remove themselves from the research process without an explanation. This can be challenging for a teacher who is invested in the research, but any attempt to coerce the subjects in any form or fashion, whether stated or not, undermines the credibility of the study. The process and anonymity of the study must be made apparent to all stakeholders.

Transparency in method was critical to sidestepping questions of researcher bias, or at least meeting those suggestions of bias head-on by making it clear to critics what was done. Similarly, an honest self-assessment on my part was fundamental to approaching interpretation of qualitative data. Peshkin (1988) observes that by attending to their biases researchers "can possibly escape the thwarting biases that subjectivity engenders, while attaining the singular perspective its special persuasions promise" (21). Establishing positionality on the part of the researcher is an important part of the research process, and confronting that positionality during every step of the research is essential to producing research where the bias does not unduly complicate the results. Peshkin (1988) observes within his own qualitative work that recognition of subjectivity is not enough: the research instead must "manage it--to preclude it from being unwittingly burdensome" (20). All research reflects bias on the part of the researcher in some capacity, quality research is done by directly addressing and redressing that bias from the outset of the experiment. As a result, all my research is couched in the understanding that I am an advocate for DDGBL, and the focus was not on efficacy or quantifying whether students learned more using the method. Instead, by making the focus to create a narrative which intertwined a

variety of student experiences, both positive and negative, with a wide variety of DDGBL experiences allowed me to sidestep questions about my own investment in DDGBL and move the focus largely to the experience of the participants.

Ethical Concerns

Ethics were of the highest priority for me during this study. I followed the careful adoption and application of ethical standards for a qualitative study, as outlined in this chapter, to ensure validity and reliability. I updated my investigation skills continually, especially in terms of methodology, finding new techniques to carry out studies, negotiating research procedures, and providing information about the consequences of the various procedural choices. I acquired informed consent through a contract before each interview, and the interview protocols in Appendix B included a verbal consent clause as well. I used the Adult Participant Consent, Parental Consent, and Student Assent forms to obtain permission before the interviews. I aligned my research practices with Kennesaw State University, local school, and IRB guidelines. Both written and verbal consent included opportunities for participants to withdraw from my study at any time without penalty, and I expunged any withdrawn materials from the study. There were minimal risks to human subjects associated with this study. All participants were either 18 years of age, or else were participating with the written consent of a guardian, and did not demonstrate impaired mental capacity. Additionally, I will erase all materials after 3 years, pending approval by the research community. This reduces any potential confidentiality risks.

Summary

My purpose for this chapter was to explain and define the methods I used to conduct research and determine how DDGBL could be improved. I included an examination of the

procedures that I used to develop the data, the participants involved in my study, the collection of data, and the distillation of interview questions. I outlined the specific details of study conduction and participation. I utilized the application of grounded theory through a constructivist lens to augment existing literature on the use of digital game-based learning broadly, and improvement of DDGBL specifically. All participants in the study made additions to the development of improvement by sharing their experiences with DDGBL and the perspectives on both its successes and failures, as well as recommendations for improvement, both over and implied. The goal of Chapter 4 is to present the results of the study and show how I followed the Chapter 3 methodology.

CHAPTER 4

FINDINGS

Introduction

I undertook this grounded research study to increase my knowledge about how I can improve the implementation of differentiated digital game-based learning (DDGBL) in my classroom, as well as how I could align curriculum goals and student self-regulated learning in a better way by leveraging DDGBL. Finding new ways to improve DDGBL would help to examine a prevalent process in my classroom: the use of different digital-game based learning activities, with tiered difficulty levels, based on the knowledge base of the students. DDGBL is made up of four key elements: assessment, review, grouping, and gaming. A careful examination of each element and how they all relate to curriculum goals and SRL could avoid pitfalls in utilizing the technique: some of those pitfalls I was already aware of or had predicted, and the study would expose others which I suspected or had not foreseen. To understand how to improve DDGBL it is important to understand first how I was using it in my own classroom.

A typical class day during the study would begin with a short warm-up DDGBL activity. I would give a 20 question multiple choice assessment which examined the content the class had covered the previous day. While the assessments covered vocabulary, grammar, cumulative vocabulary, culture, and derivatives--the five key areas for each unit--I decided to focus the study primarily on the vocabulary assessments. The reasons were threefold. First, vocabulary is a fundamental building block for the rest of the course content, so finding ways to improve student learning in that area is critical to later success. Second, when the school system transitioned to a hybrid curriculum, with students both in-person and virtual at the same time, vocabulary was the easiest DDGBL activity to implement for both types of students simultaneously. Finally, the game I was using for DDGBL (Jewels of Wisdom on Cram.com) was one of the most stable and worked successfully on a variety of platforms. I had to dramatically change the protocols and methods used to give the warm-up assessment at the beginning of class when the COVID-19

pandemic forced the classroom into a virtual environment. Before the pandemic students had taken the warm-ups using pen and paper, and then self-graded as the class reviewed the answers. Once students went to a virtual/hybrid curriculum I transferred those warm-ups to Illuminate Education (Illuminate). Illuminate allowed me to upload the daily warm-ups and have students access and answer the questions on their devices. It was multiplatform and was the school system recommended hybrid assessment tool.

Once students completed the 20-question assessment (normally taking 6-8 minutes) we reviewed the answers. When the implementation was pencil-and-paper students self-graded using a red pen to mark errors. When I transitioned to the Illuminate digital assessment platform, the interface self-graded and gave students their scores immediately. Additionally, Illuminate allowed me to watch student performance in real time, and to see when all students were done with the assessment. Once students completed the assessment, I reviewed each answer, and took questions from students if they did not understand, or disagreed. Taking the time to discuss the answers, especially if students disagreed, often led to teachable moments in the classroom. The review process typically took 3-4 minutes. Illuminate also provided anonymous class-wide performance analysis; an example of the Illuminate anonymous class-wide reporting portal can be seen in Figure 4.1.
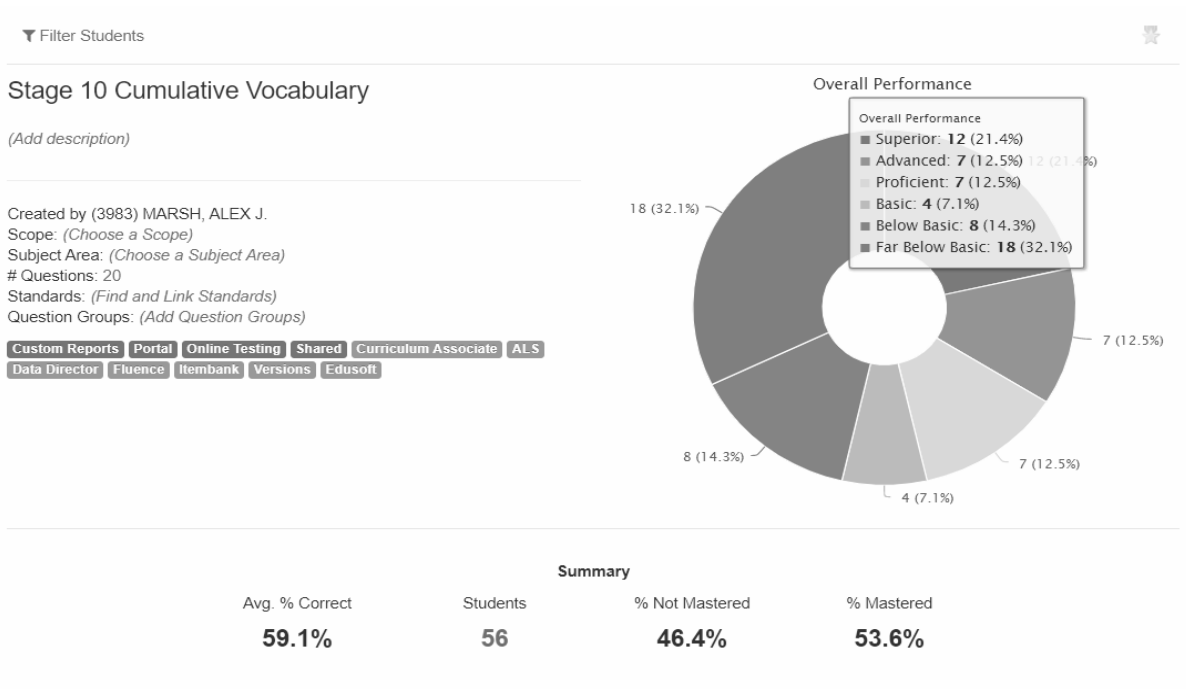
Figure 4.1 *Illuminate score reporting*

Once students were done, I began the grouping process. I asked students to take a moment and self-assess: how did they feel about their performance on the assessment? If the students felt that they were guessing or were not confident, they were put in Group 1. Those students who felt they had adequate understanding were in Group 2. Students who felt they had mastered the content and were ready to move on were in Group 3. In earlier implementations of DDGBL I gave benchmarks to help them decide: if they scored below 70% they were in Group 1; 70% to 90% was in Group 2; 90% and higher was in Group 3. However, once we began using Illuminate I allowed students to self-assess without specific benchmarks. At no point did I ever tell an individual student which group he or she should undertake. Instead, the instructions were given broadly, as a guideline to help them make their own decisions.

Once students were grouped they would then click on a link which took them to the appropriately difficult game. These links were available on my website www.MarshLatin.wordpress.com as well as on the digital lesson plans, which were hosted on

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Microsoft Sway. I used a variety of games over the course of various implementations, but the primary focus for this study will be the Jewels of Wisdom game hosted on Cram.com. Jewels of Wisdom allows teachers to use their own curricular vocabulary and definitions to create custom games which can align exactly with instruction and assessment. This customization allowed me to create my own games specialized for my own content, as opposed to using a pre-made set of games. This tailored approach to game-building allowed me significant flexibility and influence in the design and goal of the game. This game requires students to match the vocabulary words with their definitions. Each vocabulary word is in a block on the left side of the screen. Correctly clicking on the block and its definition on the right side results in the block disappearing, with any blocks above them falling down into the previous place. The blocks are different colors: when three blocks of the same color touch they disappear and the words fall from the top in new blocks for additional points. It is similar to games like Bejeweled or Candy Crush. Each version of the game uses a different vocabulary list, which the instructor can curtail, expand, or edit as needed. The Group 1 game uses the same vocabulary list as the assessment and the previous day's vocabulary lesson. The Group 2 game uses that vocabulary list, but also includes vocabulary from previous units, making it a cumulative vocabulary contest. The Group 3 game uses unfamiliar vocabulary, requiring students to learn new terms by playing. A screenshot of the game can be seen in Figure 4.2.

Figure 4.2 *Jewels of Wisdom game*

For purposes of this study DDGBL means the combination of assessment, review, grouping, and gaming. The application of tiered games based on student's perceived needs, as determined by the assessment, is the central practice I hope to improve upon and discover new ways to align with curriculum goals.

In this chapter I include an analysis from interviews and persistent note taking based on the activities used within a language classroom, how that aligns with grounded theory, and the connection between analysis and the research question. In addition I provide sample demographics of the study participants. Next, I describe the process used to analyze 15 individual interview transcripts, development of codes, and distillation of themes. I present multiple levels of analysis, beginning with manual and open coding, followed by selective coding, and finishing with theoretical coding. I reveal cross-interview comparison in each stage of the analysis to help refine the data and develop themes. I have also included tables and graphics presenting the code and theme data in detail within the chapter, which I further with vignettes from individual interviews emphasizing central themes and observations about

DDGBL improvement.

Pilot Study

There was no pilot study for this program. However, the DDGBL process has been implemented for about six years before the study. During that time the process underwent several critical changes. The most significant was the expansion from two groups (passing/failing) to three groups. My own observations noted that in two groups the students often felt the grouping process was punitive. From my own experience, the addition of a third group allowed the highest performers to be more challenged while the lower performers did not feel as targeted.

Setting

The setting for this study was a language learning classroom in a suburban high school. The school itself was in the suburbs or a large metropolitan area in the Southeastern corner of the United States. Classroom sizes varied from as large as 34 students to as small as seven students. The participants took the class between 2018 and 2021. While the school's exact demographics and population shifted over the course of those years, the population hovered around 2100 students. The school was approximately 55% Caucasian, 20% African-American, 15% Asian, and 10% Latinx. There were less than 1% of students in any other categories. The student body was generally affluent, with the majority of families lying within the upper-middle class range.

Demographics

Fifteen participants agreed to interviews for this study. Table 4.1 represents the participant demographics of the interviewees, including information such as the number of years they took part in the practice of DDGBL as well as how long it had been since they had engaged in the practice. This table can also be found in Appendix A. These are important considerations in the analysis of the data. Students who used game-based learning for several years have

different experiences than those who have only done it for a few weeks, and students who have

not engaged in the activity in a few years might not have the same observations as those who

have done it recently.

Name	Gender	Nationality	Years Participation	Age
Alcyon	F	Caucasian	4	18
Tereus	M	Asian	3	18
Phaea	M	Asian	3	17
Lycaon	M	Causcasian	4	18
Sinis	F	Causcasian	3	18
Demiphon	M	Causcasian	4	17
Camesus	M	Causcasian	3	18
Mastusius	M	Causcasian	3	17
Icmalius	M	Causcasian	2	16
Neleus	F	Causcasian	4	17
Hippolyta	M	African-American	2	16
Eupeithes	M	Causcasian	4	17
Orion	M	Caucasian	3	17
Balus	M	Caucasian	2	16
Glaucus	T	Caucasian	2	17

Table 4.1 *Participant Data*

Five of the participants, or 33% of the sample size, were high school graduates who had

taken my course for a minimum of three years, and had participated in a variety of different

implementations of DDGBL. My practice varied from year to year, particularly during the 2020-

2021 school year, where the school undertook a hybrid curriculum, with students taking classes

from home and at school simultaneously. The majority of these graduates had not experienced

DDGBL in a hybrid platform, so their observations were based on how I had leveraged DDGBL

with pencil-paper assessments and self-grading.
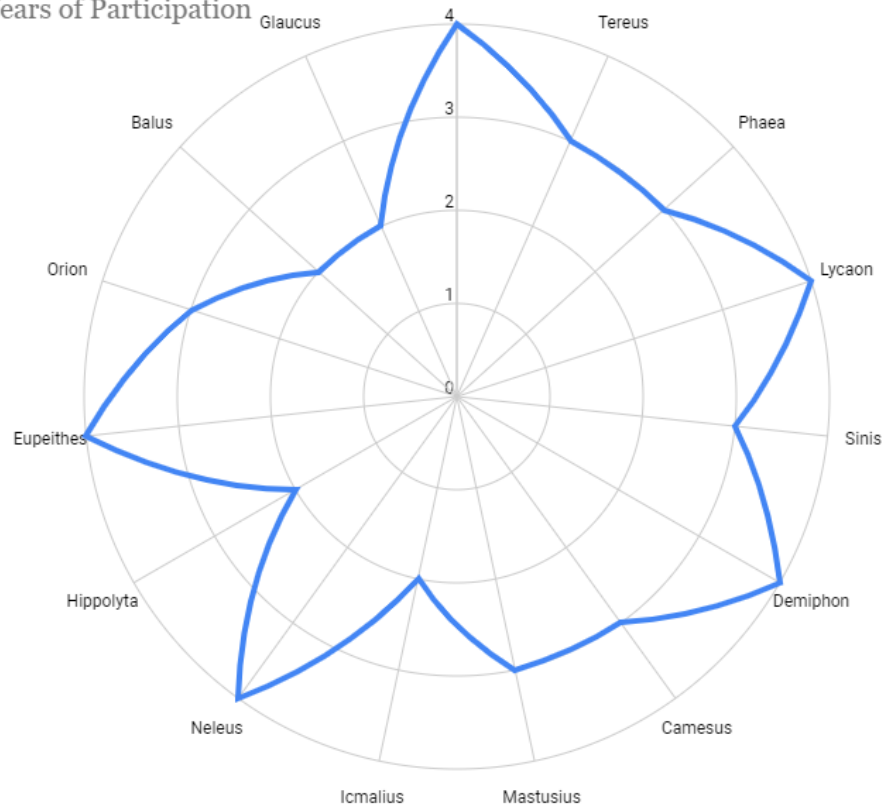
Figure 4.3 *Years of Participation*

The remaining 10 participants, or 67% of the sample size, had experienced my implementation of DDGBL in a hybrid environment during the 2020-2021 school year as well as in my face-to-face (F2F) implementation during the fall 2021 semester. Those participants were broken down as follows: 19% of the participants had engaged in DDGBL for 2 years, 7% for three years, and 27% had participated in it all four years of high school. Additionally, 13% were first-time participants in the DDGBL experience. A graphic representation showing years of participation in DDGBL are provided in figure 4.3.

Count of Gender
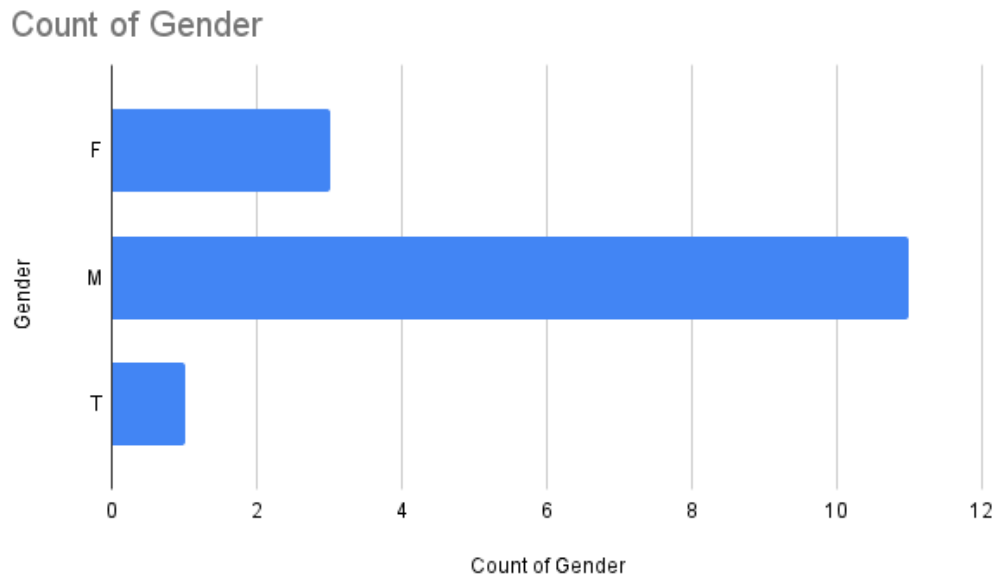
Figure 4.4 *Participant Gender*

Count of Nationality
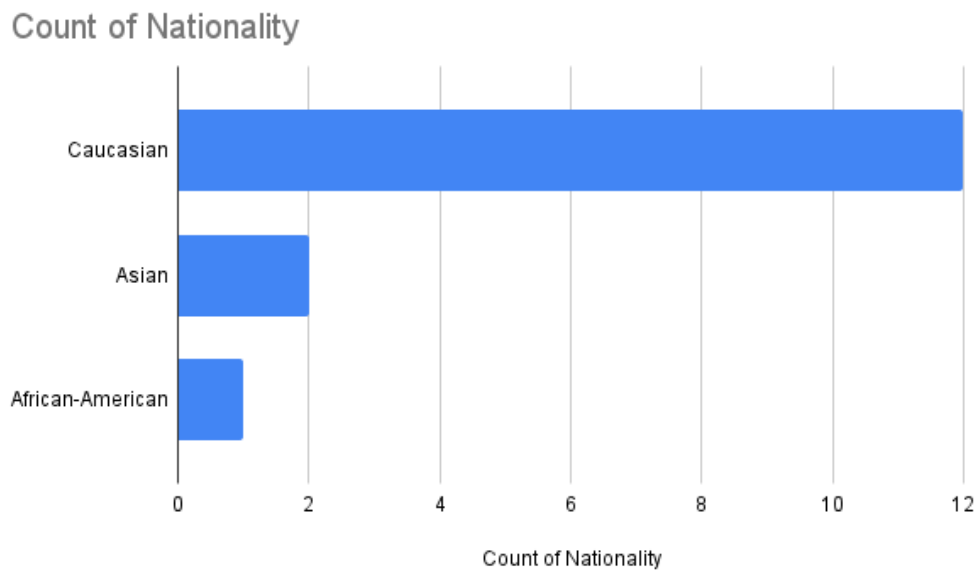
Figure 4.5 *Participant Nationality*

Twelve of the 15 participants (80%) were White, non-Hispanic, while 2 (13%) were

Asian, and 1 (7%) was African-American. The ages of the participants were between 16 and 18

years of age. Participants who were 18 years old represented 33% of the sample, 47% were 17

years of age, while 20% were 16 years old. A graphic representation of gender can be found in

figure 4.4, representation of nationality in figure 4.5, and age in 4.6. All data is additionally

available in Appendix A.
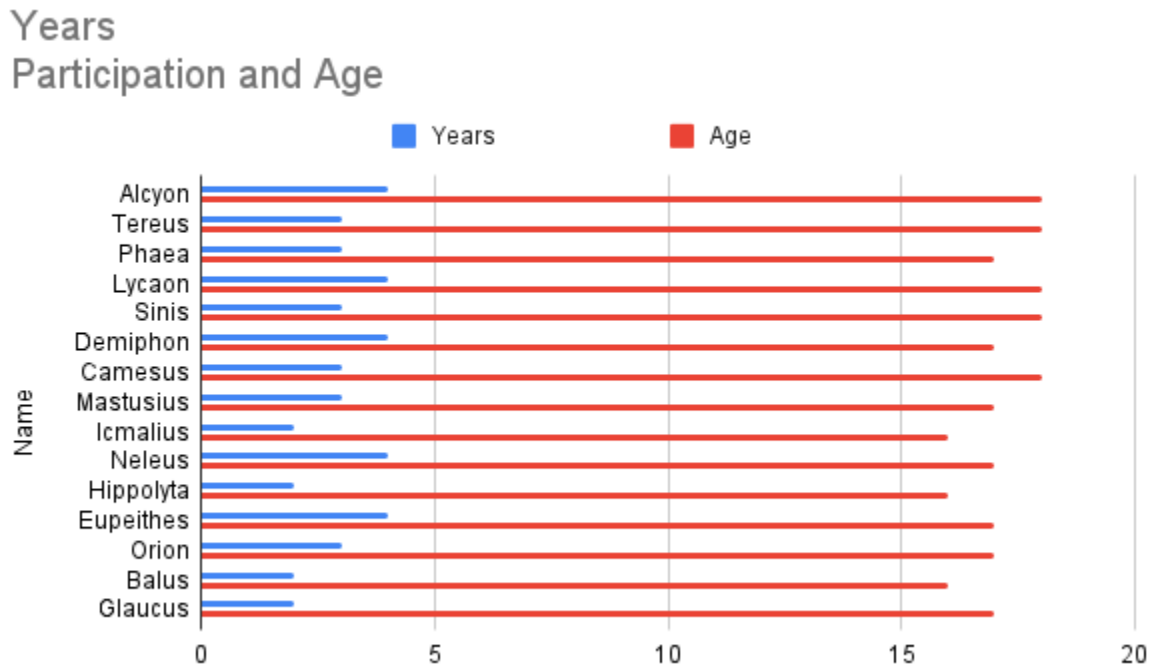
Figure 4.6 *Age and Years of Participation*

Data Collection

I conducted 15 interviews with students who had participated in DDGBL activities. I

combined these interviews with my own persistent note taking about the process. While I

originally intended to use a focus group as well, the local school system approval process for the

research recommended against any group protocols. The reasons were twofold: first the local

school system did not feel student privacy could be maintained in a focus group, and, more

importantly, the school system COVID protocols banned gathering of students in a single space

outside of the classroom. As a result, the interviews and persistent note-taking provide the

primary sources of research data. I coded the interviews manually and then I reviewed for emerging themes after each set of five interviews was completed. In the first batch I interviewed one participant face-to-face, in which case I used Sound Recorder for Android to document the interaction, and used Otter.ai to transcribe the interview. I conducted the remainder of the interviews in the first batch virtually, using Microsoft Teams to host a video call, which was recorded and transcribed using Team's built-in transcription and recording interfaces. I then reviewed the transcriptions for corrections while listening to or viewing the interviews. Once corrected transcriptions were completed I re-read the interviews and began manually coding quotes and ideas which I thought were important to the study.

Each participant was assigned an alias to protect their anonymity. Each alias was taken from Greek mythology, and was selected at random, with no alignment of gender, age, or experience. Similarly, each of the mythological names begins with a different letter of the alphabet. This makes it easier to keep track of individual respondents: having multiple similar names could be confusing. The mythological names were selected from a massive (1000+ question) mythology test database hosted on Quia.com which had a randomizer within it. The random selection of names using the Quia.com assessment platform allowed researcher bias to be removed from the assignment of the aliases.

Per this technique, I made certain that I implemented grounded theory methodology in all parts of the data collection process. As I began interviewing and coding, as well as comparing participant responses with my own notes I began to see patterns and themes emerging. Using *in vivo* coding I created a spreadsheet highlighting those quotes which seemed to provide personal and insightful responses to the questions. I realized that my interview protocols, while adequate, left room for improvement. As a result, I began to adjust the original format of the interviews to

accommodate the *a priori* themes established within the first batch. I provided the original interview protocol as well as any subsequent amendments to said protocol over the course of the study in Appendix B.

Data Analysis

I began by implementing manual coding for all interviews. Interviews were completed in batches of five, allowing ample time for analysis and changes in interview protocols before the next batch of participants were interviewed. This also let me "live" with the interviews for several weeks, pondering how the participant responses reflected the questions, and what seemed to be missing in the interview protocol. I explored themes within the first batch of five interviews, then coded and categorized the concepts found within them. I then cross-referenced participant responses with my own persistent notes to check for alignment and potential contradictions. This process allowed me to begin theoretical coding by looking at the frequency and adjacence of open codes. Concepts such as *enjoyment*, *motivation*, and *frustration* all became more clear as I began the manual coding process.

During the course of the interviews, I often included follow-up questions to help get more explicit responses from participants. I found that several of those follow-up questions seemed to be more fruitful than the original questions. From this I concluded that there was room for improvement on follow-up questions, and that some of the concepts such as enjoyment of games outside the classroom should be more directly addressed within the interview. For example, one of the early interviews included a respondent sharing that the grouping process sometimes felt "demeaning." This critique came as a surprise to me: it was a contradiction to my own notes about the grouping process. Thus I included questions in batch two and three specifically asking participants about their affective response to the grouping process. Based on the observations

from the first batch I modified other interview protocols in a similar way by adding more

questions and including clarifying follow-up questions. The process of manual coding resulted in

10 codes, which I used as a framework for open coding. The changes I made in the interview

protocol can be found in Appendix B, my analysis of manual and open codes are available in

Appendix C.

   I used Atlas.ti version 9 to store and analyze interview transcripts. I compared the initial

manual coding of each interview with digital coding and analysis using Atlas.ti v9. The process

of coding the interviews in batches, and then analyzing all 15 together supported the constant

comparative analysis expected in the grounded theory methodology. I safeguarded the

consistency of emphasis for critical concepts during coding through a process of comparison.

From this process I discovered 14 codes via open coding, which can be found in Figure 4.7.

Further coding data can be found in Appendix C.

Manual Codes
Warm-up
Jewels
Grouping
Improvement
Cheating
Alignment
Enjoyment
Motivation
Dislikes
Competition

Open Codes
Self-grading issues
Logistic issues
Immediacy
Qualifying questions
Inquiry opportunity
Technology issues
Cheating
Thinking about thinking
Clearly defined guidelines
Competitions
Potential collaboration
Improved learning
Awareness of learning
Glitch Mitigation

Figure 4.7 *Manual and Open Coding Values*

After open coding I began the selective coding process by screening the open codes for emerging semblances. I began to notice patterns emerging, particularly around key concepts such as feedback and metacognition, but I wanted to map out how these concepts related to the open codes. Four major elements in DDGBL began to appear as I continued the selective coding process: assessment, review, grouping, and game-play. Open codes crossed over between these elements. I created a mind-map using MindMup (mindmup.com) to map vignettes and open codes and align them with the four processes involved in DDGBL. Figure 4.8 holds a data summary, and the processes I put in place to analyze theoretical, selective, and open codes throughout the research process.

OPEN CODING	SLECTIVE CODING	THEORETICAL CODING
Interviews and persistent research notes from manual coding were individually entered into Atlas.ti and either assigned unique codes or compiled with existing codes. Transcriptions of interviews were manually entered individually into the code.	Open codes were aligned using MindMup which was then installed as a linking tool for open and selective codes from participant stories and research notes. Atlas.ti's word counting tool was implemented as an ancillary review device for interview transcriptions.	Themes were mined from MindMup, linking codes from interviews and persistent researcher notes in situations where there were unclear, discernable, and unimpeded relationships. High frequency selective codes created the groundwork for any theoretical coding.

Figure 4.8 *Process for Analysis of Data*

I defined selective codes and further distilled those codes through the application of the word-count and source code data analysis tools in Atlas.ti v9's software package. My examination of open code frequency and density per interview revealed selective codes. I qualified open codes which appeared 5 times or more within the body of the interviews as having high density and thus were used as selective codes. I began to coalesce my thinking around

concepts such as feedback and the differences between pencil-paper administrations of warm-ups and warm-ups which used the Illuminate assessment platform. All of these concepts operated under the assessment process of DDGBL. I chose these coalescing concepts, often embracing multiple open codes, as selective codes. The relationship between open and selective coding can be seen in Figure 4.9.
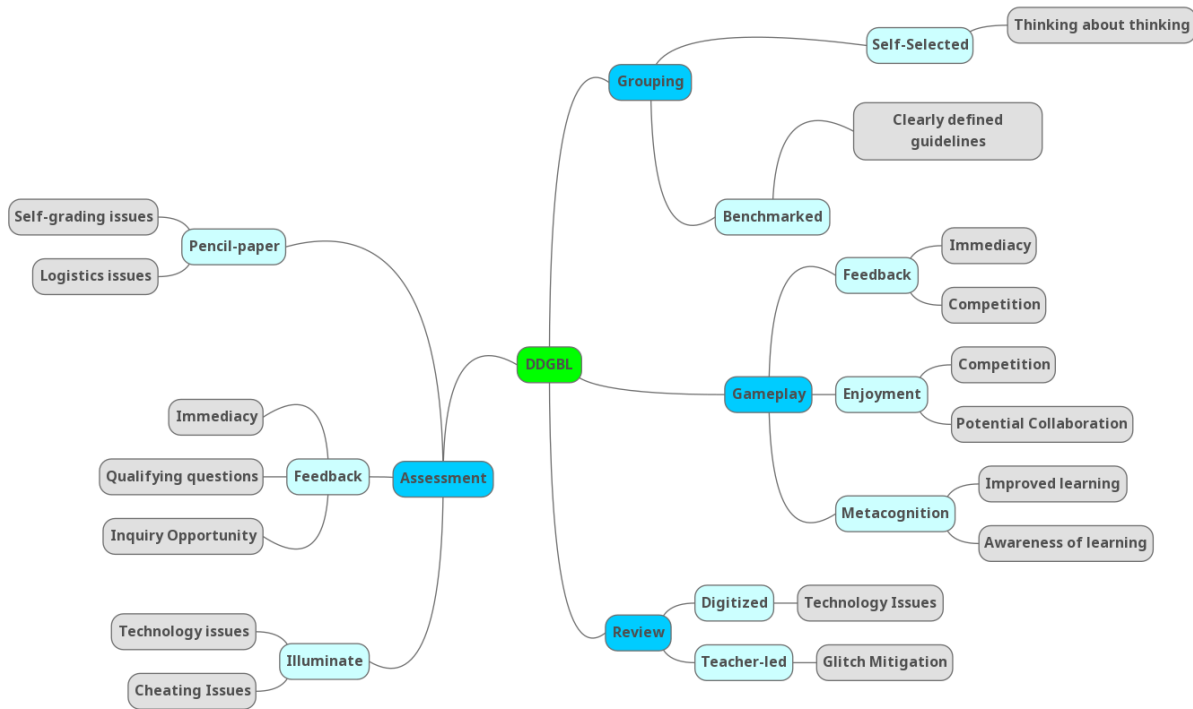
Figure 4.9 *MindMup Map*

The relationship between open and selective codes provided the basis for developing theoretical coding, both within the individual interviews as well as across the entire range of interviews. The use of MindMup mind-mapping software was invaluable to the distillation process. The relationships across the selective codes were analyzed via similar relationships revealed by the mind-map. Pairing open and selective codes with the original interview texts allowed that interview to be reviewed for cross-code relationships. If there was a relationship, the extrapolation of said relationship was signified with a line.

Not every participant received an identical set of questions. Some interviewees were reluctant or vague about answers, requiring me to provide follow-up questions to help reveal their intentions. Additionally, I amended the questions after each batch of five interviews, as I distilled the process and I began coding to reveal critical understandings of key components in differentiated digital game-based learning. While the changes were generally minor, and did not change the general scope or direction of the interviews, I used constant comparison between initial open codes and later ones to ensure that I was not putting additional weight on later interviews.

For example, I asked every participant how they might improve upon the DDGBL process, but I did not redirect every interviewee specifically towards vocabulary learning. This change occurred in interviews 6 through 15 since many of the earlier participants began to focus on adventure type gaming which was used to explore cultural and historical topics. Since my study focuses primarily on the use of vocabulary gaming, that section of those interviews provided less open codes. There were four key dividing lines within the selective codes: *assessment* codes, *grouping* codes, *gaming* codes, and *recommendation for improvement* codes.

Assessment	Grouping	Gaming	Improvement
Paper vs. Digital Assessments	Affective Response to Grouping	Jewels of Wisdom	Structure of Games/ Assessments
Establishing Expectations	Assigned vs. Self-Selected	Alignment to Course Content	Collaborative Learning
Learning about Learning (Metacognition)	Personalized Learning	Motivation	Expanding Styles of Games

Table 4.2 *Selective Codes*

Assessment Codes

Differentiated digital game-based learning is a multi-step process of analyzing student learning and then providing game-based learning experiences which align with learning data. Having an assessment tool to provide that data is critical. My student participants explained the use of the daily warm-up activities and how that helped both me and themselves to understand how well they understood course content. Observations about the assessment included discussion of pencil-paper and digital warm-ups, the way that my use of daily assessment helped to establish classroom expectations, and how students could use those assessments to understand their own learning processes (metacognition).

Assessment: Differences taking paper and digital warm-ups. Illuminate is a web-based assessment software that allows teachers to upload questions and create answer keys for those questions. When students take the warm-ups the software automatically grades the students performance. Illuminate allows me, as the instructor, to see login times and when students have finished, as well as allowing me to force finish the warm-up. During the hybrid instruction period I used the proctoring interface on Illuminate to document student participation for virtual students - I could share the live proctoring screen to show students who had logged in and who had not. This feature significantly improved participation during hybrid instruction, an issue which was a bugbear for most instructors during the pandemic. I reviewed the answers with the class once everyone had submitted.

Several of the participants had been present for the transition from paper to Illuminate-based warm-ups, and had opinions about both the analogue and digital assessment tools. Icmalius, noting some of the challenges of logging into the Illuminate software each day, observed "it takes a little bit to, like, get into it. But it's not really an issue. Like, you have to go to, like, multiple links to be clicked." Mastusius stated that:

I prefer the paper copies just because I can see what I got wrong. But I enjoyed the

option of Illuminate because for times like last year when we were in COVID, it allowed

us to do what we needed to do, even in our remote scenario.

Orion agreed, stating

I kind of prefer paper copies. Just because you can really physically see what you got

wrong and you have to go back and correct the answers. And because the one thing with

Illuminate warmups, as you see that you've got it wrong, but you don't exactly see what

you put down and what the correct answer is.

Neleus said "I just like writing answers out instead of just, like, clicking a button. I feel like it's

more engaging to write it out." All of the participants who averred their preference of the paper

copies had taken the course before the COVID pandemic. This aligned with my own notes about

the transition from paper to Illuminate: the digital interface seemed to make the assessments

seem distant and impersonal.

While many students preferred the paper copies, several identified positive elements to

the digital interface. For example, Glaucus observed "I like that [Illuminate] gives you your

scores right away so you can discuss them almost immediately." The immediacy of the grading

helped students know instantaneously how they did overall on the content, although individual

questions could not be reviewed easily. Some participants spoke about the transition to virtual

assessments more broadly, as a way to help students focus on course content. Lycaon stated that

"it was a good way to I felt to just kind of get my feet wet with the subjects" then followed it

with the observation that "the idea of having a warm-up then a game is a good overall strategy."

Many of the participants who preferred Illuminate had begun the course during the pandemic. In

my own notes I recognized that Illuminate, while feeling distant, did have improved data

analytics and allowed students to know their score with the click of a button.

Assessment: Establishing expectations. There was a general consensus among the participants that having a short warm-up activity to start each class helped establish the expectations, and helped them review the content from the previous day. There were 16 open codes that noted the role that the daily warm-ups played in helping students understand the expectations of the course as well as modeling the questions they might see on an exam. Icmalius said "I like the routine of it. And you just know every day you have that warm up to do and it can show you where you're lacking." Building upon the idea of the assessment as a tool for self-analysis, Sinis said "it was a good way of putting pressure on me to study the night before and make sure I really learned the material." Additionally, Alcyon noted "It's very effective. It definitely gets me into the zone of 'I'm in...class.'"

Participant opinions about their emotional response to the warm-ups varied. While some, like Sinis above, felt like it put pressure on them, others disagreed. Lycaeon related that "It was good to start the day I felt because it wasn't like the most pressurized environment 'cause it wasn't the end of the world." Because the value of the warm-ups changed over the course of the experiment, student responses were different. For those who had taken the course for four years the warm-ups had been as much as 35% of their grade. On the other hand, the warm-ups during the hybrid instruction year were used exclusively to mark participation and attendance, with no direct bearing on the student's grade. Finally, in the most recent year, the warm-ups were used as a practice grade and only constituted 5% of the grade. These changes in significance to class average of the warm-ups appear to relate to changes in student perspective about the pressure to perform on them. Balus said

It definitely shows me where I am struggling and it helps me understand exactly where

I'm weakest and where I need to improve, as well as where I'm strongest, so it allows me

to build, or it allows me to determine how I should study. For example, if I am strong on

vocabulary, but weak on grammar.

For a student like Balus the feedback afforded by the warm-ups allowed them to develop self-regulated learning through increased awareness of their strengths and weaknesses. Glaucus similarly noted

It gives you a low stakes introduction into the content for the class and, that was in, that

was an issue that I've had with some of my other language classes as we were diving right

in. The way that the warm-ups work is that they are only a practice grade, so you still feel

you still have motivation to do well on them without having that anxiety around it being a

test or quiz.

Some of the participants observed that, while the warm-ups were good general practice,

they were not enough to spur learning on their own. Camesus felt that

The warm ups in combination with the extra credit and homework [help students learn], I

don't think the warm ups on their own would be enough, but if you do all the assignments

then they help.

However, there were other students who believed that the process of taking the warm-ups, combined with a review of the answers immediately afterwards, did help them learn. Hippolyta said "I feel like it does help a little bit. Well, I think it helps more when you see what you got wrong. and see what you have to practice."

My own notes observed how, when speaking with other teachers, they frequently did not know if students were actively engaging in course content. The score reporting and participation logs availed by Illuminate allowed me to quantify student participation in a way which was

lacking for many of my colleagues. This allowed my course to establish and maintain rigorous

expectations at a time when many other teachers complained that they were either watering down

or slow-walking their curriculum.

    Assessment: Using assessments to learn about learning (metacognition) One of the

most attractive elements I observed about daily warm-ups is that it seemed to help students own

their learning, and think about what works for them and what does not. Participants generally

believed that taking a short warm-up each day helped them to know where they stood, and

helped them to think about their own learning. Orion said "It gives you a good kind of evaluation

of where you stand for each of the concepts learned in class."

    Other students recognized how, because they knew that they were going to be assessed on

new curriculum elements each day, it helped to frame learning as something that happened

continually, and not just within the confines of the classroom. Tereus observed "it got me

thinking about [course content] even outside of class." Building on the idea of learning outside

the school, Demiphone responded that

> It definitely helps because I like to study the night before when I'm able to review the
>
> next day and ask questions on a warm-up [about] it. It definitely helps me reinforce it
>
> and, like, know it. It helped me recognize what I know better.

For that respondent the structure of the daily assessments helped them plan their learning and

recognize where there might be shortfalls. Balus stated that

> I feel it's a good gauge of my progress in class. It allows me to gather an accurate
>
> prediction on how I would do on specific portions of quizzes or tests. It is a personal
>
> milestone or checkpoint that you can look at and use it to base your own personal study
>
> plan. If you do well in a specific section, such as vocabulary, but you struggle on a

different warm up, such as grammar, it allows you to more specifically tailor your own study time to focus on the areas that you're lacking, which allows you to perform better on quizzes or tests.

Being able to understand areas of improvement every day was positively received by all the participants. Some of them focused on how the warm-ups helped them develop metacognition, although no participants used that term. Camesus observed that with the daily warm-ups "You know what you don't know. I like that." Along a similar vein, Tereus recognized that "if some people aren't as confident or did well, I think they should have. They can go back and review. So I thought that was a good, like, supplement activity to do after those two." Balus responded that the daily assessments allowed students to identify areas where they were having problems, "and it also allows the student to look at exactly what they missed and breakdown the questions that they missed, so they're able to more effectively study and learn." For this participant the identification of problem areas provided by the daily warm-ups helped students develop a self-regulated learning process.

Central to the development of a metacognitive approach to learning was the immediacy of the feedback. Because students could discover their mistakes immediately, and the warm-ups ended with a class-wide review and discussion of the answers, students felt it helped them learn. Glaucus stated "I like that [Illuminate] gives you your scores right away so you can discuss them almost immediately." While Hippolyta said "I feel like it does help a little bit. Well, I think it helps more when you see what you got wrong. and see what you have to practice."

My own notes about student learning varied with the different implementations. When students were self-grading their daily warm-ups, and having to mark their mistakes themselves, I found them more willing to talk about the mistakes, and try to justify their answers in hopes they

could get credit. That sort of self-advocacy and discussion was not present with the use of Illuminate. Students still asked questions about content, but seemed to accept their grades and were less likely to debate or argue for credit. This is a double-edged sword. On one hand the lack of argumentative debate leads to a more peaceful classroom experience. However, those discussions of content often led to critical realizations for students, and helped make the learning experience more personal.

Grouping Codes

Once students have completed their daily warm-ups I review the answers with the class, discuss any questions about the assessment, and present classwide data for performance. I then give students the choice between three different assignments, based on how well they feel they understand the content. The second group of open codes appeared as participants discussed the process of grouping and selecting the appropriate game based on the assessment. I explored themes from the open codes about student affective response to the grouping process, differences between being assigned a group and self-selecting, and how the grouping process created a personalized learning experience for the participants.

Grouping: Affective response to grouping. Several participants discussed the affective elements of the grouping process done after the warm-ups were completed and reviewed. At that point I asked students to participate in one of three different games, based on their performance and a self-assessment of the knowledge. Students that needed help were in group 1. Students that felt they knew most of the material but had not yet fully mastered it were in group 2. Students that felt they had mastered the material and were ready for something more challenging were in group 3. Some participants felt that the grouping process made them feel self-conscious. Alcyon noted:

In some ways it was a tiny bit degrading, especially if you were in the group that if you were like the lower group it was like, 'oh, you're in Group three or not able to play the fun game,' but it was also effective in singling out issues.

Most of the open codes about the affective impact of the grouping process were positive, however. Glaucus said "I really like that: it's just that students can sort of self assess their own comfort level with the content." Later in the interview Glaucus expanded on the idea, saying

It's not calling students out who may not learn it who may not know it as well as they think they could. So it gives students a chance to sort of admit that they need review without shame. So I like how it's structured.

Phaea concurred, stating

[The grouping process] wasn't, like, condescending or anything. You don't like calling anybody out or anything like that...People, like, they kind of used it as, like, a benchmark of sorts to figure out, like, where they were, and to know what type of practice they need to do.

Neleus shared that

It's not like anyone ever really asked, like, what group are you in. So, I mean, it was kind of, like, I was able to, like, be my own enclosure thing and no one really, like, judged anyone based on what group they were in.

This set of observations largely aligned with my own persistent notes about the grouping process. I generally felt that the anonymity of game assignments was designed so that students would not feel self-conscious. When Alcyon shared a feeling of being demeaned, those feelings were in contradiction to my own notes. I felt this was an area for further exploration. I adjusted my questions in the interviews to add clarifying questions about the emotional response to the

grouping process. The remainder of the interviews did not expose any additional sense of self-consciousness or disrespect. However, this is an important observation which can shape future implementations of DDGBL.

While I proffered suggested benchmarks for each group, students were ultimately allowed to choose the challenge level which they felt fit their needs. The idea of choice had a generally positive response. Orion said "I like how you kind of let us choose. Just because there are days that I might get a good grade on the warm up. Although unfortunately those days are very rare." The participant went on to explain that just because they performed well on the warm-up did not necessarily mean that they felt confident about the material. Allowing students to choose which group best met their needs instead of basing it solely on performance appeared to be well-received. Along similar lines, Demiphon noted

> Not everyone gets group three, a lot of people do group one, two, and three, so it never really felt like I was left out or anything. and it's just based off me, like, what helps me in the future, so I knew I had to study to [the point] where I felt confident.

Some participants related how grouping impacted their emotions as well. Lycaon related that "Because when I miss zero/one I felt great about going to group three, or if I missed seven I was like 'I need to go back and review this.'" Balus stated

> It's very self-directed, which gives the students the ability to determine how strong they are. It also allows some flexibility. For example, if a student did very, very well on the vocab, got a 90 or above and they enter the highest level of vocab game, but they struggle on it, it allows them to drop down a level to something they're more comfortable at, which allows them to realize that there is still some work to do, even though they did very well in the vocab.

Grouping: Assigned Groups vs. Self-Selected. My process for establishing groups changed over the course of the pandemic. During the first years of practice I gave students benchmarks to determine which group best fit their needs. However, when the classroom transitioned to distance learning, then hybrid, the method changed. After reviewing the warm-up and receiving their scores I allowed students to select the group they felt best fit their needs.

Some participants appreciated the structure of benchmark-based grouping, where I told them which grades aligned with which groups. Neleus said

> I think at first I liked having the direction, but once I kind of was able to tell which group I personally belonged in, or like which one I felt comfortable being in. That was nice. So I guess like at first I did, but then, as, like, I was kind of full, more familiar with which group kind of had, like, which level then, I liked being able to tell for myself.

Most of the codes and vignettes about benchmark-based or self-selected grouping tended to prefer self-selection. Icmalius observed "I'm going to get to choose based on which group we think we belong to. And you can move up and down depending on how you feel about whatever game you choose." In support of self-selection Hippolyta noted "I really like that, it's just that students can sort of self assess their own comfort level with the content." In addition Hippolyta explained

> I feel everyone learns differently and grasps concepts in different ways. So, I know that you do three different levels. one for people who don't really know, two for people who kind of know it, three who do know it. So I feel like that's smart, if you see where you are in the group, we have practice.

Camesus summed it up, saying "

> When you see for yourself. There's, you know, maybe one of the questions you just

missed by accident. Maybe one of the questions. Just kind of made a difference and you

ended up in the group that you don't really belong to, whereas. If you picked yourself,

you can know. Really be the judge and see what you need to do.

Eupeithes had a differing opinion

When you're doing something that's based on what the student thinks they might

overestimate, or if they lack confidence in what they're doing under, below, their ability.

But at the same time, if you're going off of just the fact of what they got wrong, or

something was really circumstantial. Or is the question that they knew the answer, but

they just either didn't get around to getting it or didn't quite [get it].

Not all participants agreed on the process of selection, with most believing self-selection

was the superior option, nevertheless a few students suggested that self-selection might

not always lead to accurate results.

My own notes about grouping discussed the change in format from benchmarked to

student-chosen grouping. When students took pencil-and-paper assessments and self-graded I

could walk by and see their grades on the sheet, and I felt that their grade should be the guiding

element in group selection. However, when the pandemic forced students to use Illuminate to

take the warm-ups, it was difficult to quickly assess which groups were best for each student. I

implemented the choice protocols as a result. My own notes about student choice were positive,

particularly since it took the "lucky guessing" element out of benchmarked grouping. More

importantly, having students self-assess their knowledge level after taking the warm-up allowed

them to own their own learning in a way which benchmarked grouping had not allowed.

Grouping: Personalized Learning. Once I provided students with data from the warm-up

to gauge their knowledge, and they had the opportunity to self-assess their learning, the students

would then begin playing a digital learning game with a difficulty which aligned with that assessment. This allowed students to personalize their learning. Mastusius said

> I believe that's a good way to catch up students that are falling behind in a good way to help people that are on level to get a little bit above and to give people that are above some extra work that they can improve on.

Mastisius continued on, explaining that "Most of the time, if I am in Group one, I know that I really need to study it already, which is not very often in Group Two and three are pretty similar in what I need to review it feels like." Along similar lines Glaucus observed that

> The three different vocab games give you a chance to sort of advance your understanding. So if you did well on the warm up and you feel like you understood it, you can do, I think, group 3 go on with vocabulary that you might not know before. And if you need, like, if you need to go review then.

Most students felt that the process of assessment and grouping helped them feel as if the learning experience was tailored to their needs. Phaea noted "it was helpful for people to...figure out the level of practice that they need on the concept or something." While Demiphon recognized that "whenever I do vocab warm so definitely helps when I'm when I'm if I feel I did really well. It helps to do like the higher tier vocabulary for the future but also does help me, like, review the vocab." Balus stated

> In my opinion, they're very, very, they're like a break from school. They allow you to feel very free, almost like an individual, guiding your own learning as if it was asynchronous (like) the year before. It's focused. If it makes you feel like the learning is focused specifically for you.

Since I was customizing the learning to fit their needs, participants felt they could review and

relearn based on their self-assessment. Lycaon said that "That was helpful because like it was...basically redo that lesson which is going to miss seven or more likely. I didn't get it so I had to do it again" For some learners the grouping process was more basic. Eupeithes added that the grouping process for them was a distillation of learning: "because they need different groups of skill. In order to correspond with how well or how bad(ly) they did on the warm up."

My own notes observed how students that were typically slow to participate in other activities often put more effort into DDGBL activities. While the hedonic elements of game-based learning were part of it, my own notes suggested that students also felt that the process was organic and personal. I felt that much of the curricula in other courses was industrialized and impersonal, with learning goals and activities which were "one size fits all." For students who feel that what they do in school does not really pertain to them, having an activity which is a direct reflection of their own opinions about their learning was distinctly different and allowed for increased participation.

Gaming Codes

Central to any exploration of game-based learning are the games themselves. The interviews I conducted provided over 100 open codes discussing the use of games in the classroom. While a variety of games were used, the demands of a hybrid learning environment forced most DDGBL activities to focus on vocabulary acquisition. Participants discussed their responses to Jewels of Wisdom, the most commonly used vocabulary game in the course. Further discussion explored the relationship and alignment of the games with the assessment, and finally participants discussed how game-based activities impacted their motivation to learn.

Gaming: Participant observations about the Jewels of Wisdom. While earlier iterations of differentiated digital game-based learning applied to grammar and cultural concepts as well as

vocabulary, that changed during the COVID pandemic. The demands of online learning and hybrid learning forced a distillation of the method to focus exclusively on vocabulary learning. The Jewels of Wisdom game, hosted by www.cram.com was the primary vehicle for vocabulary DDGBL.

Several of the participants likened the game to Candy Crush, a popular mobile game. Icmalius explained that

> Jewels of Wisdom. It's very popular. And you...it's kind of like candy crush, you have to match the vocab, vocab and then try to get multiple colors, like in the stack. And then you're scored against other people who choose to put your name on the leaderboard.

Glaucus expanded on the explanation, saying that

> It's a matching game. On one side there is a term which is the jewels, and on another side there's the definition. And so you click the term that matches to the definition and and then that'll and then you can match the different colored jewels and it'll give you scores based off of that. But based on your accuracy, the timing and how many matches you make.

Over the course of the DDGBL implementation I used several games in addition to Jewels of Wisdom. Hippolyta explained how several of the vocabulary games worked.

> So we play the Jewels game of Wisdom, I think the name is. It is like Candy Crush. I feel like I can make it really fun, Wordshoot. That game is hard because the ads are in the way but it's pretty fun. We used to play the asteroid game [Stellar Speller], but I don't think we play anymore. I think I like that one a lot. That was fun. Then there's the grammar one, it is basically just like a Quizlet. But I like the wordshoot and the asteroid one we did before.

Balus observed

> Jewels of Wisdom is not specifically meant to be just a matching game. That would be
> much too scholastic, almost very rigid. It's similar to a Candy Crush, wherein if you
> match three or more together, those three disappear and give you points, so it is both a
> game and a learning activity.

Several participants explained why the Jewels game was popular among the students. Neleus
shared that

> For the Jewel game like I was saying earlier how it has, like, the 'applying to real life'
> examples. That was just kind of able to help me because I was able to actually see the
> different words in action and like how they were, how they worked with different things,
> like how they worked with in different examples and I felt that it was a really good like
> learning activity I guess and I felt like I learned a lot from it.

Tereus said "I think that's one of the things I really enjoyed playing because I'm really not the
type of guy to use flash cards. I've never really found them useful."

> While some participants focused on how much fun it was to play the game, others talked
about how it helped them learn. Lycaon stated that "I think the Jewels of Wisdom [game] is
good, like, just for starters, do you get the vocab, like, you know, the words: you know what they
mean." Sinis explained that

> I remember playing the Jewels game. And that was my favorite because of course the
> best...I liked the website itself. It was on cram. And you were able to switch either do like
> Latin and English or the inverse.

Mastusius responded that

> That's a really good way to review vocab, especially since it makes you have to do them

in a certain order. Sometimes you don't have to do them in the exact order and it helps

you assess the speed at which you can do vocab.

Eupeithes added

The Jewels games absolutely set my mind up for vocab I would. If I didn't do the Jewels

game, I wouldn't do good at all in the vocab the next week. But if I did. Then I would

basically get a guaranteed one hundred, so it's very effective, at least in that regard for

basic vocab.

Not every student enjoyed playing the Jewels game. One participant, Phaea, observed

that "I wasn't particularly good at that one. So I didn't really like it, but I mean it was still kind of

fun. It was good practice, but you know, it was kind of a bit more difficult."

My own notes explored different games as I tried to find games which had a good

combination of hedonic and utilitarian elements. Many platforms such as Quia and Quizlet had a

variety of games with high utility: they were not fun to play. Some platforms such as Classtools

provided arcade-style games based off of Pac-Man or Donkey-Kong. These games were fun to

play, but their utilitarian value was low. I gravitated towards Cram as a platform because both its

games (Jewels of Wisdom and Stellar Speller) had both high hedonic and high utilitarian values.

However, I quickly noted that students could score over 1 million points in Stellar Speller and

have a 0% accuracy rating: if you were good enough at the game you could sidestep learning the

vocabulary. Thus I gravitated towards Jewels of Wisdom. Student observations about the game

generally aligned with my own observations: the game was fun to play and helped them learn

vocabulary.

Gaming: Alignment of games with course content. One of the concerns I had with

creating a successful DDGBL curriculum was that I wanted a clear alignment between the

games, the assessment, and course content. I wanted to help students understand the relationship, but to also make the practice purposeful. The participants believed that there was a clear relationship between the warm-up and the games. Icmalius explained "you go straight into the games, and you can see the same vocabulary and work on that. Like, sometimes you'll see the same vocabulary, and sometimes it will be slightly different." Demiphon recognized

> The games are always consistent based off what we…the work we did that morning, whether it was history, vocabulary, or derivatives was. The games are always consistent with it, so it definitely helped.

Camesus said "Mostly related to vocabulary warm ups, but I think. I think they are fairly independent, so that they don't feel repetitive after the warm up, but they just...kind of help." Balus summarized the alignment of warm-ups with games with the following: "the games are effectively the warm-ups in game form."

> While most participants focused on vocabulary learning, others recalled when DDGBL had been used for other content. Neleus said

> So they would, like, have warm-up vocabulary. They would have the vocabulary that...we've been learning. And previous vocabulary that we've learned to kind of like reiterate what we learned in the past. And I didn't mention this earlier. But like the grammar one with, like, the butterflies, that was also one, like the kind of, that was really good about applying what we learned the day before.

Several participants voiced the idea that success in the game would lead to further success in other parts of the curriculum. Mastusius noted "what you get on…the game seemed to reflect how you will do on the exams." Along similar lines Icmalius stated

> It's very good at getting you to associate an English word with the Latin vocabulary

quickly, which is great for translations. Because you have to know, like, very fast because they score you on speed.

Eupeithes disagreed:

Well, I can tell you quite clearly the AP vocab that it usually does not at all, because the vocab that we're learning for the unit seems to be completely separated from the vocab that you'll see in, like, group 3, or group two, group one. Although for those ones I think that specifically, the point I can understand for group 3.

While most of the participants felt there was clear alignment between the warm-ups and the games, it was not a universally held opinion. My own observations reflected Eupeithes' recognition about a lack of parallels between the AP curricular vocabulary and the games. Part of this was because the AP course had undergone a massive reorganization during the pandemic, when I decided to use the official AP syllabus instead of my own, which meant that vocabulary and pacing were significantly different. While I managed to adjust some of the games, not every version aligned with the new curriculum. Group 3 games in particular were aligned with the National Latin Vocabulary Exam, not the AP Latin exam, and the different eras of vocabulary did not mesh neatly.

Gaming: Digital game-based learning as a motivating factor. One of the most attractive elements to game-based learning is a perceived increase in student engagement and motivation. Sinis explained how the students in the class sometimes participated in competitive, collaborative gaming "So you guys could play the game together often and it was, like, nice." Glaucus stated that

After the vocab warm-ups almost all of the vocabulary that we see on the games has been in the warm-up and so we're already sort of familiar with it. And we got an extra chance

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to review on things we may have gotten wrong in the warm ups, so I definitely feel like they relate.

Along similar lines, when playing Kahoot as part of content review, participants enjoyed the competitive elements of game play. Icmalius explained

Kahoot is good, because if you're on the leaderboard, it's competitive. But if you're not on the leaderboard, nobody really knows where you are. So it's not like, your last place or anything. Like only you would know that.

Several participants recognized how the Jewels of Wisdom leaderboard on the game operated as a motivating factor for them. The leaderboard shows the historically highest scores for that particular version of the game. Glaucus noted that

There are leaderboards within the game, with some having the most common score that we have to reach in Latin Class is about 10 or 11 thousand and there are people with like really really super high scores.

Icmalius admitted "if I see the number one [on the game leaderboard] is like 14,000 I feel like 13,500 or something I'll probably play a few extra games…I usually play it like five more times than needed."

For some participants, learning the content for future assessments was the primary motivation in playing the games. Orion said

I feel like they definitely help me learn. just, like, especially for the cumulative vocabulary exams. The one thing that is very difficult is that a lot of the terms look exactly the same to me, some days and the cumulative vocabulary games are just more - there's more diversity in the terms, so it's not all 'I's' or all 'D's' or all. Which is definitely good for when it comes to translations etc.

Along similar lines Demiphon noted that

> I like how they test you on/based off how well you feel like you know the content and
> then. It's always good to have that resource later on, because when you can, like when
> you can come back and study, it feels a lot that you can feel progress when you start off,
> like I didn't feel very good today. So you come back, you start with Group One, then you
> work your way up throughout, like that helps a lot: being able to study that.

Other participants just recognized that they had fun playing games in class. Lycaon said "It was
only class right like we did that consistently. I really enjoyed that part of the class." Balus stated
"I am especially fond of the Jewels of Wisdom game. It's very fun in my opinion." Balus later
added

> I feel like Latin is especially refreshing, because the environment that we learn in is
> incredibly positive and incredibly open. It allows amazing interaction between students
> and there are no major barriers to learning. It's very, very open and very fun.

For this participant the structure of the class, with its emphasis on games, increases
motivation to participate in class, making the course more pleasurable. My own notes
supported this idea, with observations both about those students who came to me
bragging about beating a certain student's score on the high score page, or from
overhearing students share the same ideas with their peers. There seemed, from my
perspective, to be noteworthy crossover in the students who were playing the game for
fun and the improvement of reading comprehension. Quite simply, it appeared they knew
more of the words, so they understood unfamiliar passages more quickly and with more
confidence.

Improvement Codes

Ten open codes from the interviews discussed ways that participants felt differentiated digital game-based learning could be improved. While there were many suggestions and ideas, three central concepts were distilled from the open codes to develop themes for adapting the method. The relationship between the codes and the themes can be found in figure 4.10. One of the more common observations were about issues with structure and technical issues with both the games and the digital assessments. Several participants independently suggested more collaborative learning opportunities within the game-based learning umbrella. Finally, participants suggested a variety of different or transformed styles of digital learning games.
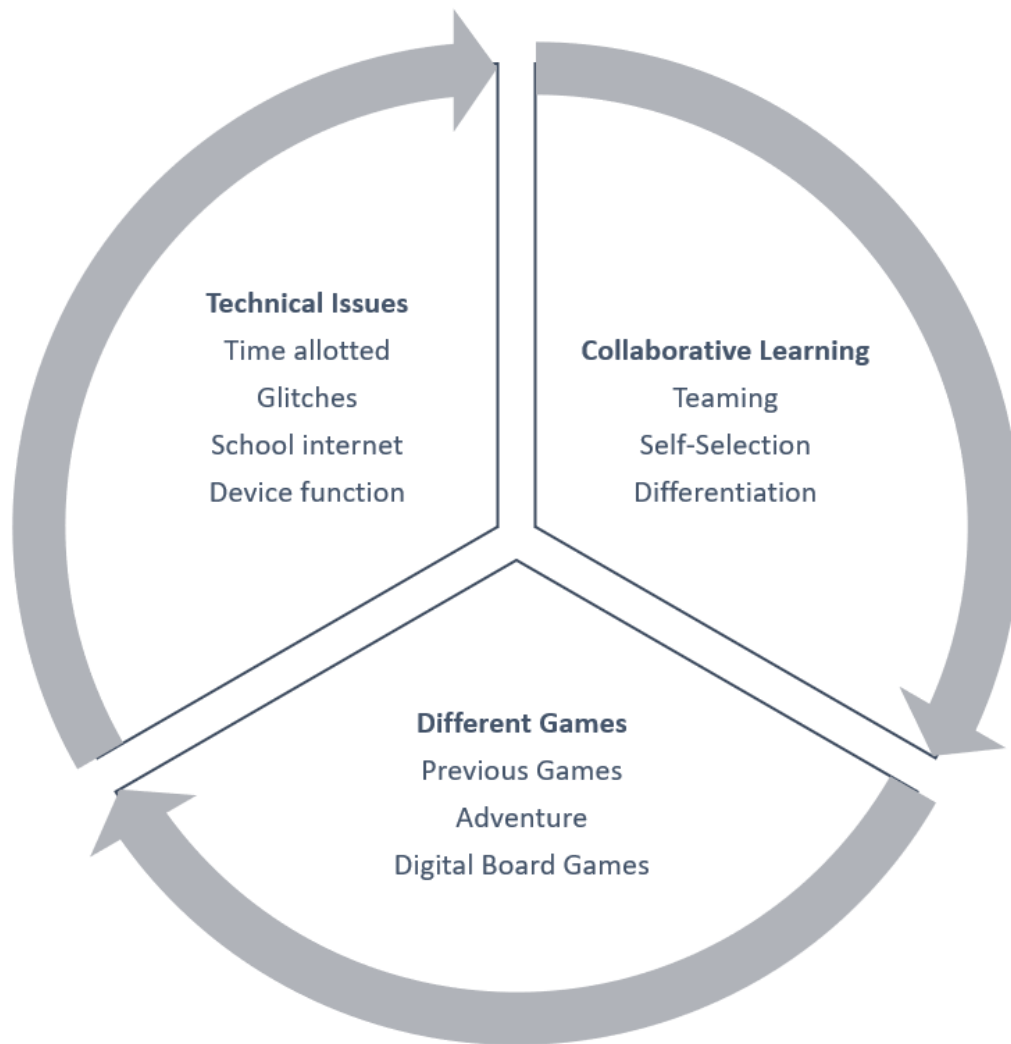
Technical Issues
Time allotted
Glitches
School internet
Device function

Collaborative Learning
Teaming
Self-Selection
Differentiation

Different Games
Previous Games
Adventure
Digital Board Games

Figure 4.10 *Improvement Codes*

Improvement: Improving structure of some games and assessments. Participants had several observations about ways that the process could be improved. One of the most common critiques was the length of time which was provided for the warm-ups. Students were given 10 minutes from the beginning of class to log into Illuminate and complete the 20 multiple-choice question assessment. Some participants felt like this was not enough time. Glaucus suggested "give a little more time for the warmups themselves, 'cause sometimes at the end I feel like I'm rushing a little bit." This was not a universal complaint, however, with some participants suggesting that 10 minutes was too much time. Alcyon made a recommendation to "lessen the time that we have to complete the warm ups."

Technical issues were the greatest area for improvement, based on the number of codes specifically mentioning glitches or not working. Tereus stated "some games, like, it may just not work properly, but I think overall it's pretty smooth." Along similar lines Glaucus observed that

Sometimes they glitch and you clicked the wrong ones accidentally, so it doesn't give you a higher score and that's or as high scores you could get in. That's my only issue with it, because sometimes due to slow Wi-Fi or low battery on the computer you might not get the score that you need.

Only one participant made a recommendation about the grouping process. That participant suggested that the groups be separated into four groups instead of three. Neleus said "Maybe with, like, the vocabulary game there is, like, a fourth option. 'cause sometimes I would feel like I would be kind of in the middle between one and two, or like in the middle of two and three."

Illuminate had a common complaint as a warm-up format: the inability for students to see exactly what answers they missed. Hippolyta observed that on occasion "You won't be able to

see the questions, or you won't be able to see your answer choices, Sometimes the timer says like 15 minutes and you have to have like 10. And then it just submits." Other students noted that Illuminate was problematic, especially when students were using their phone to access the warm-up. Glaucus had the following critique:

> Sometimes...you can't see the questions immediately [on Illuminate], so sometimes, and you can only have the answer portion or the question portion, so sometimes you have to put the questions on the board, but other than that I like it.

Balus noted that "There are instances based not off the illuminate platform, but the school system, where you are unable to access illuminate because it off before you're able to look at what you got as a grade, it redirects you to a [school] platform, but that's more [school] based."

Some participants just had an issue with digital assessment in general. Orion opined that "With digital warm ups, I feel like the biggest problem is not being able to really, not having to physically write down what the correct answer is." Orion noted afterwards that there were problems with paper assessments as well: "The big downside of the paper warm ups was the time it took to, like, actually get the physical papers and having to go through all of the 20-something papers at the beginning of every class."

Another common complaint among the interviewees was the invasive advertisements on Jewels of Wisdom. Because www.cram.com provides the game for free, it generates revenue through hosting ads. Sometimes these ads overlap parts of the playing screen. Hippolyta shared that the biggest problem was "Definitely the ad. Sometimes ads are in the way that you can't see some of the words and overall, I like to go on." Orion expanded on the issue, saying "The biggest issue with...Jewels of Wisdom is the ads. But then you just make the text smaller and it's no longer an issue." Balus mentioned

The ads are very present, but that can be mitigated because if you minimize it you

decrease the size of your screen, the game size remains the same. However the adverts

shrink so your gameplay is not diminished by shrinking the ads.

For many of the participants the realization that reducing the zoom size on the Chrome

browser reduced the ad size significantly reduced the invasiveness of the advertising.

Improvement: Implementing collaborative learning games. Three open codes (teaming,

self-selection, and differentiation) specifically suggested that the learning games could be more

collaborative, including student peers in the learning process. One participant shared how

students could work together on the warm-ups. Phaea suggested "I think maybe if there was one

thing [it] would probably be just if anybody wanted to discuss [the warm-up] with their

classmates. You know, talk about it, talk over it." Another participant also suggested students

work in teams to support one another. Demiphon hypothesized "I guess, if there is a way to work

with other people in your group. So maybe you can collaborate and help each other out."

Participants also acknowledged that there had been changes in the format, and that some

of those changes were an improvement on previous policies. Camesus, who had taken the course

pre-COVID, advised that "Well, honestly, if you asked me in Latin one, I would just say let us

pick our own groups, but right now I kind of like what you're doing." According to this

participant, allowing students to pick their own groups was an improvement from the pre-

pandemic strategy.

One of the participants noted how there were collaborative games used in the classroom,

and expressed how much they enjoyed playing collaborative games. Balus suggested

One of the games that we play is the derivatives game wherein a word is put up on a

screen and the students have to write down as many Latin to English derivatives that

those teams can guess. They foster both a sense of competition inside the class in a team

or a sense of teamwork inside the group.

Collaborative gaming was not paired with differentiated implementations, but the participant

believed an implementation including collaboration would be an area of improvement.

     Improvement: Changing or expanding the style of digital game used. Multiple

participants, while recognizing that they enjoyed Jewels of Wisdom, had suggestions for other

styles of learning games which could be implemented in its place. Mastusius said if they could

design a game it would be "along the lines of the [Jewels of Wisdom] game, but mix it with the

Wordshoot a little bit because the Wordshoot allows you to more...gives you a time limit on it."

Wordshoot is a vocabulary learning game hosted on www.classtools.net which was used in

earlier iterations of DDGBL, but had a problematic implementation when it transitioned to

HTML5 and was removed from the process.

     Two participants suggested games which were digital versions of popular board games or

interactive reading. Icmalius related that one game they would like to see:e

> [I would like to see] Pictionary online. And you're like, like we do it in class. But well,
>
> trying to think, yeah, they gave me like, they give you a word and you have to draw it and
>
> like the computer tries to recognize it.

Tereus noted

> I really enjoyed [choose your own adventure games]. I wish we did it more, but I know
>
> there was likely a long time to iy. We couldn't do it as much. But yeah, I might design
>
> something like that where you kind of explore an area and that would [be an
>
> improvement].

 Balus suggested one improvement of the warm-up process would be

On one of the days where the warm up is not as important, such as perhaps culture where

it's more of a team based activity where students are able to bounce ideas off of each

other. So if it's grammar and most students are specifically struggling, another student can

point [it] out."

Later Balus suggested a format such as this "It allows the student to kind of more directly see

peer-to-peer exactly what they're missing."

One participant suggested using a platform other than a laptop or tablet to initiate

DDGBL. Phaea recommended "Probably be like some sort of console game as a lot of people

prefer to use like oh consoles. Or maybe their phones PCs I guess." While another recommended

increasing the number of interactions available. Demiphon offered that

I guess it would cover, like, all types of ranges of questions like matching multiple

choice. That's why, like Quizlet, 'cause you can. Some questions have to spell it. Spell it

out yourself. So a lot of words are, like, really similar in Latin and helps…you to

recognize, like, certain parts of the word. Like if you know how to spell it, that definitely

helps recognize it in the future.

The participant believed that games involving more than the recall of vocabulary definitions

could improve student vocabulary acquisition.

My own notes about areas of improvement were significantly different from those of the

participants. For example, I observed that the AP Latin vocabulary warm-ups did not dovetail

neatly with the vocabulary DDGBL activities, and either the vocabulary lists and warm-ups

needed to be revisited, or else the games themselves needed to be updated. While I did have a

rudimentary adventure-style game exploring the Roman baths, I had noted that the effort level to

update the game was not commensurate with the learning from playing the game. Simply put: the

game was fun to play but did not appear to make a measurable change in student knowledge about Roman baths. Many of my notes focused on improving score reporting, and finding a better way to observe student scores. As it currently stands with Jewels of Wisdom, students need to take a screenshot of their score to show they have achieved the goal. This is not ideal, and leads to additional problems with sending those screenshots.

Atlas.ti v9 Analysis Result

Fifteen interviews were examined using the Atlas.ti v9 word frequency query, after manual coding was used to expand ancillary themes. Word frequency queries using a variety of ranges were executed in order to explore the interview transcripts for differences within same-word queries. Additional queries were implemented to excavate similar word groups as well as *hapax legomenon* (a term where only one instance was transcribed). The results of the word frequency queries can be found in figure 4.11. Certain high-frequency words that were not tied to the study (such as "the" and "like") were omitted from the results. After removing non-content based diction, the highest resulting word from the study was "do" with "game" and "games" as the next most frequent. When "game" and "games" are combined they occur a total of 420 times, while "do" occurs 299 times. The words "game" and "games" were most frequently paired with the word "play." A total of 12 Selective Codes were revealed through Atlas.ti and manual analysis: these codes can be found in figure 4.12.

EXACT
Game/s
Do
Think
Warm-Up
Feel

SIMILAR
Play
Work
Credit
Kind
Activity

BETWEEN
EXACT/SIMILAR
Game/s
Practice
Question/s
Activity
Know
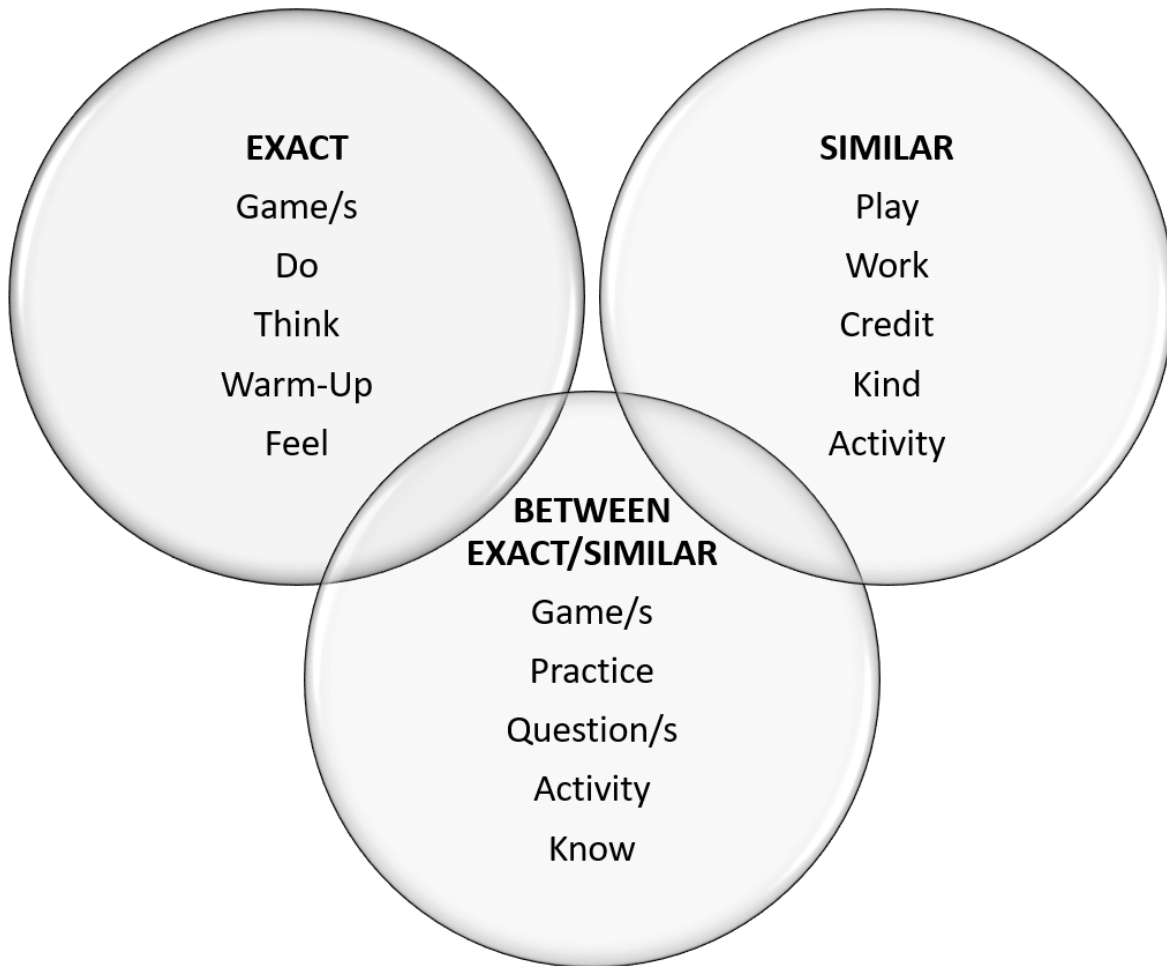
Figure 4.11 *Atlas.ti v9 word frequency list*
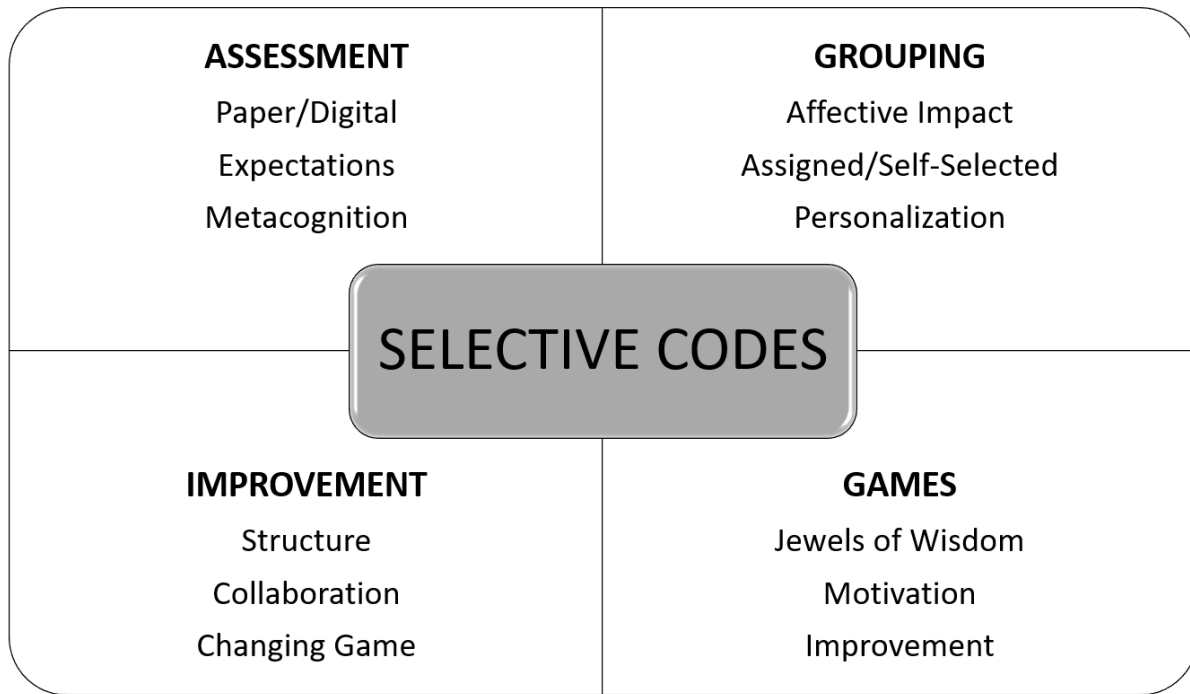
Figure 4.12 *Selective Codes*

Summary of Theoretical Coding Results

I excavated five critical themes using the mind-mapping and Atlas.ti v9 analysis tools, combined with manual coding. These critical themes can be found in figure 4.13. My use of the mind-mapping software allowed for deeper understanding of the relationships between open and selective codes, resulting in a more robust set of theoretical codes. The highest frequency selective codes provided the original basis for theoretical coding, which was then distilled through application of open code connections. The themes which resulted from the theoretical coding process were the following: (a) both gamers and non-gamers enjoy game-based learning, (b) students value well-designed learning experiences, (c) gaming platform stability is critical to successful implementation, (d) affective responses to DDGBL must be acknowledged, and (e) feedback immediacy in assessment and gaming encourages metacognition. I have provided a list of critical themes in Appendix C.
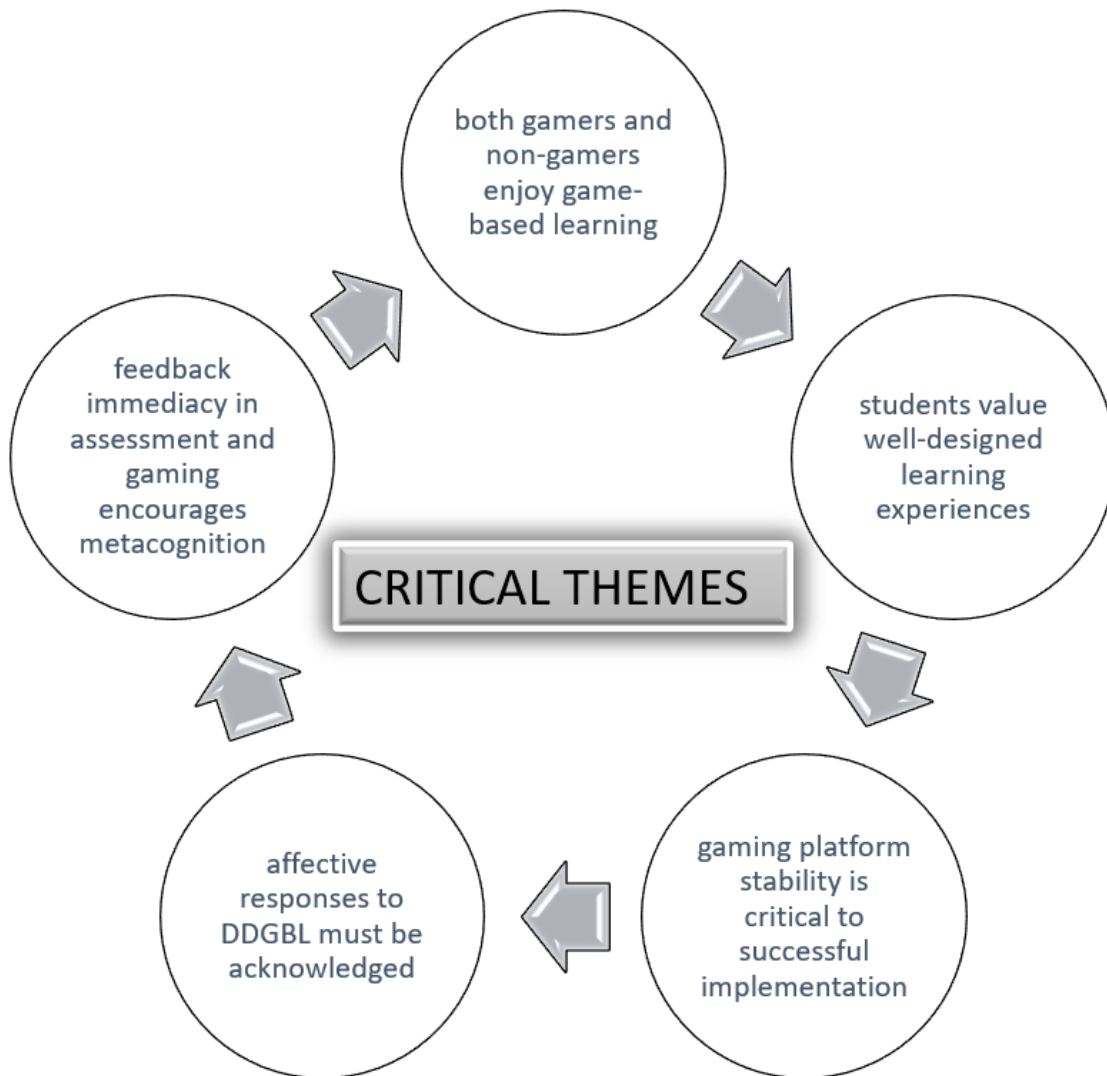
Figure 4.13 *Five critical themes*

These themes resulted from open and selective coding relationship review. The first two -

that (a) both gamers and non-gamers enjoy game-based learning and that (b) students value well-

designed learning experiences - deal with individual experiences, connecting on individual

experiences. The last three - (c) gaming platform stability is critical to successful

implementation, (d) affective responses to DDGBL must be acknowledged, and (e) feedback

immediacy in assessment and gaming encourages metacognition - are selective codes which

align with best practices in the implementation of a differentiated digital game-based learning curriculum. The codes then transition from individual experiences with DDGBL towards a broader understanding of the critical elements needed to create a program which will be successful, including key provisions dealing with shortcomings in various iterations of the implementation.

Individual experiences provide insights into larger patterns of interaction. Best practices and policies emerged over the course of the open and selective coding process, distilling into these five central themes as part of successful classroom structure. The fourth theme (affective responses to DDGBL must be acknowledged), for example, emerged as some participants suggested that they felt self-conscious during the grouping process, while others noted that the self-selection strategy used during COVID removed some of the stigma.

The final theme (feedback immediacy in assessment and gaming encourages metacognition) touches on the central ideas which surfaced during the research review as well. DDGBL allows students to take ownership of their learning processes, while also making them more cognizant of their learning. Central to the development of this metacognition is the immediacy of the feedback offered by both the daily warm-ups and the digital learning games. An expanded discussion of these five themes is offered below.

Theme 1: Students enjoy game-based learning

The word "like" was the most commonly occurring word across all interviews. Many of the occurrences were used as pause-words for students and, as a result, were removed from analysis. Still, the verb "like" was used in every one of the interviews, with the noun "fun" showing up in 86% of the interviews. For all interview respondents game-based learning was positively received and was reported as something they enjoy. Top individual responses

frequently paired enjoyment of the game with learning.

There were a variety of modalities expressing pleasure with the use of games within the classroom. Multiple participants admitted to playing the game for pure hedonic reasons, or playing just for the fun of playing. Others expressed interest in using the games to help them learn, but that the games made the learning process more enjoyable. All participants agreed that they enjoyed game-based learning: none of the participants mentioned disliking the games, although they did criticize elements of gameplay that were frustrating to them.

One participant explained how they would play the game outside the boundaries of the classroom, often getting other friends to play with them, to create an extramural collaborative, competitive environment. Tereus admitted

> Sometimes I would go to school early with my friend, like [student name], and we both do the game just to get those points ready for class and that was really fun and I feel like I actually learn the vocab a lot quicker with that 'cause you just do it over and over again. You don't really think about it like it is studying, more like a competitive game or something fun.

For this respondent the opportunity to compete with a peer made the game more pleasurable to play.

Another participant enjoyed the games, but intentionally chose easier games from earlier in the curriculum as a nostrum for boredom. Neleus said "honestly, sometimes if I'm, like, super bored, I'll go on to the Latin one page and then just do the vocab warm-ups like the vocab game." This participant established the idea of playing the games just to pass the time, and specifically playing games which were not connected to current course content. Eupeithes added "getting that knowledge in the head through something that's enthusiastically fun or just not a chore is very

beneficial. I know it's helped me a lot in my class."

Several participants professed that they were not gamers, i.e. they did not play video games for pleasure. Yet even among these students the game-based learning resonated. Alcyon proudly stated that they did not have time for video games. However, they still admitted that "I full-heartedly enjoyed the Jewels of Wisdom game much more. It was extremely effective in my understanding of Latin and just basic vocabulary. It was very enjoyable to play the game." This interviewee expressed appreciation for both the function of the game, i.e. to learn vocabulary, as well as the hedonic value of gameplay.

Demiphon also was not one to play video games, but when asked about games such as Jewels of Wisdom said "I think I like the vocab one, the most. The matching is definitely, like, the most helpful and fun for me." For this respondent the combination of pleasure and utility created a value-add for the learning game. Camesus, who was also not an avid video game player, said "if you don't do it, it doesn't hurt you. But if you do it, then you may get extra points on the test, so I, like...basically I like that concept." This participant enjoyed the paucity of consequences and the freedom to fail afforded by the learning game, despite not identifying as someone who played video games for fun.

Some participants focused on the challenge of the games themselves, and the satisfaction they got from beating a previous high score, or getting further in the game than they had before. Neleus noted "Stellar Speller...the rocks start coming faster at you and you have to think a little bit better, a little bit faster about it. So I just like having this challenge." For this interviewee the hedonic value found in game difficulty appeared to lead to increased enjoyment. Some participants suggested the ease of access afforded by the games made it less of an inconvenience, and thus an attractive method to improve learning. Eupeithes shared that

[Playing games to learn is] definitely more fun and would help a student drive to do it, but It's debatable whether or not it actually helps me more than writing it down. I just want to do it more because it's less of a pain to do it.

The organization of the games to align with content, and the ability to organize and access those games on both the class website and the digital lesson plans increased the likelihood that the participant would actively review course content. This seemed to go hand-in-hand with my own notes, where I observed that having a website with games organized by unit seemed to help students who struggled with organization, and by extension motivation. Having the materials already organized and prepared increased accessibility and the likelihood these students would play the games.

Theme 2: Students value well-designed learning experiences

Developing assessments which tie tiered gaming experiences tailored to individual needs is time consuming for me: it took a variety of skill sets for me to implement DDGBL. Just creating the games was not enough - I had to design a platform which made it easy for students to access the games at the appropriate time. There were 6 games per unit, and 48 units over the course of Latin 1 through Latin 3, meaning that there were approximately 300 games available -- and that was just for the Jewels of Wisdom game. Technology in the classroom does not always function correctly, and students are frequently engaging in digital course content on a variety of devices and operating systems. Participants in the study reported that they valued the relatively seamless integration of technology tools. Responses, while generally positive, fell into two different groups. One group tended to focus on the importance of the assessment, while a second group of codes discussed the importance of the game.

Participants who communicated a sense of satisfaction with the assessment frequently

framed their response in terms of learning and review. I taught course content on the previous day, and the warm-up was intended to assess how well students understood the previous day's lesson. For example, if we unpacked vocabulary on a Monday, the warm-up and DDGBL activity would be on Tuesday. Participants seemed to both understand the role of the warm-up as a review tool as well as its importance in owning their learning. Tereus noted

> I think it was a great way to start the class. It definitely, like, before every class. I would have some topic that I think about already before. OK, anything about culture or any vocab before class and it got me thinking about [course content] even outside of class.

The participant believed that having a review assignment at the beginning of class helped students frame their learning and supplied a vehicle for consideration of curriculum outside the classroom.

One participant considered the assessment as an intermediary between lessons. Because the previous day's lesson was assessed at the beginning of class, participants appreciated how the two elements intersected. Demiphon stated "I think it's a good review [be]cause usually we go over...what to cover the day before when we go over the next day." The connection between the previous day's lesson and the current day's assessment was perceived by the respondent as an excellent review opportunity.

During the experiment, once students completed the daily warm-up, the answers were reviewed with the class, and students had the opportunity to ask questions and receive further explanations if they were unsure why they missed an item on the assessment. One respondent explained how this was a helpful practice. Neleus observed that

> If I didn't understand the question, [the teacher was] really good about explaining it and making sure that I understood what was going on and I feel like it kind of, like, reiterated

again like what we were learning the day before.

Allowing students to ask me questions and receive immediate feedback was perceived by the respondent as effective classroom practice.

Some of the participants seemed to put a high value on the assessment as a means to provide feedback and redeliver curriculum. The combination of feedback and the opportunity to ask questions about what they did not understand was perceived by these participants as helping them learn the course content. Other participants put elevated esteem on the integration of game-based learning. The creation of digital games which mirrored the content from instruction and reading was reported as helping them feel as if the participants were active parts of the learning process.

One participant shared how the process of instruction paired with warm-ups and game-based learning made them active participants in the learning process. Lycaon shared that game-based learning "definitely made class more engaging and like I wanted to learn information more definitely then like if I was just like you know reading off of paper or study guide." Developing an integrated system for review and remediation was seen as making the course more engrossing than instruction alone would have been. Along similar lines Eupeithes suggested that

> One of the big problems that I think students have with studying is that. It's not that they don't want to do well, or that they don't want to study, it's that they don't want to have to work to get the material to study.

The organization of course materials into engaging, game-based review made this participant more likely to study.

Another participant noted that other instructional strategies for learning vocabulary were not as engaging as game-based learning was. They specifically discussed how the Jewels of

Wisdom game was an improved tool for content redelivery. Camesus stated that "the Jewels game: I think it's better review than, say, flash cards because it's not so mundane." The participant revealed that a game-based learning system, even if it was based off of a flash card model, was still better for their learning than flash cards alone. While speaking about Jewels of Wisdom Lycaon mirrored the observation from Camesus, sharing the opinion that "they're great. I mean they're just good. I think those were just a good basic review. Like, do you get this concept?" Having a game which could quickly and immediately give feedback allowed the participant to self-assess whether or not they had content mastery.

Interview participants often used the term "fun" to describe the learning experience. The term "fun" showed up in 45 paragraphs over the course of the interviews. One participant explained the difference between a traditional assessment and game-based learning. Hippolyta shared that "I feel like the warm ups are more like a straightforward pen-and-paper test but the warm ups - I mean the game - it's like the warm-ups with a little more fun to it so you actually learn it more." This participant felt that the daily assessments were a more traditional instructional method, and were not as pleasurable, while the game-based learning activities were both more enjoyable and, as a result, more effective as a content delivery model.

Theme 3: Platform stability is critical to successful implementation

I found there were many pitfalls to developing a successful differentiated digital game-based learning activity. Many of the participants provided critique of various games used in the processes, as well as providing suggestions for improvement. One of the most common criticisms dealt with technology issues. Some of the interviewees talked about specific technical issues with specific games, others discussed the importance of having stable games more broadly. Finally, a few participants identified systemic issues with game-based learning in the

classroom, particularly the issues associated with the variety of devices and operating systems being used to access the games.

Some participants mentioned issues with specific games. Several of the games had functionality issues which became problematic over the program's implementation. Neleus noted

The Jewel game: that one's really nice and then I don't know if it was like this was an actual Group One that we did like the 1-2-3 group. We played the Stellar Speller. That was a little bit more challenging for me, because...spelling is not my forte. And then we had the Word Shoot, but then that one just kind of failed because the website crashed.

The website which housed, Classtools.net, was noted by the respondent as being problematic and prone to lagging or failing to load the game.

The Illuminate platform was used by the students to host the daily warm-ups. The use of Illuminate began during the hybrid instruction model mandated by COVID amelioration efforts. One participant noted that Illuminate, while multi-platform, frequently did not function correctly, especially for students who were using their phones to access the content. Balus recognized that

There are occasions when Illuminate the content doesn't load as in the actual test.

However, that is often rectified by the teacher having the test up on the board, which does mitigate that sometimes.

For this participant, my ability to share my screen on Teams allowed them to see the questions on the assessment when they would not load on the assessment platform. They also recognized that it took additional mitigation efforts on my part to troubleshoot issues of this sort.

One of the interviewees recognized that certain games, while fun to play, did not necessarily improve student learning. Camesus lamented that

In that game [Stellar Speller] most of the focus is just on your reaction in not yet your

actual Latin skills, so I didn't play that game at all. I only played it like three or four

times, maybe, maybe so.

This participant reported that games which relied heavily on student game skill rather than

content knowledge were less valuable to them, and therefore were played less often. Eupeithes

noted that the pressure to perform was a distraction, saying "Your mind might be more focused

on and finding the answer to get the high enough score instead of finding out what the answer to

these questions are."

However, not all participants agreed. A different participant explained how speed-based

games were more fun to play, and therefore helped them learn more. Hippolyta shared that "I like

more interactive games to get better high scores, like the WordShoot and then [Stellar Speller],

those are the ones that help me the most." For this participant the high level of skill needed in

those games increased the hedonic value, and encouraged repeated gameplay, which meant more

review of the concepts and increased learning.

Some of the respondents observed that technical issues were not necessarily on account

of shortcomings on the part of the game host, but instead revealed systemic issues within the

school itself. Balus complained

The biggest problem that I have with the games is...the loading time. Which is more a

symptom of lackluster Internet at the school and not the games themselves, because when

the games do load, there is very very little lag.

This respondent noted that school internet connectivity was often symptomatic of poor digital

learning experiences.

The school system in the study was a one-to-one district, meaning that each student was

issued a tablet, Chromebook, or laptop at no expense. However, some respondents expressed

dissatisfaction with the equipment. Eupeithes expanded on this idea, saying

> The school issued laptops: they usually cannot run the games smoothly, which kind of
> lowers, or it's just a kind of annoying, and gets that mindset of just annoyance when... the
> page just won't load and you go in with an irritated mindset, and you're focused, and
> you're rushing trying to get this done, and so the information doesn't get absorbed into
> your head as well.

This respondent, who identified as a gamer in the same interview, was unhappy with the speed
and response time of the school-issued equipment.

> Several participants noted that the system could be abused by cheating. The cheating
focused either on the assessment or on the games themselves. When discussing potential
cheating during the digital assessment Eupeithes noted

> [When it comes to cheating] they could easily hide what they're doing with a laptop
> instead of a paper. They'd have to pull out a laptop or some kind of phone. But on
> Illuminate they can just open another tab and look it up.

This student felt that the web-based digital assessment gave other students more opportunities to
use web resources on the assessment without opportunity for discovery.

> Another participant was more concerned about students cheating on the games,
specifically Quizlet. Alcyon stated

> With, like, the Quizlet people do cheat. I will tell you that. I've seen like even like [female
> student name], like, I've seen her, like, doing that. I will also let you know that a lot of the
> time people don't translate.

This participant had seen other students cheating firsthand, both on digital learning games and on
the in class translation assignments.

Theme 4: Personalization of activities makes learning more meaningful

All participants were asked why they felt I provided three different assignment options after taking the warm-up. The majority of the interviewees expressed positive opinions about having an assignment which matched their personal learning needs. The responses fell into three basic camps: (a) the differing levels of gameplay allowed for an individualized approach to coursework, (b) the personalized opportunities for growth allowed them to learn content better, and (c) that the different levels allowed them, on their own time, to advance to more difficult games at their own pace.

Many participants spoke about the individualized learning experience afforded by DDGBL. One participant observed how having different games catered towards individual needs. Tereus suggested "Instead of giving everyone the same activity, you would cater that towards their performance and then give them the best." The customization of the learning experience towards a difficulty appropriate for each individual student was viewed as a best practice.

For another participant, there was a sense of belonging within a specific group. Neleus said "I like being in the second group. I feel like that was a pretty, like, nice in between, sort of. Just like just knowing the vocabulary and then applying it. It was a nice little, like, 50/50." Because this participant felt like they had a basic grasp of the course content, but was not at a place where they were ready to learn something new, they felt like there was a class activity which resonated with their needs, providing a sense of comfort.

Several participants just recognized the relationship between assessment performance, grouping, and game selection. One respondent explained why they thought this would be a good practice. Phaea observed that "different groups of people would probably need, like, different

levels of practice based on how much they already know." This respondent recognized the relationship between expressed knowledge and potential knowledge for those in the classroom, and how different groups could meet those needs.

Exploring the relationship between having three games and meeting the specific needs of the learners Lycaon simply stated "I felt the three groups specialized it better." For this participant the idea was that learning could be made special and specific by establishing three different groups. Another participant explored the idea of specialization more fully. Balus expanded on the idea of customized learning, explaining how it allows them to tailor their own study plan.

> If they feel somewhat weak on the issue, such as, oftentimes, they calculated they can play one of the games, which is slightly easier, [and] allows them to study the core. The fundamentals of what they're weakest as well, not stretching into the more advanced topics, and it also gives them a good confidence boost, as these easier games let them do better. So they can see themselves improving, which then gives them the confidence to begin to move up.

For this participant the idea was that course content was curated and specialized for student needs, meeting them where they currently are in the course, but guiding them towards greater learning.

Several participants noted how the combination of assessment, feedback, and gaming helped them become more aware of their own learning, and allowed them to learn more as a result. This is a learning pattern frequently associated with metacognition. One respondent noted that the level-based learning helped them to grasp concepts they did not fully understand before. Demiphon recognized that "I definitely felt more prepared in the future and I was able to

recognize these future words. And I didn't feel like I did perfectly. Definitely helps to review

stuff on your level. Help you get there." For this participant any perceived shortcomings in

knowledge could be addressed with customized review content in a game-based learning system.

Another participant observed how the game-based learning format made it easier for

them to learn, particularly when learning shortfalls were identified, or stress-tested. Eupetheis

said

> The warm up gets our mindset on the topic that we're going to be learning in checks to
>
> see how well each student learns. It divides them into groups based off of their
>
> performance in order to stress tests and find their weaknesses in it and help them grow
>
> enough to where, when they get into that pen and paper lesson that you teach, they can
>
> absorb it better.

The assessment, grouping, and gaming process helped students identify weaknesses, according to

this respondent, and then set up the foundation for greater learning later in the class period.

A final group of participants shared how they had changed the differentiated game-based

learning system to meet their needs by allowing them to scale the difficulty of the games without

instructor guidance. For these participants the idea was that they would master the game which

was appropriate for them first, but then they would move on to more difficult ones, often outside

the bounds of the classroom. This self-guided tour of the different games was not part of the

course curriculum, but access to the tiered gaming system allowed them to transform the system

into something that met their individual learning needs better.

One participant framed the use of self-guided game scaling as a solution for poor

performance on assessments. Glaucus said "some vocab warm-ups I haven't gotten the great

grade on, and both being able to see the grades immediately on Illuminate and having those three

options, I could go back and review." For this student the access to the different levels of the game could help them improve upon any content detriment which had been exposed by the warm-up assessment.

For another interviewee the sense of accomplishment from completing an easier game gave them the confidence to try harder games afterwards. Lycaon noted that "Once I felt pretty good about the topic and then I was like really a challenge like it was like 'OK I can go to the next level of this." In many ways this participant was gamifying the in-class gaming experience by thinking of each game as a higher level: successful completion of one level led that student to believe they were ready for the increased challenge of the next one.

Another participant acknowledged going the other direction, and changing to an easier game if they found their initial placement too challenging. Orion admitted

> It really just depends on where you stand with the concepts. Some days I do worse than others. But like yesterday was a great example I did do relatively well on the exam. I attempted the second Group 2 game and then I realized that the odds of me going anywhere with that was very slim, unfortunately. So I went back to the original one and then I had some spare time towards the end, so I went and attempted the second group.

For this participant, the ability to change the difficulty of the game allowed them to self-assess and change the level to one which was more appropriate for their needs. Then, once they had gained the appropriate knowledge, advanced to the original placement with more success.

Theme 5: Feedback immediacy in assessment and gaming encourages metacognition

Many of the participants framed the process of assessment, grouping, and gaming as both making them more cognizant of their learning level, but also more aware of their learning processes and the relationship between preparation and success. Awareness of learning is known

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as metacognition. Participants used the word "speed" five times over the course of the interviews, but the word "fast" only appeared one time. While the participants never used the term metacognition in describing their responses to DDGBL, many of their responses were suggestive of improved metacognition.

A key element to improved metacognition among the participants was the immediacy of feedback afforded by DDGBL. Because students discovered they made mistakes the moment they made them, the time between the error and the feedback was immediate, and allowed for faster correction. For the participants they often referenced speed as a factor.

One participant noted how quickly the games allowed them to understand the definition of words, and which words were problematic for them. Glaucus said "how you do in the game and how you do in the game in class is not based on how the game works, it is based on your understanding and speed with understanding words and questions." For this participant there was increased cognitive load and faster response time developed through gameplay.

Another respondent made an observation about how DDGBL created a situation where students needed to consider and come to grips with what they did and did not know. Camesus recognized that "the idea that you know you take care of what you think you need to take care of basically. Do what you think you need to do to be successful." This respondent believed that a better understanding of their own learning, and how that learning impacted curriculum goals, was an important element in DDGBL instruction. Along similar lines a respondent described how the assessment and grouping strategy helped to establish checkpoints for learning. Hippolyta explained that "I like it a lot because you see where you are and where you stand, and what you have to practice, and it helps you get stronger and you can reach different checkpoints to another group." The respondent believed that DDGBL helped them become a better learner,

but also helped them achieve greater checkpoints in later iterations.

The relationship between the previous day's lesson and the current day's warm-up was of particular interest to one interviewee. Neleus said "especially like last year and like in the past years, whenever you do the warm ups, it's like a really good reflection of the class work from the day before." The relationship of the previous day's lesson with the assessment, grouping, and gaming strategy was perceived by this interviewee as being closely aligned, and, as a result, improving student learning. Yet not every interviewee was as certain about the effectiveness of having the warm-ups cover the previous day's content. One interviewee, in particular, felt that the warm-up and gaming system should be a prequel to having the assessment content taught in class. Eupeithes said

> It does a good job of getting the mindset into the class. Usually the problem is I feel as though it sometimes distracts from the major things that we're trying to do in the day. When there's a big topic, it kind of seems to take up time usually, but at the same time it can get you into the flow of working and just get ready for tackling a big topic because you need to be set in the mind for that.

For this interviewee the time commitment of assessment, grouping, and gaming took away from time that could have been spent addressing major content concepts.

The ability for students to review the answers to the assessment, and ask clarifying questions was highly esteemed by one participant. Glaucus shared that " if I miss some questions and have questions about what I miss. I always feel like I can ask questions about those things that I am not understanding or didn't get exactly right." The ability to get answers to uncertainty on a daily basis helped the student feel more comfortable with asking questions.

Sometimes student learning can seem ephemeral, and what works on one day does not

always work the next day. One respondent explored how the changing nature of the game forced them to change their strategy for learning and being successful. Mastusius observed that

> The Jewel game, for instance, If you get the word wrong it gives you a chance to redo it after doing another word, but it doesn't just let you choose the word over and over again. So you can move on to another word and it gets one definition of the way.

The ability to make a mistake and receive feedback was helpful for learning, but it was not necessarily enough to make winning at the game impossible.

The immediacy of the feedback in the games was an attractive quality for some participants. One participant, in particular, went to great lengths to explain how game feedback could help them to review basic concepts, and even move into more challenging content outside the confines of the classroom. Glaucus noted that "I could see where I was. Go back and review with the first game and then, when I felt like I was comfortable with that, move on to the second or maybe even third." Later Glaucus explained how

> Usually there are some words that I know already and some words that I am not sure about. But it'll tell you immediately when you get something wrong and just doing it over and over again and getting a higher score each time is really motivating, and it helps me.

The speed at which feedback was provided helped this participant, in their opinion,
make course corrections while playing the game, guiding them towards a better understanding of the material, as well as increasing the speed of recall.

Additional Data Collected

Not all participants engaged in DDGBL in the same way. Because the process changed over the years, particularly during the 2020-2021 school year on account of COVID, the ontology of differentiation and gameplay varied based on class level, age, and school year.

Students who did not take the course during the 2020-2021 school year experienced DDGBL in a face-to-face environment, while those who did experienced it in a hybrid course. In the hybrid classroom some students were taking the course synchronously online while other students were in a face-to-face environment. Previous to the pandemic my students took all the warm-ups on paper and self-graded.

Year	Format	Student Access
2018-2019	Face-to-Face	Pencil Paper (Analog)
2019-2020	Face-to-Face > Virtual	Transition to Digital
2020-2021	Virtual > Hybrid	Full Digital
2021-2022	Face-to-Face	Full Digital

Table 4.3 *Classroom Experiences*

The variety of experiences for the students in the hybrid environment required that a few significant changes be made in the DDGBL process. One of the most significant was that DDGBL was used exclusively for vocabulary learning during the 2020-2021 school year. Previous years had used the method for cultural, historical, and syntactic learning as well. However, the need to simplify the process, as demanded by the challenges of hybrid teaching, meant that only the most fully developed DDGBL resources could be leveraged.

While the variety of different experiences can make quantifiable improvements difficult to assess, those same variances provide some insight into best practices that were successful in the eyes of the participants, as well as practices which were less effective. The goal is to improve on the DDGBL experience, and a broader range of experiences within the DDGBL phenomenon allows for a broader range of practices.

Evidence of Trustworthiness

Credibility. This project included several strategies to establish credibility. First and foremost, the research underwent a rigorous approval process with both the International Review Board (IRB) as well as the local school system. Part of this approval process included assurances that participants would be safeguarded in terms of their anonymity as well as insulated from repercussions for taking part in the interviews. All students were given a paper survey to indicate interest in participation: those who responded were then contacted privately via email and given documents for parental consent, student assent (for those under 18 years of age), or student consent (for those over 18 years of age). All respondents were randomly assigned pseudonyms to help protect their identity, and access to that pseudonym list was only available to the researcher and the three person panel approving the research. This is in alignment with the strategies established in chapter 3. Consent and assent forms are available for review in Appendix A.

Whenever participants have a relationship with the researcher outside the scope of the research project additional measures must be made to insulate participants from any potential negative consequences from the interview. All participants were informed that the process was entirely voluntary, and that they could leave the study at any time without consequence. The language protecting the respondents was included in the initial survey as well as the consent/assent forms. The information was repeated in the preamble of the interview script. The assent and consent forms can be found in Appendix A. The interview script and subsequent amendments can be found in Appendix C.

Five of the participants in the interviews were high school graduates who had taken the course for a minimum of three years, and had participated in a variety of different implementations of DDGBL. The practice varied from year to year, particularly during the 2020-2021 school year, where the school undertook a hybrid curriculum, with students taking classes

from home and at school simultaneously. The majority of the graduates had not experienced

DDGBL in a hybrid platform, so their observations are based on pre-COVID protocols. These

observations are critical because they show varying implementations of DDGBL, but also

because these students, as graduates, no longer had qualifying relationships with the teacher-

practitioner, and could be more honest about things they had not found useful.

Transferability. Grounded study research projects are not designed to create

generalizations about the content area, but instead are expected to be a deep dive into the lived

experiences of the participants, with the hope of producing transferable finds. As a result there

was little external validity, or generalizability, in this study: discovering broad truths which can

be applied in a variety of situations was not the goal of the study. Instead the goal is to document

the experiences of those who have participated in DDGBL in a language learning classroom in

hopes of improving the implementation of DDGBL in later attempts. The information I have

gleaned from these interviews and my own persistent notes will allow me to improve my own

practice with my students, but can also help me implement DDGBL for fellow educators in my

building, in my school system, across the state, and hopefully nationwide.

While the central focus of my study was an examination of language learning in a Latin

classroom, I believe that the skills developed using DDGBL are transferable into other content

areas. Ultimately developing functional vocabulary use is a critical skill in ELA classrooms as

well as the sciences, and even in mathematics and physics. The fundamental mechanics of

assessing, reviewing, grouping, and gaming could help students understand the definition of a

polynomial in their algebra class or the definition of acceleration in a physics class. Anywhere

that flashcards could be used to help students learn concepts, those cards could be digitized and

gamefied using the Cram.com website. That broad application of learning extends beyond just

language learning into any curriculum which requires specialized vocabulary.

Dependability. The dependability of this study hinges on the relationship between myself and the students who participated in the interviews. Having a pre-existing relationship with the participants is a double-edged sword. On one hand, because there is already familiarity between interviewer and interviewee, it allows for a level of trust and intimacy which is difficult to achieve otherwise. However, that relationship also means that participants might have worried about my affective response to their interview. Several safeguards were put in place to assure the respondents that their information would both be kept anonymous and would not be party to any decisions made about them outside the interview environment. This could be a cause of concern for students: after all, I was the one grading their work and assigning their final grades in their course. While 33% of the participants had already graduated, and concern about potential retribution was thus a non-factor, the other 67% were still taking the course.

Shenton (2004) notes that participants should clearly understand they have the right to remove themselves from the research process without an explanation. I recognized my own investment in the research, but I also knew that attempting to coerce the subjects in any form or fashion, whether stated or not, would undermine the credibility of the study. That is why I made removal rights a point of emphasis on the consent/assent forms. Similarly, I reiterated before each interview began that participants would be insulated from consequences of anything said in the interview. In addition, I repeated that participants could leave the interview at any time if they became uncomfortable. At no point did any participant ask to leave the interview or for interview materials to be expunged.

Because persistent note-taking was central to the research process, having protocols in place for those notes was critical. Notes were taken several times each week, using voice-to-text

in a Google doc. The concepts and themes within the notes were not organized, but instead were a stream of consciousness brain dump of what I had observed during that week's implementation. I found this method of persistent note-taking allowed me to explore my own thoughts and feelings about the process in a way which was authentic, and was not mediated by the process of writing and editing. Word search functions were used to find persistent notes that cross-referenced interview data. Consistent application of those processes allowed for authentic and dependable persistent note-taking.

  Confirmability. Qualitative research establishes its validity through its depth of confirmability. Every step of the interview process was carefully documented, from this signed assent and consent forms from the participants and their guardians (as appropriate), to the video and audio recordings of the interviews, and the careful transcription of their responses. To achieve transparency I needed to address questions of researcher bias, or at least acknowledge any suggestions of bias head-on by making my research processes overt and manifest. Similarly, an honest self-assessment on my part was fundamental to approaching interpretation of qualitative data. Peshkin (1988) observes that by attending to their biases researchers "can possibly escape the thwarting biases that subjectivity engenders, while attaining the singular perspective its special persuasions promise" (21). Establishing my positionality was an important part of the research process, and confronting that positionality during every step of the research was essential to producing research where the bias did not complicate the results. Peshkin (1988) observes within his own qualitative work that recognition of subjectivity is not enough: the research instead must "manage it--to preclude it from being unwittingly burdensome" (20). All of my research reflects my bias in some capacity, I could confirm the results by directly addressing and redressing that bias from the outset of the experiment.

Results

  The results of the analysis, analytical connections to the research question, and a demonstrable consistency of the analysis are contained within this chapter. Fifteen participants took part in interviews for this grounded theory study. The questions within those interviews were created to understand how differentiated digital game-based learning could be improved. All participants were high school students in a language class at a suburban high school. Most students engaged in DDGBL in a variety of ways, whether it be face-to-face, virtual, or in a hybrid classroom. One of the participants had not taken the class during the 2020-2021 school year, and had only experienced DDGBL in a face-to-face environment.

  Consistent with grounded theory methodology, I administered three levels of analysis, open coding, selective coding, and theoretical coding. Nine codes emerged via the open coding process. I practiced constant comparison analytics by using mind-mapping and Atlas.ti v9 software and discovered 12 selective codes, merging into categories from the open codes. I used additional constant comparison analysis to discover the relationships between and within the open and selective codes, leading to five critical themes. These five themes act as a summary of the key considerations in improving digital game-based learning: (A) both gamers and non-gamers enjoy game-based learning, (B) students value well-designed learning experiences, (C) gaming platform stability is critical to successful implementation, (D) affective responses to DDGBL must be acknowledged, and (E) feedback immediacy in assessment and gaming encourages metacognition.

Summary

  This study reflects the experiences of participants over the course of four years in a language learning course. The length of time participants engaged in DDGBL varied from two to

four years, with implementations of DDGBL happening pre-COVID, during a year of hybrid instruction, and then a return to classroom practice. The external changes in education created by the COVID pandemic transformed my implementations of DDGBL, but the fundamental elements of assessment, review, grouping, and gaming always stayed the same. The use of interviews and persistent notes provided the data to examine who I could improve DDGBL. The central goal of the study was to address two critical questions. The first question was:

RQ1: How can I improve the use of differentiated digital game-based learning for students learning the Latin language at a metropolitan Atlanta suburban high school?

The solutions provided to the first question were varied and various. However, opinions expressed about DDGBL and its improvement coalesced around the four central elements of DDGBL: assessment, review, grouping, and gaming. Concerning assessment, it appears that taking the warm-ups using pencil-and-paper was generally regarded as superior because it offered better opportunities for feedback and reduced opportunities for cheating. It also reduced the technical issues which sometimes occured with the Illuminate assessment platform. When it comes to review, the ability to self-grade was generally seen as the best option because it allowed students to discuss and advocate for answers in a way which the Illuminate platform did not allow. In terms of grouping, students should be given the freedom to select which game best suits their learning needs. While benchmarks can be provided to help students and provide guide rails, ultimately students should be given the opportunity to self-assess and choose for themselves. Finally, in terms of gaming, the Jewels of Wisdom game was broadly considered to be the best option for vocabulary acquisition because the game was fun to play, had a high utility value, andwas stable across a variety of devices.

The second question explored by this paper was:

RQ2: How can I align curriculum learning goals and student self-regulated learning in a better way using differentiated digital game-based learning?

This question was informed by the interviews, but depended largely on my own persistent note-taking during the course of the study. While most participants felt the alignment of the vocabulary games was clear and apparent, at least one participant noted that the AP course did not have the same consistency. This was supported by my own observations. Additionally, because the class begins with the warm-up assessment, it meant the class always began by looking backwards. Some students suggested placing the assessment closer to the point where vocabulary was unpacked - making it a mid-class activity instead of the beginning of the next day's class. This is something I had not considered, and I anticipate I will do an experimental implementation of it in the future. Both participant responses and my own notes suggested that allowing students to self-select their game based on their feelings about their learning helped to develop more awareness of their own learning - a central prerequisite of SRL. While I will still provide suggested benchmarks for students who are just beginning to take part in DDGBL activities, I will make it apparent that those are simply suggestions, and that students should take a quick inventory of the knowledge based on the warm-up and review, and select the game difficulty which best reflects their own perceptions of their learning needs.

Additional data on the similarities and differences discovered across demographics, how different teaching modalities contribute, and what academic factors contribute are also found in this chapter. While there are many attractive qualities to digital game-based learning, it is evident in the research results that there is variability in how participants view areas of improvement and

manifest their suggestions. Chapter 5 includes the summary for the critical analysis and

discussion on the five themes.

CHAPTER V

DISCUSSION

Introduction

My purpose during this qualitative grounded theory study was to identify ways that I could improve differentiated digital game-based learning (DDGBL), with a focus on the language learning classroom. This chapter includes an exchange of my findings based on literature surrounding digital game-based learning, student responses to DDGBL, and suggestions for improvement of DDGBL. I have also included a colloquy on how DDGBL relates to student opinions about learning and best practices for DDGBL implementation. I conclude the chapter with a deliberation on the shortcomings and limitations of this study, recommendations about areas for potential future research, and an abbreviated summary.

This chapter contains discussion about DDGBL the future research possibilities within the same field in order to answer the research questions:

RQ1: How can I improve the use of differentiated digital game-based learning for students learning the Latin language at a metropolitan Atlanta suburban high school?

RQ2: How can I align curriculum learning goals and student self-regulated learning in a better way using differentiated digital game-based learning?

My analysis of interviews and persistent observation revealed a variety of recurring statements and concepts which are critical to the improvement of DDGBL. I further distilled these recurring concepts into five critical themes. There are the five critical themes to consider in analysis and development of DDGBL implementation:

Theme A	Both gamers and non-gamers enjoy game-based learning
Theme B	Students value well-designed learning experiences
Theme C	Gaming platform stability is critical to successful implementation
Theme D	Personalization of activities makes learning more meaningful
Theme E	Feedback immediacy in assessment and gaming encourages metacognition

Table 5.1 *DDGBL Critical Themes*

Additionally, research review provided several key considerations in the implementation and improvement of DDGBL: philosophical and theoretical basis for educational gaming; relevant theories of motivation in game-based learning and conventional organizational alignment; differences in digital gaming and the theoretical framework for classroom use of DDGBL, and the considerations of DDGBL for curricula and skills.

Findings Interpretation

While individual experiences with DDGBL varied from student to student, participants appeared to coalesce around five critical themes to consider in analysis and development of improved methods for implementing DDGBL. Because student learning is a transformative practice, the metamorphoses of best practices will be dynamic and, by definition, need to change over the course of implementing a DDGBL program. How students react to elements of DDGBL changes over time. I examine the five critical themes discursively in the following sections.

Both gamers and non-gamers enjoy game-based learning. There is literature to support my conclusion that students enjoy game-based learning whether or not they identify as gamers. Several studies indicate the engagement levels afforded by digital game-based learning do not depend on the student-participants already being digital game hobbyists (Gee, 2003; Gestsdottir & Lerner, 2008; Prensky, 2001). Hedonistic use of digital gaming is based on

individual preference, but utilitarian applications of digital game-based learning appear to be preferential to worksheets, lectures, or other less engaging methods of instruction and practice. Responses from participants who did not identify themselves as gamers still universally included either the words "fun" or "enjoy" while describing the gaming experience in class.

Students who did not identify as "gamers" still often played digital games for fun outside the classroom, making them *ipso facto* gaming hobbyists. However, the "gamer" identity itself is something of a misnomer. Paaßen, et al (2017) observed that many individuals do not identify as part of the gamer community despite being gaming hobbyists, at least in part because the definition of what makes a gamer often focuses on console-based gaming instead of mobile or computer gaming. Participants who did not consider themselves gamers mentioned playing the DDGBL activities outside the classroom, doing so because they enjoyed playing them, not because of any learning associated with gameplay. The idea that DDGBL activities could be an entertainment source suggests that the participants who engaged in gameplay outside the classroom were actually gaming hobbyists - or "gamers" - despite not identifying as such.

All participants in the study said they enjoyed playing games in class and that this helped them learn. This reflects what Gee (2012) noted about how rich experiences built from simulations are more meaningful and helpful than a lecture, and avails itself to more varied iterations. Developing rich digital simulations of authentic learning experiences which vary each time they are played makes the experience both more valuable, and more pleasurable.

In this study the participants emphasized different types of gaming as being preferable. Some focused on games which require more skill (i.e. hand-eye coordination) to be successful, while others preferred ones which required greater knowledge. Throughout the majority of the interviews, the respondents described a general sense of pleasure when playing the games, and

most had very specific opinions about which games were more fun to play than others. While the

greater number expressed preference for the Jewels of Wisdom game, hosted on Cram.com, the

students who identified as gamers preferred faster games such as Wordshoot and Stellar Speller.

All participants shared the opinion that playing games helped them learn. These opinions align

with Kaltman's (2019) observation that DGBL is designed specifically to transform instruction to

engage participants using video games. DGBL affords the teacher the opportunity to transform

curriculum: if students are having fun learning, it makes the idea of learning more attractive, and

makes it something learners want to do, instead of being something they are forced to do.

    Students value well-designed learning experiences. All participants averred that the

process of assessment, feedback, and tiered gaming helped them learn, and made them feel that

their personal learning requisites were being met. The feeling that course content was being

tailored to their individual learning needs was met with positive feedback from each individual

interviewee. Central to the design of DDGBL is the idea that students, once they have had an

opportunity to demonstrate their knowledge, have the tools to identify their own pedagogical

desideratum. This aligns with the research. Sykes (2006) claimed that students are active in their

own learning during game-based learning, making it an appropriate pedagogical model, since it

establishes tasks and goals for the student to undertake in a digital educational environment. The

active learning afforded by DDGBL was viewed by the participants as a valuable learning

technique.

    Several participants noted that the games themselves, while helpful, were not enough to

teach the course content. However, when those games were provided as a reinforcement after a

warm-up, and students were given feedback from the warm-up as well as the opportunity to ask

clarifying questions, the instruction became more effective. Prensky (2001) observed that

"Digital Game Based Learning is great in that it motivates and teaches in ways that other methods seldom do. But it is neither the unique solution to all training problems nor a panacea. Digital Game Based Learning needs to be combined with other learning methods that work equally well" (7). Participants perceived the combination of assessment, feedback, grouping, and gaming as being more helpful than gaming on its own would have been.

This observation builds on an important idea: gaming on its own is not enough. Chu & Fowler (2020) state that "the use of computer games in education has been increasing in popularity during the past decade. Game-based learning environments are designed to teach specific knowledge content and skill-based learning outcomes using game elements" (3). Despite the increase in game-based learning, it is important to frame the learning in a way that helps the learner understand the context of their own learning. Using an assessment tool to help students identify their own learning needs grounds the game-based learning experience in the content, and personalizes the experience.

Gaming platform stability is critical to successful implementation. The single most common complaint, across all interviews during this study, was about issues with technology. This aligns with research data about digital game-based learning issues. There are significant technical and technological challenges associated with implementing a digital game-based learning curriculum (Harold, 2015; VanEck, 2006; NCES, 2020). The complaints fell into essentially two camps: infrastructure issues and gaming issues. The most frequent infrastructure complaints were about poorly operating school devices and internet connectivity issues. The most common concerns about gaming were non-functioning or poorly functioning gaming platforms, and invasive platform advertising,

Respondents reported that the school-issued devices did not always work well, could be prone to freezing, and sometimes did not connect to the internet. Harold (2015) observerved that "internet bandwidth, technical limitations and school policies have frequently presented problems with playing games with a large class" (24). For these respondents this was certainly the case. While having multi-platform gaming options did somewhat mitigate the issues, this forced students to use their own personal devices and occasionally their own internet providers. School-wide refreshment of devices over the course of the last year did little to help, according to the respondents. A district-wide internet connectivity issue at the beginning of the school year exacerbated the issue, requiring each device to be individually refreshed.

Several participants recognized efforts on the part of the instructor to deal with internet connectivity, and they appreciated the ability to access content on a variety of devices. Having a teacher who is comfortable troubleshooting technical issues is important, according to Virvou & Manos (2005), who qualify that DGBL should be an ancillary resource to direct instruction. Having an instructor there who can help with issues and adjust instruction based on those issues still offers greater sophistication than a software solution does. Because digital gaming in the classroom is still a relatively new phenomenon, teacher familiarity with a variety of digital tools and quick fixes becomes mandatory for successful implementation of a DDGBL system.

One of the biggest issues in customizable gaming is that the games which are easiest for a teacher to make, on platforms which are stable and popular, are frequently not terribly fun to play (Virvou et al., 2005). Wordshoot, Stellar Speller, and Jewels of Wisdom - the three games most often mentioned in the interviews - are games which are free to play, and free to create. However, the gaming experience comes at a different cost. The games produce revenue through

advertising, or the sale of increased access and ad-free gaming through paid subscription to gaming services.

Several of the participants complained about the advertising and glitches which occurred on several of the games. While games such as Wordshoot were more likely to glitch, the Jewels of Wisdom game included advertisements which were large enough to occasionally cover up part of the gaming space. Two of the participants specifically recognized that changing the zoom level on Microsoft Chrome would mitigate the issue, and that teacher-led troubleshooting made the advertising an insignificant inconvenience. However, the solution to the issue with invasive advertising is not always so easily rectified. Instructors implementing a DDGBL curriculum will need to carefully consider the pros and cons of different educational gaming platforms, platform stability and advertising invasiveness are serious considerations alongside the hedonistic and utilitarian values of the games.

Personalization of activities makes learning more meaningful. My conclusion is that different students respond to differentiated digital game-based learning in different ways. Affective responses to assessment, grouping, and gaming varied, although the general consensus among respondents was that the experience was a positive one. The learning activity was more meaningful to students because they felt the tiered activities were designed to meet their individual needs. Gee (2003) noted that learning is a distinct social practice, and that it is both transformational and personal. Making these distinctive practices personal - tailoring them to the needs of the individual student - is central to DDGBL. Participants gravitated towards three responses when discussing their experiences with assessment, grouping, and gaming in DDGBL: (A) the differing levels of gameplay allowed for an individualized approach to coursework, (B) the personalized opportunities for growth allowed them to learn content better, and (C) that the

different levels allowed them, on their own time, to advance to more difficult games at their own pace.

Study respondents discussed that differing levels of gameplay allowed for an individualized approach to coursework. The respondents felt that by being allowed to select a game based on their comfort with the curriculum content, established through the warm-up activity, let them take control of their learning. This aligns with the research: Sykes (2006) observes how there are unique paralinguistic communications between the game and the participant, providing the potential for game performance to reflect the emotional state of the participant as well as heralding an opportunity to alter the affective delivery of educational goals.

Interviewees talked about how the personalized opportunities for growth allowed them to learn content better. The participants in the study expressed different learning goals. Some were simply trying to meet the minimum requirements of the course to get a good grade. Others were trying to push themselves to learn content which was not included in the curriculum. Both of these groups of participants felt that the DDGBL system of assessment, grouping, and gaming allowed their personal learning goals to be met. The interviewee observations parallel those made by Abrams & Gerber (2013): that game-based learning allows students to govern their own assessment and change, creating relevant, active learning. DDGBL provided these interviewees the chance to have content curated to their personal assessment of shortcomings, making the students feel as though they were in control of the course content and curriculum rigor.

Several of the participants mentioned that the different levels allowed them, on their own time, to advance to more difficult games at their own pace. One of the more surprising admissions from several of the participants was that they played the games outside the classroom, often scaffolding their learning based on the rigor of the games, almost as if showing

mastery of each of the tiered games had become a game in itself. Barr (2018) observed how students believed that learning games provided graduated opportunities for growth. Bovermann & Bastiens (2020) noted how learners could be motivated through engaging digital learning environments, developing the learner's own individual motivation through game-like concepts. When the participants repurposed the tiered gaming system into "levels" of a game they were applying those game-like concepts to an element of the course which was not originally intended to be a game.

Participants discuss how motivation and willingness to take on greater course rigor with DDGBL came not from the teacher, but from their own intrinsic desire to play the game and win. Prenskey (2001) suggested something similar, saying "even though the kids were doing harder work, they felt like they were in control: 'I'm doing this harder stuff because I chose to do it, not because the teacher told me to do it'" (188). Students feel comfortable playing games, and even those students who do not identify as gaming hobbyists have familiarity with the ideas behind most of the games. This is because, as Harbon, Moloney, & Sherratt (2016) noted how gaming is for many of these learners something that on some level forms part of their everyday social and online experience and even their identity.

Feedback immediacy in assessment and gaming encourages metacognition. This study's conclusion is that the decentralization of instruction, i.e. moving the opportunity for assessment and feedback away from the teacher, helps students take ownership of their learning, fosters an awareness of how learning happens, and encourages learning outside the classroom. Participants in the interviews remarked on how they felt as if they were in control of their learning and placement in DDGBL. Central to this feeling of comfort and control was the immediacy of feedback and freedom to fail afforded by game-based learning. This aligns with

research about feedback. Duckworth (2016) recognized that the celerity with which feedback is provided is critical to its acceptance and impactfulness.

Ownership of learning was mentioned by the majority of the participants. The combination of assessment, review, grouping, and gaming used in DDGBL allowed students to see how well they knew the content on the assessment, then pick a group which they felt met their learning goals. The speed with which students were given feedback both on the assessment (within a few minutes) or the games (in most cases less than a second) allowed them to accurately and adequately define their learning. Rinkl (2017) notes that taking just-in-time feedback allows students to transition from simple skills to more complex ones by chunking single-step solutions into more complex ones. While vocabulary acquisition might be viewed as a relatively simple learning goal, the ability to recognize those same words in sentences and paragraphs are the essential elements to developing literacy. Participants noted how their increased vocabulary knowledge made complex reading tasks easier.

Student learning can be difficult to consistently support. Learners need constant challenges, which shift as their level of master changes, to make the learning meaningful. Repeated learning of concepts which have already been mastered is neither engaging, nor perceived as an effective use of time. One of the participants noted that the changing elements of the game forced them to constantly change their strategy towards learning and academic success. Abrams & Gerber suggests "in the videogame world, errors lead to successes because the players have the immediate advantage of learning from mistakes and becoming self-assessors of their learning by recognizing and applying moves that can beget progress and improvement" (2013, p. 98). The ability to make a mistake and receive feedback helped the learner understand the material better, while the challenge of the changing game board allowed them to make mistakes

without a high cost. The freedom to fail which DDGBL provides allows students to become more willing to make educated guesses.

Respondents described how the assessment and grouping strategy helped to establish checkpoints for learning. These recipients felt that DDGBL helped them become better learners because it helped them define and achieve measurable checkpoints through the feedback of the warm-ups and the games. The research into feedback supports this opinion. Feedback is an essential tool for educators to help students come to a fuller understanding of their curriculum. Hattie & Gan, in "Instruction Based on Feedback," said that feedback can "make learning visible...lead to error detection, and enhance students' assessment capabilities" (2017, p. 265). Several of the participants noted that they continued to play the games outside of the classroom, using the tiered games as assessment points for their learning.

Theory and Research Implications

Chapter 2 included several critical elements of DDGBL research. Focusing largely on philosophical and theoretical basis for educational gaming with pedagogical evolution, relevant theories of motivation in game-based learning and conventional organizational alignment, differences in digital gaming and the theoretical framework for classroom use, differentiated digital game-based learning, and the considerations of differentiated digital game-based learning for ELA curricula and skills. How I developed DDGBL as a learning modality and how the data from this study applies to those research concepts is explored in the following sections. I found there were four critical elements of DDGBL research.

Element 1	There is a philosophical and theoretical basis for educational gaming.
Element 2	Theories of motivation are supported in game-based learning.
Element 3	There are differences in digital gaming and the framework for use of DDGBL.

Element 4	There are considerations of DDGBL which are multi-curricular.

Table 5.2 *Critical Elements of DDGBL Research*

There is a philosophical and theoretical basis for educational gaming. A variety of studies established that digital game-based learning was seen as an effective teaching tool (Chang et al, 2018; Chen, et al 2018; Harbon et al, 2016; Singaravelu, 2008; Yang et al, 2018). The results of this study supported this idea, showing that students felt as though the gaming process helped them learn better and faster.

One of the biggest issues in customizable gaming is that the games which are easiest for a teacher to make, on platforms which are stable and popular, are frequently not terribly fun to play (Virvou et al., 2005). This was an issue with this study as well. While school internet issues and district-provided devices were frequently blamed, the results show that very few games held broad appeal to all learners while also being stable across a variety of platforms. The game which appears to be the exception was the Jewels of Wisdom game, which was reported as being fun to play, and significantly more stable than games such as Stellar Speller or Wordshoot.

Theories of motivation are supported in game-based learning. A comparison of the results from this study with theories of motivation within game-based learning shows there are several similarities, but also a few distinct differences. Kaltman (2019) recognizes the importance of engagement to spawn deep learning, as well as how traditional tools such as worksheets often fall short of engaging the students. The results from this study supported that idea, revealing that the DDGBL activities were viewed as engaging while also fostering better control of curricular concepts.

Game-based learning is often credited with helping students stay engaged with course content for longer periods of time than reading alone. Research from the last five years (Tejedor-Garcia et al., 2020; Chang et al., 2018; Yang et al., 2018) suggests that students move into an

immersive learning state because they are failing and trying to find ways to improve. This was supported by this research study, with a majority of the participants noting how DDGBL helped them learn and improve their learning by engaging with the class materials for a longer period of time. Several participants specifically mentioned playing the games outside of the classroom for improvement.

Game-based learning is often credited with creating experiences which are more meaningful for learners than a worksheet or a study guide are. James Gee (2003) recognizes that simulated educational experiences construct richer learning than through lectures. The results of this study revealed that participants felt the DDGBL experience was more meaningful and provided richer learning. Several participants specifically asserted the superiority of DDGBL to worksheets or study guides. The pre-organization of the content into tiered systems also helped some participants build their own distinctive learning experiences.

There are differences in digital gaming and the framework for use of DDGBL. The results of my study provided a functional framework for the implementation of a DDGBL curriculum within a high school language learning classroom. The consensus of all participants was that the method helped them learn. There are important considerations when planning to implement DDGBL. Currently, game-based learning requires teachers who implement the strategy to oversee production, advice, and coaching for these activities in an environment where teachers are often still expected to be knowledge dispensers and enforcers of rules (Squire, 2011). To design games which are aligned with course content the teachers have to choose games which allow them to create the word banks and the correct answers. This means that teachers implementing a DDGBL curriculum would need to feel comfortable with the upload and import options on websites such as classtools.net and cram.com. Participants in the study noted issues

such as glitches, internet outages, and games that simply would not work. Several of the participants recognized the efforts of the teacher to mitigate those issues in real time, identifying important strategies to help sidestep frequently occurring issues with technology or with the games themselves. The requirement for the teacher to be technologically savvy, while never specifically mentioned by the participants, was alluded to through the specific examples provided of how the instructor helped the learners when things were not operating as planned.

Critical to successful implementation of DDGBL is the alignment of the games with the course content. The assessment and the games should be interrelated. Barr (2013) suggests looking more closely at key concepts of DBGL such as external consultation, peer discussion, cross-platform learning (taking lessons from one digital interaction and applying it to a different one) and the freedom to fail to build an effective model. The majority of the participants in the study agreed that the games aligned with the warm-ups, and they noted how the previous day's lessons were reinforced through the pattern of assessment, review, grouping, and gaming.

There are considerations of DDGBL which are multi-curricular. The results of my study were focused primarily on differentiation of vocabulary gaming. Vocabulary is important for a wide variety of curricula, making the content of this study cross-curricular, and not exclusive to the learning of language. However, the focus on vocabulary acquisition is of particular interest for the English-Language arts curriculum as well as World Languages. Zulkiply & Aziz (2019) recognized that game-based learners outperformed flash-card learners in acquisition of English vocabulary. The results of this study reveal that participants felt more comfortable in their vocabulary acquisition when using DDGBL - the alignment of the game difficulty with their needs allowed them to self-assess but also made the content of the course match their own personal learning requirements.

Participants in the study made several key observations which are important considerations in developing an ELA course which uses DDGBL. Respondents noted that the ability to view their scores was important, and that advertising or graphics changes in the games sometimes made score reporting difficult to see or record. This aligns with the research. Prensky (2001) recognized that well-designed DGBL resources should have score reporting capabilities which are sharable and confirmable. The lack of score reporting for games like Wordshoot, and the ability to get high scores without being successful in a game like Stellar Speller, made score confirmation and reporting arduous, and made games such as this less useful for the implementation of DDGBL. Individual participants acknowledged an enjoyment of these games, but the issues with seeing and viewing scores made them less attractive for the majority of the participants.

The results of this study show how participants' affective states were impacted by DDGBL. Sykes (2006) observes how there are unique paralinguistic communications between the game and the participant, providing the potential for game performance to reflect the emotional state of the participant as well as heralding an opportunity to alter the affective delivery of educational goals. Participants in the study explained how they felt more comfortable and more in control of their learning when engaging in DDGBL activities. The combination of tailored learning experiences which reflected both their current knowledge base as well as their learning goals helped to create the custom learning experience which made them feel more comfortable learning.

The results of this study showed how participants felt more comfortable taking risks while playing a game. For many of the participants, the freedom to fail afforded by game-based learning removed the stigma of making a mistake. The research about ELA best practices

suggests the same thing. Elbow (1993) noted how becoming comfortable with taking risks and making guesses is an important skill to developing transformative practice within an ELA curriculum. Other research suggested that risk taking and transformative practice extended beyond the classroom into the real world. Gee (2003) noted that the ability to learn and relearn quickly was central to developing successful adults who could transform their portfolio to meet changing circumstances. Learning must be transformative, and successful learning includes transformative learning practices. Participants in the study explained how DDGBL changed their perceptions about learning in general, and their own learning in particular, establishing DDGBL as a transformative pedagogical tool.

Implications for Practice

Not every student learns in the same way. However, there are certain agreed-upon standards which are shared by the best teaching practices. Helping students develop self-awareness about the learning process, supplying feedback, and allowing students the opportunity to learn from mistakes are all central to developing a strong teaching curriculum. Gesssdottir & Lerner (2008) observed how developing metacognition and self-regulated learning is an important developmental asset. Participants in the study repeatedly recognized how DDGBL helped them to know what they knew, and what they did not know, helping to develop metacognition as well as self-regulated learning. Similarly, Hattie et al (2017) explained how feedback was central to helping students come to a better understanding of the curriculum, and that the speed at which feedback was given was an important consideration in its effectiveness. Participants in this study stated that they could make a mistake and immediately learn from that mistake while playing the Jewels of Wisdom game. The results from this study suggest three key areas where DDGBL can be improved.

Area 1	Technical and technological issues should be anticipated.
Area 2	Gaming modalities should be expanded and enhanced.
Area 3	Alignment between the assessment and the game should be readily apparent.

Table 5.3 *Recommendations for Improvement*

Technical and Technological Issues should be Anticipated. Technical issues such as local school internet stability, student device and device access, and the stability of the digital gaming platform itself must all be taken into account while designing a DDGBL experience. Instructors intending to begin a DDGBL curriculum need to be comfortable building a variety of games and tailoring those games to anticipated areas of need for students. Most importantly, the instructor needs to be able to troubleshoot problems and be able to solve technical issues on the fly. While many of the mistakes are user errors (students clicking on the wrong link, not connecting their device to the internet, etc.) there are a significant amount of platform-based issues. Concerns such as invasive advertising, connectivity issues, and data corruption are all potential pitfalls. Developing a multi-platform DDGBL experience is crucial, since students will attempt to connect with a variety of devices. Therefore, web-based gaming is ideal. Even in 1-to-1 school systems, where every student is issued a device, students inevitably will forget their device or there will be a functionality issue. Having games students can play via phone, tablet, laptop, or desktop appears to be the most viable way to ensure access.

Gaming Modalities should be Expanded and Enhanced. Student engagement should be enhanced via competitive gaming, collaborative gaming, and the selection of games which are both challenging and clearly aligned with the curriculum. Participants noted how they used the tiered system to create their own "levels" within the Jewels of Wisdom game, and students frequently shared and compared scores to create a competitive learning environment. While this

was not an intended portion of the DDGBL curriculum, it was clear that some students were driven by the opportunity to compete against their peers. During the interviews several of the participants suggested collaborative gaming as well. Allowing students to work together within their own group to accomplish a learning goal is another method of increasing engagement, particularly for those students who crave peer-to-peer contact and collaboration.

Different students enjoy playing different types of games. While the Jewels of Wisdom game was generally enjoyed by all participants, several affirmed a preference for Wordshoot or Stellar Speller. The increased skill needed to play these games made them more pleasurable for those students. At the same time, several students stated that they did not enjoy playing Stellar Speller or Wordshoot. Those students felt the increased speed and skill needed to play the game was a distraction, and they felt it impeded their learning. Being able to offer a variety of games which can match the interest of the learners is an area of improvement in DDGBL.

Alignment Between the Assessment and the Game Should be Readily Apparent. There should be a clear parallel between the learning goals in the classroom and the games themselves: playing games just for the sake of playing games moves away from the utilitarian application of DDGBL into a hedonic application. Several participants recommended the use of games which were more fun to play, but which had less utilitarian value. While finding games that have some hedonic value is important, the utilitarian value is the primary consideration. Platforms such as Quia, Purpose Games, Sporcle, and Quizlet have games with high utilitarian value, but low hedonic value. Platforms such as Classtools and Wisc-online have greater hedonic value, but some of the game selections have very low utilitarian value. This study focused primarily on games supplied by Cram, since those games offered an acceptable compromise of both hedonic and utilitarian value, while still offering a multi-platform experience. Additional consideration

should be given to the ease of game creation: onerous creation protocols will result in fewer games being created by the instructor, and, as a result, less customized content for the learners.

Limitations and Recommendations for Future Research

There are several areas for research in the future where targeting student learning and response based on specific demographic subgroups could provide additional insight. Similarly, because this study was qualitative, there is the opportunity for a quantitative study to work on more clearly defining the preferences and issues students have with DDGBL as a teaching technique. Seeing how different contents are affected by application of DDGBL curricula is also an area ripe for further research, since the focus of this paper was almost exclusively around vocabulary acquisition in a language learning classroom. Over the course of the interviews a significant number of participants mentioned that they would use the tiered gaming difficulty as their own way to "level up" their learning outside the classroom. Research into a multidisciplinary review of DDGBL which focused on student motivation to "beat" different games with different difficulties is an area which could provide fruitful for further research.

The motivated nature of the students who were involved with this study also complicates the findings. A wider variety of students, and especially an increase in special education students, could provide a much wider range of experiences with game-based learning in general, and DDGBL specifically. The courses which implemented DDGBL for this study were academic elective courses - courses which students chose to take - which skews the perspective of the learners towards the content. While students get to choose academic electives, core classes or assigned to the student, removing the option of choice. This lack of choice can impact student motivation. Examining an application of DDGBL principles to a core class, particularly looking at team-taught or remedial classes could potentially produce significantly different results.

This study covers a period which includes the COVID pandemic. Some participants in the study included those who had engaged in DDGBL activities before COVID, in a traditional classroom setting. However, all respondents in the study had taken the course either virtually during the 2020-2021 school year, or as a hybrid course, with content delivered both face-to-face and online. Many of the interviewees returned to traditional instruction for the 2021-2022 school year, but with the enhanced technology support created during the pandemic course iteration. The variety of implementations which occurred as a result of the COVID pandemic, and the way that it transformed classroom practice and instruction complicates the results of this study. However, some participants noted that the game structure and orderly arrangement of tiered learning allowed them to use the game as a way of managing the stresses of the time. Further study is required to look specifically at a virtual implementation, a hybrid implementation, and a face-to-face implementation of DDGBL.

Conclusion

Different students exhibit different levels of motivation and have different learning needs. Using a rudimentary assessment tool to provide just-in-time feedback and pairing that feedback with an activity curtailed to the individual student's demonstrative needs is central to differentiated instruction. The ability of digital game-based learning to give immediate feedback and scale difficulty makes it a strong option for creating individualized learning experiences.

However, there is significant room for improvement. Technical issues such as local school internet stability, student device and device access, and the stability of the digital gaming platform itself must all be taken into account while designing a DDGBL experience. Student engagement should be enhanced via competitive gaming, collaborative gaming, and the selection of games which are both challenging and clearly aligned with the curriculum. There should be a

clear parallel between the learning goals in the classroom and the games themselves: playing games just for the sake of playing games moves away from the utilitarian application of DDGBL into a hedonic application.

The benefits of a differentiated digital game-based learning curriculum is that it can meet students where they are, then provide a customized learning experience which matches student perceptions of learning needs. This personalized the learning experience, making the learning goals relevant for the learner. However, the process does not lack drawbacks and pitfalls. Any learning modality which relies heavily on technology requires the instructor to operate as both teacher and technician. Additionally, there is considerable work involved in creating the variety of games and difficult levels necessary to adequately meet the variety of student needs. Finally, despite the increase of free learning games available on the internet, the games which are the most useful are often not engaging, while the most engaging are frequently of less use. Finding a middle ground between hedonic and utilitarian values is crucial. DDGBL allows students to recognize and assess their own learning, helping to develop metacognition. As several participants said, the learners now "know what they know." The results of this study suggest that the central considerations for educators are selecting games which comprise engagement and learning, which are multi-platform, and which can be created and maintained easily. Hopefully more instructors will gravitate towards the process of assessment, feedback, grouping, and gaming involved in DDGBL. Hopefully, should this happen, students will be able to interact with learning content which is engaging and which aligns with both course content and their own perceived learning needs. Improving DDGBL will help to meet both of those lofty goals.

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Appendix A: PARTICIPANT DEMOGRAPHICS OF THE INTERVIEWEES

Name	Gender	Nationality	Years Participation	Age
Alcyon	F	Caucasian	4	18
Tereus	M	Asian	3	18
Phaea	M	Asian	3	17
Lycaon	M	Causcasian	4	18
Sinis	F	Causcasian	3	18
Demiphon	M	Causcasian	4	17
Camesus	M	Causcasian	3	18
Mastusius	M	Causcasian	3	17
Icmalius	M	Causcasian	2	16
Neleus	F	Causcasian	4	17
Hippolyta	M	African-American	2	16
Eupeithes	M	Causcasian	4	17
Orion	M	Caucasian	3	17
Balus	M	Caucasian	2	16
Glaucus	T	Caucasian	2	17

Nationality	COUNTA of Name
African-American	1
Asian	2
Caucasian	12
Grand Total	**15**

Count of Gender

ANALYSIS

Count of Nationality
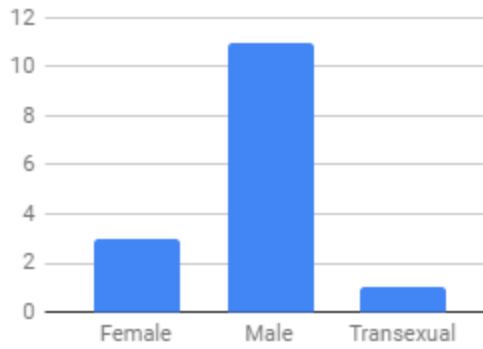
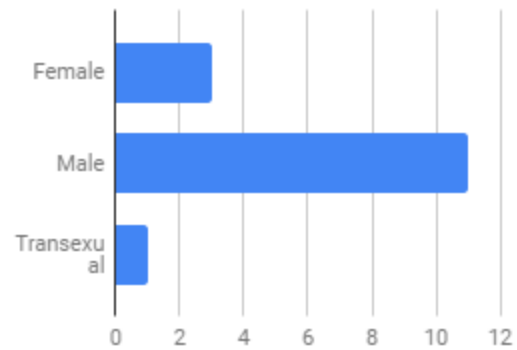

Count of Gender

Count of Nationality

Count of Gender

155
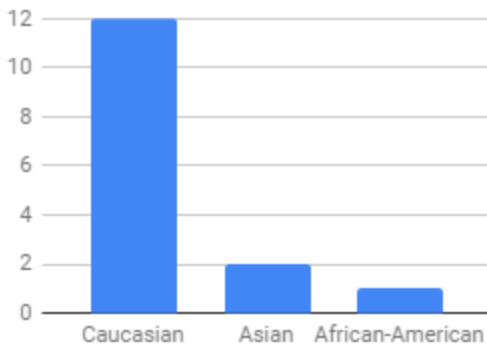
Appendix B: INTERVIEW PROTOCOLS

Interview Script 1

Greetings, salutations, and thank you for your participation today. My name is Alex Marsh and I am a Latin teacher and a graduate student at Kennesaw State University University conducting research for my Advanced Qualitative research methods class. The interview is intended to take about 20 minutes, including 10 questions regarding your education and your experiences with digital game-based learning. I would like your permission to document this interview with an audioand/or video recorder so I may accurately transcribe your statements. If you wish for me to discontinue recording or stop the interview itself, just let me know and we will stop. All responses are confidential. Responses will remain confidential, only used for class and educational purposes. I would now like to request for your verbal consent and remind you that your participation in this interview implies consent. Participation in the interview process is entirely voluntary: if you need to take a break, stop, or return a page, please let me know. You can withdraw your participation at any time, consequence-free. Do you have any questions or concerns before I start?

Then with your permission I will begin the interview.

In Latin class you start most days with a short 20-question warm-up. How do you feel about that?

After the warm-up you are asked to play one of three games. Why do you think students are given different assignments?

Tell me about the games themselves.

Are there games you like more than others? Why?

What digital games do you play outside of the school day?

How do you feel about the grouping process?

Do you feel the games align with the warm-ups? How so?

If you could design a game to help students learn what would that look like?

How would you change the current warm-up/gaming process?

Is there anything else you would like to share?

Thank you so much for your time, I really appreciate that you took these moments out of your day to help me understand student learning better.

Interview Script 2

Greetings, salutations, and thank you for your participation today. My name is Alex Marsh and I am a Latin teacher and a graduate student at Kennesaw State University. This interview is intended to take about 15 minutes, including questions regarding your education and your experiences with differentiated digital game-based learning. I would like your permission to document this interview with an audio and/or video recorder so I may accurately transcribe your statements. If you wish for me to discontinue recording or stop the interview itself, just let me know and we will stop. All responses are confidential. Responses will remain confidential, only used for educational purposes. At this point I would like to request your verbal consent and remind you that your participation in this interview implies consent. Participation in the interview process is entirely voluntary: if you need to take a break or stop please let me know. You can withdraw your participation at any time, consequence-free. Do you have any questions or concerns before I start?

In Latin class you start most days with a short 20-question warm-up. How do you feel about that?

At first you took the warm-ups as paper copies, the last two years we have used Illuminate. Which do you prefer? Why?

Do you feel the warm-ups helped you learn?

After the vocabulary warm-up you are asked to play one of three games. Why do you think students are given different assignments?

How do you feel about the grouping process after the warm-up?

Tell me about the games themselves.

Explain how the games helped you learn, or if they did not help you learn.

Are there games you like more than others? Why?

Do you feel the games align with the warm-ups? How so?

What would you do to improve the current warm-up/gaming process?

If you could design a game to help students learn what would that look like?

What digital games do you play outside of the school day?

Is there anything else you would like to share?

Thank you so much for your time, I really appreciate that you took these moments out of your day to help me understand student learning better.

Interview Script 3

Greetings, salutations, and thank you for your participation today. My name is Alex Marsh and I am a Latin teacher and a graduate student at Kennesaw State University. This interview is intended to take about 15 minutes, including questions regarding your education and your experiences with differentiated digital game-based

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learning. I would like your permission to document this interview with an audio and/or video recorder so I may accurately transcribe your statements. If you wish for me to discontinue recording or stop the interview itself, just let me know and we will stop. All responses are confidential. Responses will remain confidential, only used for educational purposes. At this point I would like to request your verbal consent and remind you that your participation in this interview implies consent. Do you consent to being recorded?

Thank you. Participation in the interview process is entirely voluntary: if you need to take a break or stop please let me know. You can withdraw your participation at any time, consequence-free. Do you have any questions or concerns before I start?

In Latin class you start most days with a short 20-question warm-up. How do you feel about that?

At first you took the warm-ups as paper copies, the last two years we have used Illuminate. Which do you prefer? Why?

Do you feel the warm-ups helped you learn?

What is the biggest problem with the warm-ups?

After the vocabulary warm-up you are asked to play one of three games. Why do you think students are given different assignments?

How do you feel about the grouping process after the warm-up?

Tell me about the games themselves.

Explain how the games helped you learn, or if they did not help you learn.

Are there games you like more than others? Why?

Do you feel the games align with the warm-ups? How so?

What is the biggest problem you've seen with the games?

What would you do to improve the current warm-up/gaming process?

If you could design a game to help students learn what would that look like?

What non-Latin digital games do you play outside of the school day?

Is there anything else you would like to share?

Thank you so much for your time, I really appreciate that you took these moments out of your day to help me understand student learning better.

Appendix C - Analysis of Manual and Open Codes

Summary of Manual Codes

Warm-up	Alignment
Jewels	Enjoyment
Grouping	Motivation
Improvement	Dislikes
Cheating	Competition

Summary of Open Codes

Self-grading issues	Thinking about thinking
Logistic issues	Clearly define guidelines
Immediacy	Competition
Qualifying questions	Potential collaboration
Inquiry opportunity	Improved learning
Technology Issues	Awareness of learning
Cheating	Glitch mitigation

Manual and Open Coding Values

Manual Codes
Warm-up
Jewels
Grouping
Improvement
Cheating
Alignment
Enjoyment
Motivation
Dislikes
Competition

Open Codes
Self-grading issues
Logistic issues
Immediacy
Qualifying questions
Inquiry opportunity
Technology issues
Cheating
Thinking about thinking
Clearly defined guidelines
Competitions
Potential collaboration
Improved learning
Awareness of learning
Glitch Mitigation

Summary of Selective Codes

Paper/digital	Structure
Expectations	Collaboration
Metacognition	Changing Game
Affective Impact	Jewels of Wisdom
Assigned/Self-selected	Motivation
Personalization	Improvement

Selective Codes

ASSESSMENT
Paper/Digital

Expectations

Metacognition

GROUPING
Affective Impact

Assigned/Self-Selected

Personalization

SELECTIVE CODES

IMPROVEMENT
Structure

Collaboration

Changing Game

GAMES
Jewels of Wisdom

Motivation

Improvement

MindMup

Grouping
Self-Selected
Thinking about thinking
Clearly defined guidelines
Benchmarked

Self-grading issues
Pencil-paper
Logistics issues

Feedback
Immediacy
Competition

DDGBL

Immediacy
Qualifying questions
Feedback
Assessment
Inquiry Opportunity

Gameplay
Enjoyment
Competition
Potential Collaboration

Metacognition
Improved learning
Awareness of learning

Technology issues
Illuminate
Cheating Issues

Review
Digitized
Technology Issues
Teacher-led
Glitch Mitigation

Word Count Analysis (WordCloud)

Critical Themes

(A) both gamers and non-gamers enjoy game-based learning,

(B) students value well-designed learning experiences,

(C) gaming platform stability is critical to successful implementation,

(D) affective responses to DDGBL must be acknowledged,

(E) feedback immediacy in assessment and gaming encourages metacognition.

Appendix D: Consent/Assent Forms

D.1 Initial Interest Survey

Greetings,

During your studies our class has participated in a learning technique called differentiated digital game-based learning. This is the activity we did on vocabulary assessment days where you selected an appropriate learning game based on how you felt about your performance during the Illuminate warm-up. I am hoping to get feedback on the technique and to learn how students felt about it in hopes of improving it in future years.

As a result I would like to interview you. The interview would be done via Teams and would take about 15 minutes. I will be recording the interviews and using that information to research how to improve the learning technique. Your information would be anonymous: only you and I would ever know what you said.

If you decide to participate please realize that this interview is independent of our classroom relationship, and nothing you say during the interview would impact your opportunities in the class in any capacity. If you decide that you do not want to participate there will be no consequences. If you change your mind about being interviewed there will be no consequences. Anything that happens in this interview will happen in a vacuum, completely separated from what happens in the classroom.

Would you be interested in being interviewed about this learning technique?

[ ] NO

[ ] YES – Name: _____

Please note that if you are under the age of 18 I will need additional permission from your parent(s) and/or guardian(s).

D.2 Parent Contact Email

Greetings,

My name is Alex Marsh and I am the Latin teacher at Milton High School. I am currently conducting research into a teaching technique we use in our classroom. In this technique students take a short (20 question) warm-up, we review the answers, then the students self-select how well they felt they knew the material. Afterwards students play one of three tiered digital learning games based on that assessment. I am interested in getting student feedback about the process, and hearing their opinions about how the technique could be improved.

Your student has expressed interest in participating in a short (about 15 minute) interview about differentiated digital game-based learning. As a result, I am contacting you to see if you will give permission to participate. The interview would be recorded and transcribed, and all content would be made anonymous. I have attached a parental consent form and a student assent form to this email, both provide a more detailed explanation of the process. If you are amenable, please fill it out.

I want to make it clear: nothing about this process will impact the classroom in any way. If students decide not to participate there will be no consequences. If they change their mind mid-interview there will be no consequences. Anything that happens during the interview will happen in a vacuum, completely separated from what happens in the classroom.

Thank you for your time and your willingness to help me improve instruction and student learning.

Take care,

Alex Marsh

D.3 Adult Participant Consent Form

Title of Research Study: Improving Differentiated Digital Game-Based Learning

Researcher's Contact Information:

Alex Jefferson Marsh

email: marshaj@fultonschools.org

phone: 404 932 8890

Introduction

You are being invited to take part in a research study conducted by Alex Jefferson Marsh of Kennesaw State University. Before you decide to participate in this study, you should read this form and ask questions about anything that you do not understand.

Description of Project

The purpose of the study is to improve the use of differentiated digital game-based learning.

Explanation of Procedures

Participants will be asked a series of questions about their experiences with differentiated digital game-based learning in their class.

Time Required

The interview will take approximately 20 minutes.

Risks or Discomforts

Students may be uncomfortable speaking honestly about classroom practice, however, the interviews will be anonymous and are not tied to the course or its grades.

Benefits

Taking part in this study will help students voice their thoughts and concerns about a teaching technique which is currently being used in their classroom. Their input can help to transform the practice in a way which will help both students and teachers alike.

There will be no costs to you for taking part in this study. You will not receive money or any other form of compensation for taking part in this study.

Confidentiality

The data for this study will be kept private and confidential to the extent allowed by federal and state law. Under rare circumstances your data may be reviewed by KSU officials or people from the organization or agency that funded the study.

This study will be using unique participant codes in lieu of names to label data while keeping a separated list to match participant names to codes. Each participant will be interviewed on different days so there will be no interaction during the interview process. Additionally, the study will use only the participant's alias. Finally, I will limit publication of information to be certain the participant cannot be identified. The data will be kept in a secured computer and will be coded using Atlas.ti. The raw data will only be accessed by myself, the IRB safety review board, and possibly the committee who is overseeing my research (Dr. Crovitz, Dr. Dail, Dr. Adams).

Audio recording of interviews is mandatory.

When we tell other people or write articles about what we learned in the study, we won't include your name or that of anyone else who took part in the study. Your information collected as part of the research, even if identifiers are removed, will not be used or distributed for future research studies

The data for this study will be kept for 3 years

Inclusion Criteria for Participation

Participants using this form should be 18 years of age by the time of final study approval.

Signed Consent

I agree and give my consent to participate in this research project. I understand that participation is voluntary and that I may withdraw my consent at any time without penalty.

_____

Signature of Participant or Authorized Representative, Date

_____

Signature of Investigator, Date

_____

PLEASE SIGN BOTH COPIES OF THIS FORM, KEEP ONE AND RETURN THE OTHER TO THE INVESTIGATOR

Research at Kennesaw State University that involves human participants is carried out under the oversight of an Institutional Review Board. Questions or problems regarding these activities should be addressed to the Institutional

Review Board, Kennesaw State University, 585 Cobb Avenue, KH3417, Kennesaw, GA 30144-5591, (470) 578-7721.

D.4 Research Study Assent Form (15-17 Year Age Range)

Study Title:

Improving Differentiated Digital Game-Based Learning

Researcher:

Alex Jefferson Marsh   email: marshaj@fultonschools.org   phone: 40

4 932 8890

My name is Alex Jefferson Marsh. I am from Kennesaw State University. I am inviting you to take part in a research study. Your parent(s) know we are talking with you about the study, but it is up to you to decide if you want to be in the study. This form will tell you about the study to help you decide whether or not you want to take part in it.

Why is this study being done?

The purpose of the study is to improve the use of differentiated digital game-based learning. You are being asked to take part because you have already engaged in differentiated digital game-based learning in the classroom and I am interested in your opinion about it.

What am I being asked to do?

If you decide to be in the study, we will ask you to answer a series of questions about your experiences with differentiated digital game-based learning in their class.

- There will be an interview about differentiated digital game-based learning. The interview will be recorded and transcribed, and students will be assigned an anonymous moniker to protect their identity.
- The interview will take approximately 20 minutes

- The interviewer will ask participants about their opinions and personal beliefs concerning the selection of different learning games based on their perceived needs.

- If any question makes a participant uncomfortable they are not required to answer, or even acknowledge, it.

- There will be no use of academic records as part of this study.

- The results of this study will be published to help other educators know how to improve digital game-based learning. No personal or identifying information will be shared.

Recordings are required for research participation but if that makes you uncomfortable, that is ok, you do not have to participate anyway.

What are the benefits to me for taking part in the study?

Taking part in this study will help students voice their thoughts and concerns about a teaching technique which is currently being used in their classroom. Their input can help to transform the practice in a way which will help both students and teachers alike.

Are there any risks to me if I am in this study?

The potential risks of taking part in this study are: Students may be uncomfortable speaking honestly about classroom practice, however, the interviews are not tied to the course or its grades. Refusal to participate, or the decision to cease participation in the interviews will have no repercussions in the course. No personal or identifying information will be shared.

Will my information be kept private?

The data for this study will be kept private and confidential to the extent allowed by federal and state law. Under rare circumstances your data may be reviewed by KSU officials. This study will be using unique participant codes in lieu of names to label data while keeping a separated list to match participant names to codes. Each participant will be interviewed on different days so there will be no interaction during the interview process. Additionally, the study will use only the participant's alias. I will limit publication of information to be certain the participant cannot be identified. The data will be kept in a secured computer and will be coded using Atlas.ti. The raw data will only be accessed by myself, the IRB safety review board, and possibly the committee who is overseeing my research (Dr. Crovitz, Dr. Dail, Dr. Adams). Audio recording of interviews is mandatory. Students will be assigned an obscure

mythological character as a designation in place of their name. All recordings will be destroyed after 36 months. When we tell other people or write articles about what we learned in the study, we won't include your name or that of anyone else who took part in the study. The data for this study will be kept for 3 years

Are there any costs or payments for being in this study?

There will be no costs to you for taking part in this study. You will not receive money or any other form of compensation for taking part in this study.

What are my rights as a research study volunteer?

Your participation in this research study is completely voluntary. You do not have to be a part of this study if you don't want to. There will be no penalty to you if you choose not to take part and no one will be upset or angry at you. You may choose not to answer any questions you don't want to answer, and you can change your mind and not be in the study at any time.

Who can I talk to if I have questions?

If you have questions at any time, you can ask the researchers and you can talk to your parents about the study. We will give you a copy of this form to keep. If you want to ask us questions about the study, call or email

Alex Jefferson Marsh – marshaj@fultonschools.org (404)932 8890

The Kennesaw State University Institutional Review Board and Fulton County Schools has reviewed this study to make sure that the rights and safety of people who take part in the study are protected. If you have questions about your rights in the study, or you are unhappy about something that happens to you in the study, you can contact them at (678) 797-2268 or irb@kennesaw.edu.

What does my signature on this consent form mean?

Your signature on this form means that:

- You understand the information given to you in this form

- You have been able to ask the researcher questions and state any concerns

- The researcher has answered your questions and concerns

- You believe you understand the research study and the potential benefits and risks that are involved.

Statement of Consent

I give my voluntary consent to take part in this study. I will be given a copy of this consent document for my records.

_____   _____

Signature of Participant   Date

_____

Printed Name of Participant

D.5 Parental or Guardian Permission Form for Research Involving a Minor

Study Title:

Improving Differentiated Digital Game-Based Learning

Researcher: Alex Jefferson Marsh   email: marshaj@fultonschools.org   phone: 404 932 8890

My name is Alex Jefferson Marsh. I am from Kennesaw State University. I am inviting your student to take part in a research study. I am interested in interviewing your student about how to improve the use of differentiated digital game-based learning. This form will tell you about the study to help you decide whether or not you want to take part in it.

Why is this study being done?

The purpose of the study is to improve the use of differentiated digital game-based learning. Your student is being asked to take part because your student has already engaged in differentiated digital game-based learning in the classroom and I am interested in their opinion about it.

What am I being asked to do?

If you give permission for your student to be in the study, we will ask your student to answer a series of questions about your experiences with differentiated digital game-based learning in their class.

• There will be an interview about differentiated digital game-based learning. The interview will be recorded and transcribed, and students will be assigned an anonymous moniker to protect their identity.

• The interview will take approximately 20 minutes

• The interviewer will ask participants about their opinions and personal beliefs concerning the selection of different learning games based on their perceived needs.

• If any question makes a participant uncomfortable they are not required to answer, or even acknowledge, it.

• There will be no use of academic records as part of this study.

• The results of this study will be published to help other educators know how to improve digital game-based learning. No personal or identifying information will be shared.

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Recordings are required for research participation but if that makes you uncomfortable, that is ok, your student does not have to participate anyway.

What are the benefits to my student for taking part in the study?

Taking part in this study will help students voice their thoughts and concerns about a teaching technique which is currently being used in their classroom. Their input can help to transform the practice in a way which will help both students and teachers alike.

Are there any risks to your student if they are in this study?

The potential risks of taking part in this study are:

Students may be uncomfortable speaking honestly about classroom practice, however, the interviews are not tied to the course or its grades. Refusal to participate, or the decision to cease participation in the interviews will have no repercussions in the course. No personal or identifying information will be shared.

Will my information be kept private?

The data for this study will be kept private and confidential to the extent allowed by federal and state law. Under rare circumstances your data may be reviewed by KSU officials or people from the organization or agency that funded the study.

This study will be using unique participant codes in lieu of names to label data while keeping a separated list to match participant names to codes. Each participant will be interviewed on different days so there will be no interaction during the interview process. Additionally, the study will use only the participant's alias. Finally, I will limit publication of information to be certain the participant cannot be identified. The data will be kept in a secured computer and will be coded using Atlas.ti. The raw data will only be accessed by myself, the IRB safety review board, and possibly the committee who is overseeing my research (Dr. Crovitz, Dr. Dail, Dr. Adams).

Audio recording of interviews is mandatory. Students will be assigned an obscure mythological character as a designation to protect their identity. All recordings will be destroyed after 36 months.

When we tell other people or write articles about what we learned in the study, we won't include your student's name or that of anyone else who took part in the study. The subject's information collected as part of the research, even if identifiers are removed, will not be used or distributed for future research studies. The data for this study will be kept for 3 years

Are there any costs or payments for being in this study?

There will be no costs to you for taking part in this study. You will not receive money or any other form of compensation for taking part in this study.

What are my student's rights as a research study volunteer?

Participation in this research study is completely voluntary. They do not have to be a part of this study if they don't want to. There will be no penalty to them if they choose not to take part and no one will be upset or angry. Students may choose not to answer any questions they don't want to answer, and they can change their mind and not be in the study at any time.

Who can I talk to if I have questions?

If you have questions at any time, you can ask the researchers about the study. We will give you a copy of this form to keep. If you want to ask us questions about the study, call or email

Alex Jefferson Marsh – marshaj@fultonschools.org (404) 932 8890

The Kennesaw State University Institutional Review Board and Fulton County Schools have reviewed this study to make sure that the rights and safety of people who take part in the study are protected. If you have questions about your rights in the study, or you are unhappy about something that happens to you in the study, you can contact them at (678) 797-2268 or irb@kennesaw.edu.

What does my signature on this consent form mean?

Your signature on this form means that:

- You understand the information given to you in this form

- You have been able to ask the researcher questions and state any concerns

- The researcher has answered your questions and concerns

- You believe you understand the research study and the potential benefits and risks that are involved.

Statement of Consent

I, the parent or guardian of _____, a minor of _____ years of age, give my

voluntary consent to take part in this study. I will be given a copy of this consent document for my

records.