

An Integrative Review of the Conceptualization and Assessment of the Learner Flow Experience
in the Digital Game-Based Learning Environment between 2011 and 2021

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ABSTRACT

The impact of the learner flow experience (LFE) on learning outcomes has been studied for over four decades in a variety of formal and informal instructional settings, including the digital game-based learning (DGBL) environment. Since 2011, the examination of the LFE and its impact on learning outcomes has expanded to computer science-related disciplines, as well as other research communities. During this expansion, an increase in the number and definitions of terms related to the LFE has occurred. Likewise, the number of assessment tools used to capture evidence of the flow experience in learners playing DGBLs has increased. This integrative review examined 66 peer-reviewed articles published between 2011 and 2021, which reported the results of empirical studies seeking to identify and measure the learner experience of flow during DGBL gameplay. More specifically, this study sought to understand how the LFE and its dimensions were conceptualized and assessed in those articles. To do this, the relevant data was extracted from the articles, and, via iterative processes of analyses, the information related to the conceptualization and assessment of the LFE during DGBL game play was identified, analyzed, and organized.

The study's findings demonstrated that the number of terms used to describe the LFE dimensions increased during the time period studied, and that there is seemingly little consensus with regard to the conceptualization of the terms or their use in the assessment instruments

applied. However, this study also revealed that these terms and the methods by which they were assessed may be examined within the theoretical structure defined by Csikszentmihalyi in 1990, in which he codified nine dimensions to explain the flow experience. These dimensions are: (1) *balance of skills and challenge*; (2) *clear goals*; (3) *swift, unambiguous feedback*; (4) *merging of action and awareness*; (5) *concentration on the task at hand*; (6) *sense of control*; (7) *distorted sense of time*; (8) *loss of ego*; and (9) *autotelic experience*. Organizing the research question findings within this structure enabled the identification of themes of and synonyms for the nine flow dimensions with the addition of the construct *flow experience*.

To encourage future researchers' ability to interpret, compare, and contrast studies of the experience of the LFE during gameplay in the DGBL learning environment, a set of researcher guides was developed following an iterative process of comparisons and analysis across the research questions' findings. These guides present a description of each of the flow dimensions, associated key words and/or key phrases, synonyms for the dimension, and statements or questions used to solicit information from learners regarding their experience of each of the flow dimensions, organized by theorist. The goal for these researcher guides is that they will be used as references for future studies of the impact of flow on learning outcomes for DGBL players through providing a common vocabulary and set of assessment items. They also may help encourage and enhance collaboration between instructional designers and DGBL game designers in creating effective DGBLs that increase learning or user engagement and enjoyment through the fostering of conditions that enable the LFE phenomenon.

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GENERAL AUDIENCE ABSTRACT

Many adults recall losing track of time during play as children. Achieving the feeling of being in “the zone” during play or competition was anticipated and relished. As adults, the desire to recapture that state of being blissfully unaware of time, focused only in the moment and free from any concerns frequently drives sales of sporting equipment, leisure activities, and electronically-based games. This experience, called the flow state, can happen when engaging in a wide variety of activities, including learning. Research has shown that if a student reaches the flow state while learning, they learn more and derive greater satisfaction throughout the learning process. This has also been found to be the case for students engaging with digital game-based learning (DGBL) applications.

But how do we know if a DGBL player has entered the flow state? Researchers in the fields of instructional design and game design have asked and sought to answer this very question. This study examined the works of these researchers to understand specifically how the flow state was defined and measured in their studies.

As a result of this study, researcher guides were created to explain how the learner flow experience and its component dimensions are identified and described, as well as to provide questions that could be posed to students to help evaluate if the flow state was achieved during DGBL gameplay. The goal for these guides is that they will be used as references for future

studies of the impact of flow on learning outcomes for DGBL players through providing a common vocabulary and set of assessment items. They also may help encourage and enhance collaboration between instructional designers and DGBL game designers to create effective, enjoyable games for learning.

DEDICATION

This dissertation is dedicated

To my Dad, who has always believed in me, and has cheered me on through thick and thin, even though he never understood exactly what I was studying, and

To the memory of my Mom, whose first lesson for me was that to learn was to live;

Your grandchildren have benefitted from your combined legacy.

I love you both. Thank you for everything.

*“Muad’Dib learned rapidly because his **first training was in how to learn**. And the first lesson of all was the **basic trust that he could learn**. It is shocking to find how many people do not believe they can learn, and how many more believe learning to be difficult. Muad’Dib knew that **every experience carries its lesson**” *Dune* (Herbert, F., 1999, p. 89) (emphasis is added).*

ACKNOWLEDGEMENTS

Writing a dissertation at this age was a daunting task. I had to unlearn so much that I had learned as a business professional, and then had to learn even more to be successful in this endeavor. I arrive at the conclusion of this journey wiser and richer for the experience. At Virginia Tech, I have had the honor of studying with some brilliant and incredible people while at the School of Education (SOE).

Dr. Katherine Cennamo, my advisor, impressed me from the moment I met her. She encouraged me to find my own path and was honest in all of her dealings with me. Her tireless energy during the dissertation review process was both incredible and inspiring. There were many times she saw my eventual success more clearly than I did, and for that, I thank her. Her intense attention to detail brought clarity and inspiration to the process of finalizing this document before you.

I spent my final three semesters at Virginia Tech as a graduate assistant to Dr. Gehsmann, who arrived at the SOE as the new Director in the Fall semester of 2020. Her energy, dedication, and vision for the SOE inspired me to new heights (and skill sets) in Marketing and Communications, and enabled me to see how my studies in instructional design had made me a better marketer. I hope to bring that level of passion and vision to my future career, wherever it may lead me.

Through it all, my husband and I lived over 700 miles apart. Many hundreds of pounds of incredible quality coffee beans, flowers, food, and words of support were delivered to me in Blacksburg. The international trips and the cruises might not always have been timed well in terms of class assignments or COVID, but they were all appreciated. Our conversations about my work on my dissertation from his perspective as a highly-skilled ice hockey player and referee

and as a programmer helped me make connections that might not have otherwise surfaced.

My daughter Brennan went through her own journey of self-discovery while I pursued my doctorate; her growth inspires me daily, and I look forward to the many novels she will continue to author and publish. My sisters Deidre, Adrienne, Nadine, and Carina, and my daughter-in-law Samantha spent months listening to me talk incessantly about my dissertation. All of them, Nadine in particular, brought their keen grammar and punctuation eyes to bear on my abstracts and conclusion, and those sections of my dissertation are far better for their efforts. I have the best team supporting me from afar.

Finally, I must acknowledge my son and roommate, James Stidham, III. Much to our surprise, we made this Ph.D. journey together, he in Physics, I in Instructional Design and Technology (IDT). He was my source of sanity, my voice of reason, and my rock when all seemed lost (which occurred more times than I care to admit). His perspective from his journey helped me more than he will ever know. I am honored and blessed to have had such a companion through these years (despite the kitten for the last academic year), and I apologize here to him for using cooking as my stress relief. I am hoping both of our waistlines will recover post-graduation.

I am proud to have spent these years as part of the IDT community at Virginia Tech, with its dedicated, energized, and passionate students and faculty. I have made friends and memories I will cherish for life.

This was a journey during which I was never alone, even when I was locked in my apartment during the time of COVID and slogging through the work before you now. Thank you all for everything.

TABLE OF CONTENTS

ABSTRACT.....	ii
GENERAL AUDIENCE ABSTRACT.....	iv
DEDICATION.....	vi
ACKNOWLEDGEMENTS.....	vii
TABLE OF CONTENTS.....	ix
LIST OF TABLES.....	xii
LIST OF FIGURES	xiii
CHAPTER ONE.....	1
Need for the Study	1
Purpose of the Study.....	5
Research Questions.....	5
Significance of the Study.....	6
Organization of the Study.....	7
CHAPTER TWO	8
Literature Review	8
Digital game-based learning.....	8
DGBL Categorization.....	9
The Study of DGBLs	11
The Flow Experience	13
Dimensions of Flow.....	14

Flow Models	23
Conceptualization of the Flow Experience	26
Assessment of the Flow Experience	29
Summary of Literature Review.....	32
CHAPTER THREE	35
Methodology.....	35
Study Purpose	35
Research Questions.....	35
Study Design.....	35
Study Process	38
Stage 1: Problem identification.....	38
Stage 2: Systematic literature search and data set selection	39
Stage 3: Literature Appraisal	47
Stage 4: Data analysis	49
Stage 5: Analysis and synthesis	53
Stage 6: Present and discuss findings	59
CHAPTER FOUR.....	61
Findings	61
Findings of Research Question 1	61
Summary of Research Question 1.....	67

Findings of Research Question #2	68
Summary of Research Question 2.....	75
Synthesis into Researcher Guides.....	76
Summary of Chapter 4.....	77
CHAPTER FIVE	79
Conclusion	79
Discussion of Findings of Research Questions 1 and 2.....	81
Discussion of the Synthesis and Creation of the Researcher Guides.....	82
Unresolved Issues and Areas for Future Research	84
Limitations	85
Study Contribution and Conclusion.....	87
REFERENCES	89
APPENDIX A.....	109
APPENDIX B.....	110
APPENDIX C	111
APPENDIX D.....	117
APPENDIX E	153

LIST OF TABLES

Table 1: Listing of Flow Dimensions with References Related to Introduction of Term	26
Table 2: Listing of Additional Flow Dimensions with References Related to Introduction of Term	28
Table 3: Listing of Flow Consequences Created for the Study of the Flow Experience in the DGBL Environment with References Related to Introduction of Term	29
Table 4: Overview of Study Stages	37
Table 5: Inclusion Criteria for Data Set	41
Table 6: Summary, Selection Actions, Articles for Data Set	41
Table D1: Summary Guide, Balance of Challenge and Skills	118
Table D2: Summary Guide, Clear Goals	123
Table D3: Summary Guide, Swift, Unambiguous Feedback	126
Table D4: Summary Guide, Merging of Action and Awareness	129
Table D5: Summary Guide, Concentration on the Task at Hand	133
Table D6: Summary Guide, Sense of Control	136
Table D7: Summary Guide, Distorted Sense of Time	139
Table D8: Summary Guide, Loss of Ego / Loss of Self-Consciousness	142
Table D9: Summary Guide, Autotelic Experience	145
Table D10: Summary Guide, Flow Experience Construct	150

LIST OF FIGURES

Figure 1: Graphical Representation, Study Purpose	6
Figure 2: A Model of Flow	23
Figure 3: Csikszentmihalyi's Original Flow Model	24
Figure 4: Csikszentmihalyi's Revised Flow Model	24
Figure 5: Schell's Flow Model	25
Figure 6: Massimini and Carli's Flow Model	25
Figure 7: Counts of Studies Included in Data Set, Organized by Country of Study	42
Figure 8: List of Journals in which Studies Included in Data Set Appeared	43
Figure 9: Number of Publications by Year in Data Set	44
Figure 10: Authors Contributing Most Frequently in Included Studies	45
Figure 11: Learner Groups Organized by Educational Setting	46
Figure 12: Graphical Display, Assessments Used in Studies	51
Figure 13: Graphical Display, Assessment Variables and Statements	52
Figure 14: Frequency Analysis, Most Cited Sources for Flow Theoretical Framework in Data Set	55
Figure 15: Graphical Representation, Created Guides Within Study Purpose	84

CHAPTER ONE

This chapter examines the need for an integrative literature review of published empirical research studies of the learner flow experience (LFE) during digital game-based learning (DGBLs) gameplay, the purpose of the study, the research questions guiding the study, the significance of the study, and the organization of the study.

Need for the Study

DGBLs have been explained as “a type of active learning which applies to educational games in learning contexts” (Chen, 2020, p. 3061). This differentiates DGBLs from games designed for training, as DGBLs “target the acquisition of knowledge as its own end and foster habits of mind and understanding that are generally useful or useful within an academic context” (Klopfer et al., 2009, p. 21). The effectiveness of DGBLs in the academic environment has been studied for over 20 years, and while some mixed results have been noted, they generally have had a positive effect on learner motivation, learner performance, and learner perceptions of the material presented (Ke, 2015). The notion of using games within education to stimulate learning is not a new one (Ke, 2015; Kim et al., 2018). Gamification, and DGBLs in particular, have often been shown to increase learner engagement, learner motivation, and learning outcomes (Ke, 2016; Kim et al., 2018; Zou, 2021).

One aspect of DGBL gameplay that has intrigued researchers has been the LFE and its potential for further increasing learning outcomes (Choi et al., 2007; Esteban-Millat et al., 2014; Faiola et al., 2013; Ho & Kuo, 2010; Katuk & Ryu, 2011; Lee & Choi, 2013; Pearce et al., 2005). The flow experience phenomenon occurs during participation in a wide variety of activities as well as during DGBL gameplay. It is varyingly called *flow*, *flow experience*, *flow*

state, and in this document the *LFE*.

For over 40 years, *flow*, described as “optimal experience” (Csikszentmihalyi, 1975, p. 43), has been studied by psychologists in terms of well-being and enjoyment in the search for what makes an individual view an activity as valuable and worth repeating (Engeser et al., 2021). The goal in this search was to identify what made participation in an activity rewarding and, as such, worthy of the time invested, or as an *autotelic experience*. The *autotelic experience*, defined as “rewarding in and of itself (auto = self, telos = goal), quite apart from its end product or any extrinsic good that might result from the activity” (Nakamura & Csikszentmihalyi, 2002, p. 90), and the intrinsic rewards derived therefrom, drive the desire to replicate these enjoyable occurrences.

In his 1975 article, “*Play and Intrinsic Rewards*,” the psychologist Csikszentmihalyi defined, clarified, and codified the study of flow, and offered that his research grew out of a desire to understand intrinsically motivated activities (Nakamura & Csikszentmihalyi, 2002). Flow, Csikszentmihalyi explained, is a state of being deeply absorbed when participating in the process and experience of an activity, wherein the participant loses themselves in the moment (1975). This experience is often described in terms of the sensations athletes seek to achieve during the course of play or competition. Many experience flow when they focus closely during an activity, be it painting, running, dancing, or any other myriad possibilities. In flow, the boundaries normally imposed by ego are transcended, and we are in complete control of our actions and environment. Beard described flow as “a very positive psychological state that typically occurs when a person perceives a balance between the challenges associated with a situation and their ability to meet the demands of the challenge” (Beard, 2014, p. 353). The nine dimensions common to the flow experience have been described as: (1) *challenge-skill balance*,

(2) *action-awareness merging*, (3) *clear goals*, (4) *unambiguous feedback*, (5) *concentration on the task at hand*, (6) *sense of control*, (7) *loss of self-consciousness*, (8) *transformation of time*, and (9) an *autotelic experience* (Csikszentmihalyi, 1990; Csikszentmihalyi & Csikszentmihalyi, 1998; Nakamura & Csikszentmihalyi, 2002).

Csikszentmihalyi (1997) argued that the flow state can be utilized to center attention and to create a state of readiness to learn. Studies examining the LFE in learning environments have shown increases in student learning (Choi et al., 2007; Esteban-Millat et al., 2014; Faiola et al., 2013; Ho & Kuo, 2010; Katuk & Ryu, 2011; Lee & Choi, 2013; Pearce et al., 2005), learner persistence (Joo et al., 2011), feeling of achievement (Joo et al., 2015), desire for higher performance (Bressler & Bodzin, 2013), learner satisfaction (Choi & Baek, 2011; Esteban-Millat et al., 2014; Guo et al., 2012; Joo et al. 2013; Weibel et al., 2012), and learner exploratory behavior (Forte et al., 2012; Yang et al., 2014; Zhao et al., 2011).

The LFE and its impact on learning outcomes has been studied within the field of education for over two decades (Choi et al., 2007; Esteban-Millat et al., 2014; Faiola et al., 2013; Heutte et al., 2016; Ho & Kuo, 2010; Katuk & Ryu, 2011; Lee & Choi, 2013; Pearce et al., 2005; Rheinberg, 2008; Shernoff et al., 2003). Researchers have also studied (1) the LFE as a spontaneous occurrence (Bressler & Bodzin, 2013; Csikszentmihalyi, 1997; Csikszentmihalyi & Nakamura, 1989; Joo et al., 2015; Nakamura & Csikszentmihalyi, 2002; Shernoff et al., 2003), (2) the LFEs effects on motivation (Bressler & Bodzin, 2013; Joo et al., 2015), (3) the LFEs impact on learner engagement (Joo et al., 2015; Shernoff et al., 2003), and (4) the LFE's impact on learner satisfaction (Esteban-Millat et al., 2014; Guo et al., 2012; Joo et al., 2013; Lee & Choi, 2013; Weibel et al., 2012).

The beneficial effect of the LFE on learning outcomes has inspired researchers to

examine the effects of encouraging the LFE for the purpose of increasing learning, or creating a more enjoyable learning experience for study participants, or to observe the incidence of the LFE and its impact on learning. It continues to be examined in a variety of learning environments, including traditional face-to-face, distance learning, massive open online courses, and in DGBLs (Rheinberg, 2008; Shernoff et al., 2003; Zeng et al., 2020; Zhao et al., 2011). Findings have demonstrated that when the flow experience occurs for learners, either their actual or perceived learning, or both, was enhanced (Choi et al., 2007; Esteban-Millat et al., 2014; Faiola et al., 2013; Ho & Kuo, 2010; Katuk & Ryu, 2011; Lee & Choi, 2013; Pearce et al., 2005). As a consequence of the LFE, students' learning effort was described as being more enjoyable than had been previously experienced as learners, and as one worth repeating (Csikszentmihalyi, 1997; Eisenberger et al., 2005; Fredricks & McColskey, 2012; Pavlas et al., 2010; Shernoff et al., 2003; Xie, 2013; Xie & Ke, 2010).

Interest in the study of the LFE during DGBL gameplay has expanded from the fields of psychology and educational research into that of computer science-related disciplines, including computers in education (Bressler & Bodzin, 2013; Buil et al., 2019), educational games (Connolly et al., 2012; Zeng et al., 2020), intelligent tutoring systems (Paiva et al., 2015; Woolf, 2015), and adaptive hypermedia systems (Brusilovsky & Maybury, 2002). Concurrently, an expansion in the ways in which the flow experience is conceptualized and assessed has occurred (Payne et al., 2011; Peifer & Engeser, 2021; Seifert et al., 2011). During this period, researchers' definitions and conceptual frameworks diverged widely, resulting in difficulties associated with generalizing their findings (Peifer & Engeser, 2021).

Encouraging the incidence of the LFE for the purpose of enhancing learning is a desirable goal. It can be argued that the conceptualization of the terms of flow and its dimensions are

conceptualized should be consistent so findings may be generalized in a meaningful manner. Complicating this goal is lack of standardized assessment tools by which a researcher may identify if a learner has achieved flow (D’Mello & Graesser, 2012; Engeser et al., 2021; Peifer & Engeser, 2021). Most researchers use self-developed post-play questionnaires to assess whether a learner has achieved flow (Peifer & Engeser, 2021). These questionnaires are typically rooted in Csikszentmihalyi’s original Flow Questionnaire (published by Csikszentmihalyi in 1975), his Experience Sampling Method (ESM) (published by Csikszentmihalyi in 1997), or the Flow State Scale (FSS) developed by Jackson and Marsh (1996) (Esteban-Millat, et al., 2014; Faiola et al., 2013; Fredricks & McColskey, 2012). As a result, mismatches between assessment tools and the researcher’s conceptualization of flow may exist. The need for a study to summarize, organize, and cluster information in an understandable manner to facilitate comparison and generalization across studies of the LFE during DGBL gameplay is thus identified.

Purpose of the Study

The purpose of this study was to conduct an integrative review examining the study of the learner flow experience (LFE) of learners engaging with digital game-based learning (DGBLs) applications, specifically examining the LFE conceptualization and assessment. Figure 1 is a graphical representation of this study purpose.

Research Questions

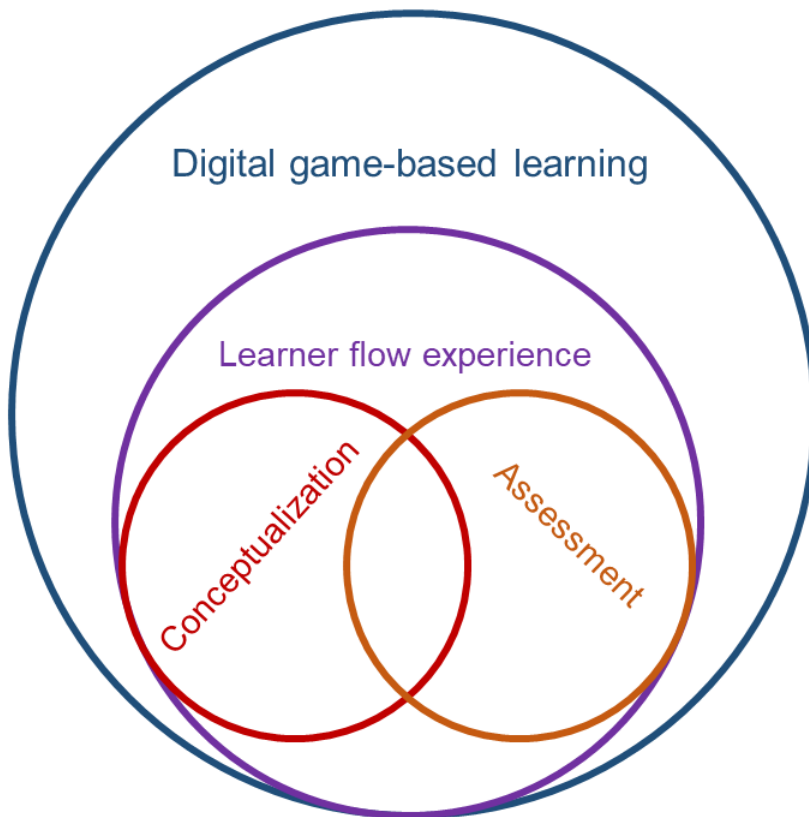
To address the identified problem, this integrative review was guided by two research questions:

1. How has the learner flow experience been conceptualized in empirical literature in the study of learners engaging with digital game-based learning?
2. How has the learner flow experience been assessed in empirical literature in the study

of learners engaging with digital game-based learning?

Figure 1

Graphical Representation, Study Purpose



Significance of the Study

Toronto (2020) explains that the purpose of an integrative literature review as “to summarize what is known about a topic and to communicate the synthesis of the literature to a targeted community” (p. 1). Further, for a review to be considered rigorous, they state the review must follow a comprehensive documented methodology. Conclusions must be drawn from diverse sources as the researcher addresses the current state of evidence, the quality of the

evidence, and gaps in the literature. Finally, the researcher should identify future steps for research and practice (Toronto, 2020).

Specifically, during the course of this study, I examined the ways in which the LFE during DGBL gameplay has been conceptualized and how it has been assessed, and drew conclusions regarding the relationships between the conceptualization of the flow experience and assessment in these studies. To do this, after selecting the studies to be included in the data set, I extracted data using the initial codes identified during the definition of this study. This extracted data was then organized into categories, which enabled data analysis and visualization in preparation for generating responses to the research questions posed. Once the research questions had been explored, a synthesis of the findings was performed, and the need for the creation of guides to enable future researchers to compare and contrast studies across disciplines and approaches was identified. These guides, structured around the conceptual framework utilized for this study, have been created as an outcome of this research.

Organization of the Study

This study is presented in five chapters. Chapter One provides an overview of the study, including the need for the study, its purpose, the research questions guiding the study, and its significance. Chapter Two presents a brief literature review about the current state of research into the LFE during DGBL gameplay. This literature review is intended to orient the reader to the topic as an introduction to this study's exploration of the extant literature. Chapter Three presents the methodological approach used in this study, including its design, process, and strategies. Chapter Four presents the findings from the integrative literature review, and the synthesis of the findings. Finally, Chapter Five presents the conclusions drawn, a discussion of the findings, the study's limitations, and direction for future research.

CHAPTER TWO

Literature Review

The purpose of this chapter is to briefly review the study of the flow experience in learners in the DGBL environment. This literature review is not intended to answer the research questions, or to critically review the breadth of available literature before beginning the study. Specifically, this literature review examines the evolving understanding of DGBLs, DGBL categorization, the flow experience, the flow experience dimensions, and how the flow experience has been conceptualized and assessed.

Digital game-based learning

Scott Rogers (2014), the designer of the Pac-Man World and Mario series of games, explains that games are basic in nature. They require at least one player, have rules, and have a win and/or lose condition. Fun, he adds, is not necessary, but it does add to the player experience. In his book on video game design, he offers “[a] game needs a clear objective so that the player knows what the goal is” (Rogers, 2014, p. 9). Kim et al. (2018) provide the following definition of a game: “A game is an action or set of actions, that includes one or more people, objects, or animals, usually in competition with others, that follows a specific set of rules, in order to achieve a goal” (p. 16). According to Baumann et al. (2016), “game developers distinguish between two aspects of demands: pacing (i.e., the time pressure to make decisions and the development of it) and ramping (i.e., the decision complexity and the development of it)” (p. 507). The balance of these two aspects, they continue, is a key element in the design of a game. More importantly, “in games, the rules define what the relevant stimuli are, and exclude everything else as irrelevant. However, rules alone are not always enough to get a person

involved with the game. Hence, the structure of games provides motivational elements which will draw the player into play” (Csikszentmihalyi, 1975, p. 46).

DGBL Categorization

Researchers have proposed a variety of categorization schema for DGBLs. In his chapter “*Education v. Entertainment: A Cultural History of Children’s Software*”, Ito (2008) argued that software developed with learning goals specifically targeted to elementary aged children “drew from a [long] history of educational reform efforts that looked to play as a site of learning” (p. 87). He examined media and industry genres to describe his educational software category schema, focused on the type of learning integrated. *Educational* games prioritize the drill-practice format, *Entertainment* games prioritize narrative and play with learning as a side effect, and *Construction* games are characterized by domain-generic incidental learning. He argued, “the three strands of curricular, entertainment, and construction software are loosely tied to behaviorist, play-centered, and constructivist educational philosophies” (Ito, 2008, p. 89). He viewed the educational software industry as mature at the time, and his categorization schema has persisted.

The *Education* category, representing the original educational DGBLs developed by software producers, featured games like *Reader Rabbit*, *Oregon Trail*, and *Math Blasters*. Ito (2008) explained that these games, and others like them, represented a departure from the past, “incorporating visual and narrative elements from popular culture” (p. 91). The *Entertainment* category grew out of the commercial off-the-shelf software industry, and was described as a “comparatively broad genre” (p. 93). In this category, Ito includes the titles *Barbie Fashion Designer*, *Pajama Sam in Thunder and Lightning Ain’t So Frightening*, and *Planetary Taxi*. “Pleasure,” Ito explained, is placed “front and center” (p. 94) in the design of these DGBLs.

Finally, *Construction* games focus on world construction and game authoring, encouraging learners to create their own worlds. Titles Ito included in this category not only included *Microworlds* and *KidPix* (LOGO programming games), but *SimCity*, *DinoPark Tycoon*, and *Print Artist*, illustrating the breadth of titles he organized into this strand.

Other researchers have suggested DGBL categorization based on the type of game play designed for users and the method by which content and learning are integrated into game play (Klopfer et al., 2009; Habgood & Ainsworth, 2011), by spatial movement (Aarseth et al., 2003), and by game type (Juul, 2009). The researchers agree however, the core design goal for a DGBL is for the acquisition of “purposefully learned information inside an educational context” (Ke, 2016, p. 224), and the enabling of learning without interrupting the game play experience (Habgood & Ainsworth, 2011; Klopfer et al., 2009; Zou et al., 2021).

More recently, the concept of serious games, and the rich categorization associated with them has been introduced (Klopfer et al., 2009). Klopfer et al. (2009) explains the serious games taxonomy as categories representing the intersections between each of the intended audiences (*Government & NGO, Defense, Healthcare, Marketing & Communications, Education, Corporate, and Industry*) and the intended purpose (*Games for Health, Advergaming, Games for Training, Games for Education, Games for Science and Research, Production, and Games for Work*) (p. 21). The intersection between the audience of “*Education*” and the purpose of “*Games for Education*” is defined as “*Learning*” in this taxonomy (Klopfer et al., 2009, p. 21). Kim et al. (2018) define “serious games for learning and education [as] games that are developed for the purpose of achieving learning and education objectives in the real world” (p. 29). Hamari et al. (2016) adds serious games “are distinct from entertainment-oriented games in that, while they are often also enjoyable, they are designed for primary end purposes other than entertainment

and leisure” (p. 171). First described in the early 2000s, serious games were initially developed for military training purposes and were quickly adapted to industry personnel training purposes (Hamari et al., 2016; Kim et al., 2018; Klopfer et al., 2009). Klopfer et al. (2009) argue “learning games are differentiated from games for training in that they target the acquisition of knowledge as its own end and foster habits of mind and understanding that are generally useful or useful within an academic context” (p. 21).

The Study of DGBLs

The learning environments within which these DGBLs may be used include formal (K-20 educational classrooms, be they physical, hybrid, or virtual), or informal (such as museums or a learner’s home). The goal of these games is to support and enhance academic learning; the challenge for teachers and instructors is to creatively integrate these into their instruction (Hamari et al., 2016; Kim et al., 2018; Klopfer et al., 2009). It is important to note many researchers have moved beyond Ito’s (2008) straightforward categorization schema into Klopfer et al.’s (2009) broader, intent-driven approach to DGBL categorization. Thus, the inclusion of games in the classification of serious games that are specifically identified as educational in nature, and associated with both formal and informal learning environments, as well as commercial off-the-shelf games (e.g., *World of Warcraft*, *Second Life*, *Assassin’s Creed*, or *Rollercoaster Tycoon*) typically associated with informal or self-learning environments is possible. The goal of these games is the learner’s acquisition of knowledge, supported through defined learning goals, through the mechanics of game play. For this integrative review, DGBLs classified as educational serious games will form the foundation of the filtering process to select the data set to be examined in this study.

According to Chen (2020), DGBLs are “regarded as a type of active learning which applies educational games in learning contexts” (p. 3061), and they have been the subject of study by researchers for more than two decades (Ke, 2016; Zou et al., 2021). In her literature review focused on the study of DGBLs, Ke (2016) suggests DGBL game play “has positive cognitive, motivational, emotional, and social effects” (p. 221). However, she cautions that while the visual and multimodal representations of information within a game, supported by problem solving simulations and instant feedback, “can provide an immersive and authentic context for experimentation and situated understanding” (p. 221), the effectiveness of DGBLs depends on the learning goals and the methods by which these games are used. Zou et al. (2021) further report “the effects of DGBL have been extensively experimented in higher education and reported to be overall positive on prompting learner motivation, raising the sense of control over learning and enhancing learning performance and perceptions” (p. 153), although they, too, acknowledge not all DGBLs are effective for these efforts.

Csikszentmihalyi’s studies into play and intrinsic motivation, and his extension of these studies into educational settings and learning are often the theoretical framework for studies of flow research (Baumann, 2016; Beard, 2014; dos Santos et al., 2018; Primus & Sonnenburg, 2018; Rogers, 2014; Sanjamsai & Phukao, 2018; Schell, 2008). In his seminal article, Csikszentmihalyi (1975) opined that his model had implications for a wide variety of social and cultural institutions, including education, and for better understanding human motivation. The LFE during DGBL gameplay has inspired excitement in researchers and has been documented and studied (Baumann et al., 2016; Beard, 2014; dos Santos et al., 2018; Erhel & Jamet, 2019; Huette, et al., 2016; Primus, 2018; Sanjamsai & Phukao, 2018). In their systematic literature review, dos Santos, et al. (2018) noted that the benefits observed from the LFE during DGBL

gameplay included “(1) [an] increase in students’ learning; (2) more in-depth reflective process; and (3) students’ satisfaction” (p. 53). Thus, researchers often reference flow theory when examining DGBL design in terms of the experience of the player experience and learning outcomes (Baumann, 2016; Beard, 2014; dos Santos et al., 2018; Primus & Rogers, 2014; Sanjamsai & Phukao, 2018; Schell, 2008; Sonnenburg, 2018).

The Flow Experience

The question of “*Why is play intrinsically rewarding?*” (Csikszentmihalyi, 1975, p. 42) and the proximate question *How can learning be viewed as play or as intrinsically rewarding?* have been a subject of study for over 40 years. In his seminal article on the topic, *Play and Intrinsic Rewards*, Csikszentmihalyi (1975) identified a common experiential state in participants engaged in play and in experts engaged in focused activities, which he called *flow*. More importantly, he realized that this experiential state was not limited to play, although it was often experienced during that time. Rather, he described flow as a “conceptually *independent process*” (Csikszentmihalyi, 1975, p. 43) which could be identified and studied. In introducing his model of flow, he argued it had implications for better understanding human motivation in a wide variety of social and cultural institutions, including education.

Flow is often felt while people truly enjoy themselves in the process and experience of an activity. Flow is what some athletes seek to achieve during the course of play or execution. Flow is what is experienced when people dive deeply into an activity, be it reading, painting, running, dancing, or in other options. Flow exists when we lose ourselves in the moment, when our awareness has merged with our existence. In flow, we transcend the boundaries normally placed by our egos, and feel in complete control of our actions and environment (Csikszentmihalyi, 1975). Flexibility in the definition of the concept of activity, allowing for a range of possible

endeavors beyond play or sport, is essential. It allows for a wide variety of experiences, opportunities, endeavors, or efforts in which one may participate and possibly enjoy the flow experience (Harmat et al., 2016).

Dimensions of Flow

Csikszentmihalyi (1975) described what he called elements of the flow experience: (1) *merging action and awareness*, (2) *centering of attention*, (3) *loss of ego*, (4) *control of action and environment*, (5) *demands for action and clear feedback*, and (6) the *autotelic nature of flow*. Csikszentmihalyi revised the list of elements, or dimensions, of the flow experience to consist of: (1) *balance of skills and challenge*, (2) *clear goals*, (3) *swift, unambiguous feedback*, (4) *merging of action and awareness*, (5) *concentration on the task at hand*, (6) *sense of control*, (7) *distorted sense of time*, (8) *loss of ego / “transcendence of self”* (p. 33), and finally, (9) an *autotelic experience* (Csikszentmihalyi, 1990). When in flow, the individual operates at their full capacity, experiencing a state of “dynamic equilibrium” (Nakamura & Csikszentmihalyi, 2002, p. 90).

Typically, researchers consider the first three dimensions, *challenge-skill balance*, *clear goals*, and *unambiguous immediate feedback* conditions for or *antecedents* of flow (Schell, 2008). The next six dimensions describe the subjective state of the experience itself with the characteristics of *concentration on the task at hand*, *merging of action and awareness*, *loss of ego*, *a sense that the individual has control over their actions*, and *a distortion of the sense of time* (Nakamura & Csikszentmihalyi, 2002). The experience of the activity as intrinsically rewarding (an autotelic experience) (Nakamura & Csikszentmihalyi, 2002) is considered the consequence of the flow experience, as are other positive benefits, including enhanced learning and enjoyment (Shernoff et al., 2003). When in flow, the individual is operating at their full

capacity, experiencing a state of “dynamic equilibrium” (Nakamura & Csikszentmihalyi, 2002, p. 90).

For the purpose of this study, the flow dimension structure that will be described corresponds with that identified by Csikszentmihalyi (1990). The first three dimensions, *balance of skills and challenge*, *clear goals*, and *swift, unambiguous feedback*, are often grouped together and referred to as antecedents or precursors to the flow experience (Csikszentmihalyi, 1975, 1990, 1997), and will be discussed first, followed by a discussion of the six dimensions that are thought to be representative of the flow experience itself.

Challenge-Skill Balance

Here, a *balance of the challenges and skills* describes the extent of the learner’s skills in terms of the material, experience, or situation in which they find themselves, and the challenges they perceive therein. Any activity in which one may engage offers the participant a selection of opportunities for action, and thus for challenges, which require the appropriate skills to realize. Setting up a checkers board, for example, is not a challenge for a practiced player, but sitting across from an opponent and competing against them requires the use of skills to meet the challenges the activity presents. However, Csikszentmihalyi cautions, “competition is enjoyable only when it is a means to perfect one’s skills, [for] when it becomes an end in itself, it ceases to be fun” (Csikszentmihalyi, 2009, p. 49). Challenges are not limited to physical or competitive activities, however. Even the enjoyment one receives from looking at a painting or sculpture in a museum depends on the challenges the work of art presents. If the challenges posed within an activity are equal to the abilities of the individual, the possibility for enjoyment exists (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002). The notion of the balance between the level of skills possessed by the individual and the challenges inherent in an

activity has been central to the notion of flow since the beginning, and has been empirically confirmed. However, as noted in Csikszentmihalyi and Nakamura's chapter in the 1989 *Handbook of Motivation Theory and Research*, those empirical studies exposed a constraint: "both the challenges and the skills must be relatively high before anything resembling the flow experience comes about" (p. 184).

Clear Goals and Unambiguous Immediate Feedback

Clear goals and unambiguous immediate feedback provide boundaries and goals by which the individual may measure their progress and success during an activity. These clear goals and unambiguous immediate feedback should be provided as part of the activity. The activity goals must be known before the start, and the feedback must be received during and within the context of the activity in pursuit of a successful conclusion. Originally listed separately in Csikszentmihalyi's 1975 article, these two dimensions are often combined by researchers in this field, since in world of psychology, they are viewed as intertwined (Csikszentmihalyi, 2009; Erhel & Jamet, 2019; Nakamura & Csikszentmihalyi, 2002).

Even when the duration of the activity is by nature quite extended, the dimensions of goals and feedback are still essential. The sense of satisfaction a gardener feels when caring for their plants provides ongoing enjoyment even as they continue to work towards their anticipated tomato harvest. Without setting goals, and without the ability to recognize and evaluate feedback, a participant is far less likely to find enjoyment in an activity. In cases where particular goals cannot be necessarily be predetermined, such as when randomly sketching on a drawing pad, the process itself often provides feedback during the artist's progress. Most activities, however, start with a clear goal or set of rules in mind; sometimes those are negotiated at the beginning of the activity. Feedback, on the other hand, is often driven by the activity undertaken.

Csikszentmihalyi (2009) offers “the *kind* of feedback we work toward is in and of itself unimportant...What makes this information valuable is the symbolic message it contains” (p. 57). What is important is that when an individual takes part in an activity, they understand what feedback is more valuable to them, and how they will seek to understand and process the received feedback. That feedback must be clear, it must be specific to the activity at hand, and it must be delivered in a manner in which a benefit is provided to the individual (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002).

Concentration on the Task at Hand

The dimension *concentration on the task at hand* describes the centering of attention to the exclusion of other stimuli. The normal state of an individual’s mind is noisy. There are distractions all about in the form of other individuals, the weather, social media, traffic, worries, and other sources of input that create disorder in one’s consciousness. One of the more enjoyable aspects about an activity during which an individual may experience flow is the complete focus of their attention on the task at hand to the exclusion of extraneous inputs (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002). During the execution of enjoyable activities, there simply is no room left for non-essential thoughts or distractions. “But it is not only the temporal focus that counts. What is more significant is that only a very select range of information can be allowed into awareness” (Csikszentmihalyi, 2009, p. 58). This does not happen due to a force of will, or by demanding the *self* ignore all else, which would be difficult, if not impossible to demand. Instead, the participant simply becomes so absorbed by the activity, by the challenges, by the skills they are leveraging, and by the experience in the moment, that no thought related to the outside world intrudes (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002).

Merging of Action and Awareness

Merging of action and awareness occurs when the individual is fully conscious of their actions, and yet are unaware of that awareness, even as they are completely involved in what they are doing. When a participant is engaged in an activity, and all of their relevant skills are required to meet the challenges of the activity, their attention will be completely absorbed by their efforts (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002). This is because there is no excess mental capacity or energy remaining that could otherwise be used to process extraneous information. Participants become so deeply involved in the activity that their actions become “spontaneous, almost automatic; they stop being aware of themselves as separate from the actions they are performing” (Csikszentmihalyi, 2009, p. 53). In that moment, there is no *self* separate from the performance. It is important to note the physical energy exerted in such an experience rarely makes it effortless. Indeed, in the example of a dancer during a performance, their exertions are strenuous. There is no excess energy to be dedicated to reflection, or for the audience’s awareness of the performance. Instead, the dance occurs “as if by magic” (Csikszentmihalyi, 2009, p. 53). The merging of action and awareness can also occur when knitting or when enjoying a performance by skilled actor—moderate to extreme physical exertion is not a requirement to experience this flow dimension (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002).

Loss of Self-Consciousness

Loss of self-consciousness is described as the shedding of self-consciousness or intrusions of ego. This occurs when a person is so completely involved in the demands of their activity they no longer consider external influences or others’ perceptions of their actions. Csikszentmihalyi and Nakamura (1989) explained that, as the merging of action and awareness occurred, the

individual enjoyed both a total concentration on and in the present moment, and they experienced a “loss of self-consciousness, such that there is an absence of critical self-talk and social comparison” (Csikszentmihalyi et al., 2018, p. 220). Csikszentmihalyi (2009) argued that the normal state of self-awareness, our awareness of threats (real and imaginary), and our notions of who we are consume mental energy. Threats to our self-image bring us into awareness, and in those moments, we are forced to evaluate our notions of our selves and our abilities, further consuming mental energy as the sense of self is brought back into balance. In flow, however, there is no mental energy available to be devoted to this self-awareness or evaluation of the self. There are clear goals, stable rules, and challenges matched to the skill level of the individual, so there is no threat to the image of their self, and no need to devote energy to maintaining the sense of self. The participant is free to fully focus on what it is they are doing, and thus is free to lose a consciousness of the self or their self-concept. They can simply exist in the moment, and in the pushing of the boundaries with which they are engaging (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002).

Sense of Control

Sense of control refers to a person’s perception of both their actions and the environment within which they find themselves. It may seem disingenuous to say that participation in an activity that allows the participant to experience flow allows them a sense of control, since it may be successfully argued that any sense of control regarding one’s life is an illusion. Instead, it is more accurate to state these participants lack worry about a loss of control, which is continuous in many areas of one’s life (Csikszentmihalyi, 2009). The perception of having a sense of control has caused researchers to express some levels of concern because of the foolhardy behaviors that some may choose to participate in (Nakamura & Csikszentmihalyi,

2002).

The feeling of being in control of one's destiny can be potent, and the loss of fear of failure can drive individuals to push their boundaries even further. For an elite athlete, this can translate into greater gains in ability, while for a gambler, this can lead to loss of money, relationships, or more. Csikszentmihalyi (2009) emphasizes "activities that produce flow experiences, even the seemingly riskiest ones, are so constructed as to allow the practitioner to develop sufficient skills to reduce the margin of error to as close to zero as possible" (p. 61). Thus, participants must be aware of the addictive nature of the activities in which they can participate, and must remain aware that participation is a conscious choice, rather than letting it slide into a necessity or into an escape from the many uncertainties and ambiguities that attend life. A sense of control, like many things in life, has clear positive and negative implications, and the individual has the responsibility to be aware of these (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002).

Transformation of Time

The concept of the *transformation of time* can best be described as that feeling after an activity, event, or experience where one says, "I don't know where the time went," and describes when the individual is fully immersed and aware of their experience, to the exclusion of the time spent (Nakamura & Csikszentmihalyi, 2002). When participating in an activity that allows the individual to enjoy the flow experience, they often report a feeling of time distortion, whereby time did not seem to pass in the usual manner (Csikszentmihalyi, 1975). Moments may seem like hours, and vice versa. Time, as measured by clocks, no longer seems to exist, or to even matter. No clear reason or source for this transformation of time has been identified by researchers—it may result from the intense concentration required to participate in the activity or from some

other force—or perhaps, it is a quality of the experience itself (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002). Regardless, the notion of a schedule as a required element for a normal daily activity is simply not part of the consciousness of a participant in an activity that encourages the flow experience. This is true even when those activities are bound by time clocks such as in the case of many sporting activities like basketball or ice hockey (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002).

Autotelic Experience

Nakamura and Csikszentmihalyi (2002) offered that intrinsically motivated activities are *autotelic*, or are activities viewed as “rewarding in and of itself (auto = self, telos = goal), quite apart from its end product or any extrinsic good that might result from the activity” (p. 90). Even if the activity was initially engaged in because of outside influences, once that activity consumes the participant, it becomes intrinsically rewarding, where simply participating in the activity is its own purpose. Csikszentmihalyi (2009) offered that “...when the experience is autotelic, the person is paying attention to the activity for its own sake; when it is not, the attention is focused on its consequences” (p. 67). It is important to note, however, that no activity is purely autotelic or exotelic (done for external reasons) (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002). Most activities are a blend of the two.

For many people, it can be argued, external incentives are required to initiate participation in an activity, especially ones that requires the participant to develop new skills. However, once they start to develop those requisite skills, the possibility exists that a level of enjoyment may accompany the participation in the activity (Nakamura & Csikszentmihalyi, 2002). This growth of skills and abilities can be seen in children when they first start to learn a game: initially, the rules may seem arcane, and the required skill set out of their reach. But, with

practice and some study, games (and other activities) become more familiar, and as the child's skill sets grow, greater challenges can be entertained (Csikszentmihalyi, 1975).

However, the desire to match skills to challenges can sometimes lead to less than optimal life choices (Csikszentmihalyi, 2009). Stealing a car takes some level of skill, and is quite a challenge, and, it can be argued, can be an autotelic experience. Like much else in life, the flow experience can be seen as either good or bad depending on the application of skills to an activity's challenges. Participants can grow towards a potential, and engage in activities that enrich their lives—this would be the preferred route—with the goal of making the most of their efforts in a positive way (Csikszentmihalyi, 1975, 1997, 2009; Nakamura & Csikszentmihalyi, 2002).

The experience of the activity as an *autotelic experience* is considered by most to be the consequence of the flow experience (Nakamura & Csikszentmihalyi, 2002; Shernoff et al., 2003), while some consider the occurrence of this final dimension as evidence of the flow experience itself. However, while some theorists propose to use a single dimension to measure the occurrence of the flow experience, recent research illustrates that this approach is inadequate (Engeser & Schiepe-Tiska, 2021). Instead, flow is thought to be the result of the complex interaction of all of the dimensions (Csikszentmihalyi, 1975, 1990, 1997; Engeser & Schiepe-Tiska, 2021; Moneta, 2021; Nakamura & Csikszentmihalyi, 2002). Engeser and Schiepe-Tiska (2021), in their chapter updating and reviewing the state of research into flow, and Nakamura and Csikszentmihalyi (2002) argue that the occurrence of any single dimension does not immediately identify the flow experience as having occurred.

The latter six dimensions of the flow experience, *merging of action and awareness*, *concentration on the task at hand*, *sense of control*, *distorted sense of time*, *loss of ego*, and

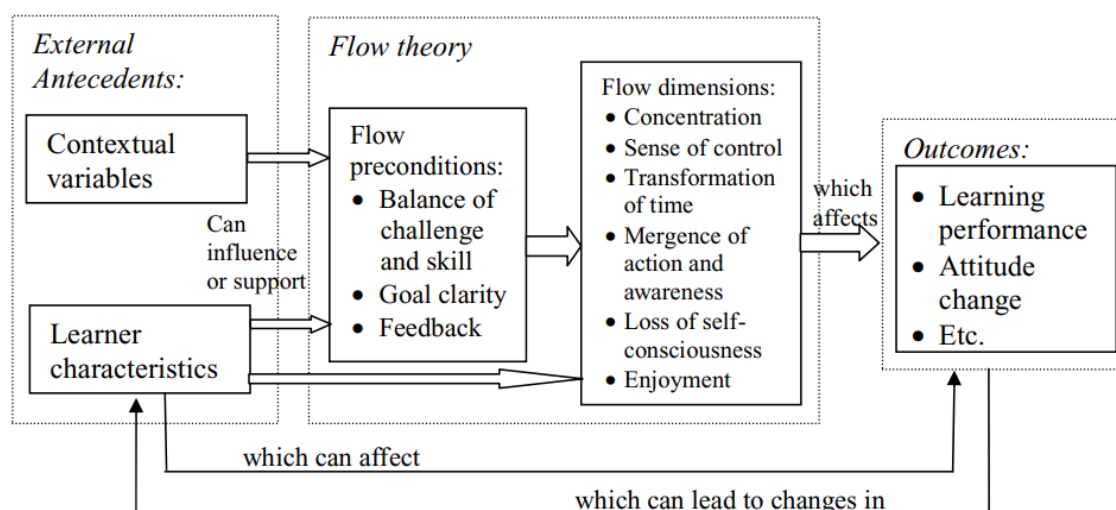
autotelic experience are often grouped together as the subjective state of the experience (Nakamura & Csikszentmihalyi, 2002).

Flow Models

Envisioning how the flow dimensions interact, and how the experience of flow may occur during an activity has also been of interest to researchers. Guo and Ro (2008) described a model which organized their view of the LFE antecedents (which they refer to as “preconditions”), the flow experience (subsumed within “flow theory”), and consequences (which they refer to as “outcomes”). Their model organized the flow dimensions within a framework that examines the interactions of external antecedents (contextual variables and learner characteristics), flow preconditions and flow dimensions, and detailed the outcomes which may be enjoyed as a result of the LFE (see Figure 2).

Figure 2

A Model of Flow

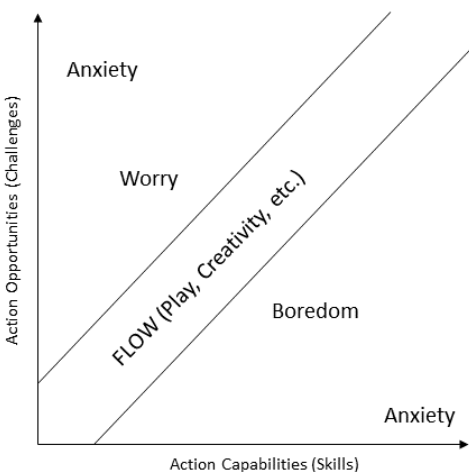


Note: From “Empirical Research: Capturing Flow in the Business Classroom,” by Y. M. Guo and Y. K. Ro, 2008, *Decision Sciences Journal of Innovative Education*, 6(2), p. 441. Reproduced with permission of publisher, John Wiley and Sons (license number: 5264370401959) and with permission of the corresponding author, Y.M. Guo.

Csikszentmihalyi (1975) proposed a model describing flow in terms of the interactions of an individual with their environment, coupled with their skills, the challenges posed, the opportunities presented to them by the environment, and a limited set of emotional states (see Figure 3). Csikszentmihalyi and Nakamura (1989) modified this model to reflect the location of flow within a range of eight different emotional states related to flow, again focused on the examination of an individual's response to the balance of skills and challenges afforded by the environment and the situation in which they find themselves (see Figure 4).

Figure 3

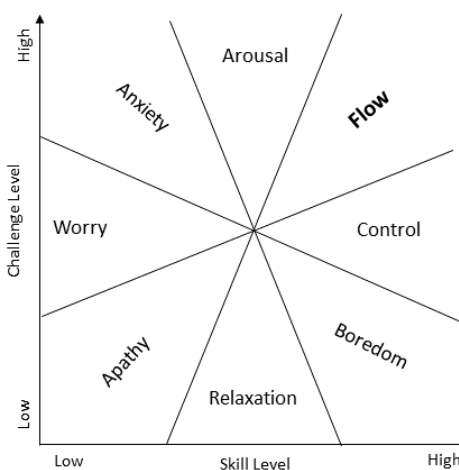
Csikszentmihalyi's Original Flow Model



Note: Csikszentmihalyi, M. (1975). "Play and Intrinsic Rewards," *Journal of Humanistic Psychology* 15(3), p. 53. Copyright 2014 Springer Science+Business Media. Reprinted by permission from Springer Nature Customer Service Centre GmbH: Springer.

Figure 4

Csikszentmihalyi's Revised Flow Model



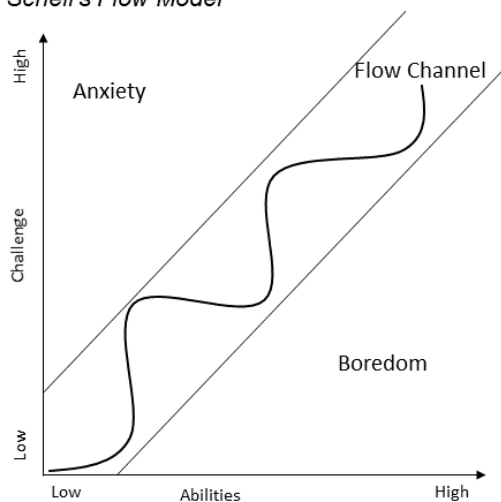
Note: Csikszentmihalyi, M., Nakamura, J. (1989). "The Dynamics of Intrinsic Motivation: A Study of Adolescents," *Handbook of Motivation Theory and Research, Vol. 3: Goals and Cognitions*, p. 11. Copyright 2014 Springer Science+Business Media. Adapted by permission from Springer Nature Customer Service Centre GmbH: Springer.

As research into flow continued, researchers proposed flow models, with differing perspectives on the flow experience. For example, Schell (2008) proposed that rather than flow representing a steady state within a zone or band as represented in Figure 3, participants experienced an ebb and flow within the zone during the gameplay experience, and cautioned game designers to respect the "delicate balance" (p. 121) of the player and their skills in any

given moment (see Figure 5). Massimini and Carli (1988) added an “average level” (p. 271) in the center, corresponding with the participants’ normal state of existence (see Figure 6). They further labeled the different emotional states as channels, describing them as representing ratios between skills and challenges. Notably, each of these models examines the drivers of the flow state in terms of emotions experienced within a balance of skills and challenges.

Figure 5

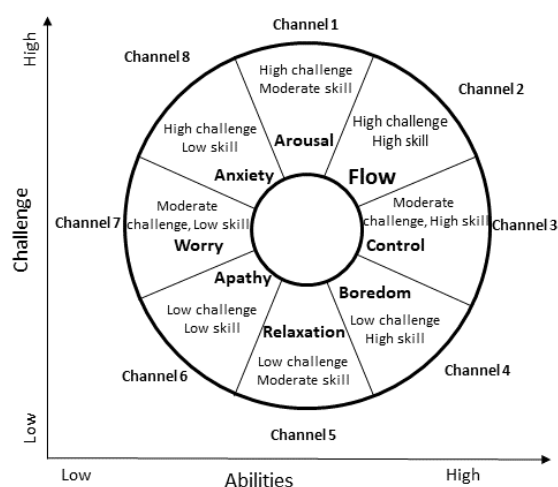
Schell's Flow Model



Note: From “The Art of Game Design: A Book of Lenses,” 2008, by J. Schell, p. 121. Copyright 2008 Morgan Kaufman Publishers. Reproduced with permission of the author.

Figure 6

Massimini and Carli's Flow Model



Note: From “The Systematic Assessment of Flow in Daily Experience,” 1988, in *Optimal Experience: Psychological Studies of Flow in Consciousness*, p. 270. Copyright 1988 Cambridge University Press. Reproduced with permission of The Licensor through PLSclear.

Understanding the dimensions of flow, their interactions, and their roles in the design and experience of an activity is essential to the study of the flow experience. Analyzing the experience of an activity specifically, and determining the recurrent patterns, has formed the foundation of flow research (Engeser, 2021). As Csikszentmihalyi continued his studies of individuals and their experience of flow, both independently and with other researchers, he realized there was a finite, consistent set of common themes or dimensions to the flow experience (Csikszentmihalyi, 1975, 1997; Csikszentmihalyi et al., 2018; Csikszentmihalyi & Larson, 1987; Csikszentmihalyi & Nakamura, 1989; Nakamura & Csikszentmihalyi, 2002).

However, while many researchers agree with this position, how the flow dimensions have been they conceptualized and described has varied.

Conceptualization of the Flow Experience

Since 1975, the original list of six flow dimensions was modified researchers, including by Csikszentmihalyi himself. Additional dimensions have been proposed, including *absorption* (Bakker, 2005; Engeser & Rheinberg, 2008; Rheinberg et al., 2003) and *distortion of time* (Csikszentmihalyi & Csikszentmihalyi, 1988; Jackson & Marsh, 1996; Nakamura & Csikszentmihalyi, 2002). Some researchers shifted the focus to the participant, offering the dimensions of (a) *experience of clear goals* (in contrast to the existence of *clear goals*, which Csikszentmihalyi described in 1975) (Jackson & Marsh, 1996); (b) *experience of unambiguous feedback* (in contrast to the existence of *immediate unambiguous feedback* presented to the participant, which may not be experienced as such) (Jackson & Marsh, 1996); and (c) *experience of challenge-skill balance* (in contrast to the presentation of an activity that meets the abilities of the participant, who might not perceive that they have the necessary skills in that moment) (Jackson & Marsh, 1996). Additional proposed dimensions included *intrinsic motivation* (Bakker, 2005), and *enjoyment* (Bakker, 2005). Hoffman and Novak (1996) took yet another approach to identifying the dimensions of flow, offering (1) *enjoyment*, (2) *telepresence*, (3) *focused attention*, (4) *engagement*, and (5) *time distortion* (see Table 1).

Table 1

Listing of Flow Dimensions with References Related to Introduction of Term

Flow Dimension	Source Reference
Merging of action and awareness	Csikszentmihalyi, 1975; Csikszentmihalyi & Csikszentmihalyi, 1988
Centering of attention	Csikszentmihalyi, 1975; Csikszentmihalyi & Csikszentmihalyi, 1988; Hoffman & Novak, 1996

Flow Dimension	Source Reference
Loss of ego / self-consciousness	Csikszentmihalyi, 1975; Csikszentmihalyi & Csikszentmihalyi, 1988
Swift, unambiguous feedback	Csikszentmihalyi, 1975; Csikszentmihalyi & Csikszentmihalyi, 1988
Experience of unambiguous feedback	Jackson & Marsh, 1996
Sense of control	Csikszentmihalyi, 1975; Hoffman & Novak, 1996; Engeser & Rheinberg, 2008
Clear, unambiguous goals	Csikszentmihalyi & Csikszentmihalyi, 1988; Jackson & Marsh, 1996
Balance of skills and challenge	Csikszentmihalyi & Csikszentmihalyi, 1988
Experience of clear goals	Jackson & Marsh, 1996
Experience of challenge-skill balance	Jackson & Marsh, 1996
Concentration on task at hand	Csikszentmihalyi & Csikszentmihalyi, 1988; Shernoff et al., 2003
Distorted sense of time	Csikszentmihalyi & Csikszentmihalyi, 1988; Jackson & Marsh, 1996; Hoffman & Novak, 1996; Nakamura & Csikszentmihalyi, 2005
Autotelic experience	Csikszentmihalyi, 1975; Csikszentmihalyi & Csikszentmihalyi, 1988
Engagement	Hoffman & Novak, 1996

Rodriguez-Sanchez and Schaufeli (2008) argued for a collapse of Csikszentmihalyi's dimensions into three aspects: (1) *absorption*, (2) *enjoyment*, and (3) *intrinsic interest*. Shernoff et al. (2003) further argued that when *concentration*, *interest*, and *enjoyment* are experienced simultaneously in an activity, then it is likely flow will occur. They combined these three variables into a composite construct dimension they called *engagement*. Peifer and Engeser (2021) also argue for a three-component approach, describing: (1) *absorption*, (2) *perceived demand-skill balance*, and (3) *enjoyment*. They stated *absorption* could be "understood to subsume [*action-awareness merging*, *centering of attention*, *loss of ego/self-consciousness*, and

time transformation] and in this sense it can be regarded as a *core component of flow*” (p. 423). They further argued that Jackson and Marsh (1996), with their focus on the participant rather than the activity, have improved how researchers should examine flow. Peifer and Engeser (2021) proposed a new core component, *perceived demand-skill balance*, which would subsume Nakamura and Csikszentmihalyi’s (2002) dimensions of *clear goals*, *immediate unambiguous feedback*, and *experience of challenge-skill balance*, and offer that the notion of the components of flow are worthy of further examination and discussion (see Table 2).

Table 2

Listing of Additional Flow Dimensions with References Related to Introduction of Term

Flow Dimension	Source Reference
Absorption	Rheinberg, Vollmeyer, & Engeser, 2003; Bakker, 2005; Engeser & Rheinberg, 2008; Peifer & Engeser, 2021
Intrinsic interest	Shernoff et al., 2003; Rodriguez-Sanches & Schaufeli, 2008
Intrinsic motivation	Bakker, 2005
Enjoyment	Hoffman & Novak, 1996; Shernoff et al., 2003; Bakker, 2005; Rodriguez-Sanches & Schaufeli, 2008; Peifer & Engeser, 2021
Perceived demand-skill balance	Peifer & Engeser, 2021

The Conceptualization of the Flow Experience in the DGBL Environment

In the world of DGBLs, researchers have defined flow consequences in differing ways, including: *feeling of achievement* (Joo et al., 2015), *creativity and imagination* (Cooper, 2010), *feeling happy and cheerful* (Esteban-Millat et al., 2014), *learner persistence* (Joo et al., 2011), *flash of intensity* (Bressler & Bodzin, 2013), *desire for higher performance* (Bressler & Bodzin, 2013), and *satisfaction* (Esteban-Millat et al., 2014; Guo et al., 2012; Joo et al., 2013; Lee & Choi, 2013; Weibel et al., 2012) (see Table 3).

Table 3

Listing of Flow Consequences Created for the Study of the Flow Experience in the DGBL Environment with References Related to Introduction of Term

Flow Dimension	Source Reference
Feeling of achievement	Joo, Oh, & Kim, 2015
Creativity and imagination	Cooper, 2010
Feeling happy and cheerful	Esteban-Millat et al., 2014
Learner persistence	Joo et al, 2011
Flash of intensity	Bressler & Bodzin, 2013
Desire for higher performance	Bressler & Bodzin, 2013
Satisfaction	Esteban-Millat et al., 2014; Joo, et al., 2013; Lee & Choi, 2013; Guo, et al., 2012; Weibel, et al., 2012

Most researchers agree on the common flow experience antecedents of *balance of skills and challenge, clearly stated measurable goals, and immediate, unambiguous feedback* identified by Csikszentmihalyi and Csikszentmihalyi (1988). However, their conceptualization of these antecedents varies. Barthelmäs and Keller (2021), like Peifer and Engeser (2021), advocate for the examination of flow as dependent on the participant's perception of the fit of their skills to the activity and its challenges. Before this broad swath of concerns and characteristics can be integrated into the study of flow in individuals participating in activities, and in educational activities in particular, I would argue that a common approach to the dimensions of flow, their descriptions, their role in the flow experience, and the expected consequences of flow should be developed.

Assessment of the Flow Experience

Just as the theoretical approaches to the conceptualization of the flow experience vary

between researchers, so, too, do approaches to the assessment of the flow experience. Nakamura and Csikszentmihalyi (2002) expressed hope that a “consensual ESM measure to facilitate the accumulation of knowledge” (p. 101) would be developed. However, the plethora of approaches and tools that have been developed complicates this goal.

For his seminal work on flow and for some years after, Csikszentmihalyi (1975) relied on interviews and questionnaires to collect information and data for his systematic analysis of the experience in individuals (Csikszentmihalyi, 1975; Shernoff et al., 2003). Citing methodological issues related to questionnaires and interviews related to recollections, personality dimensions, response sets, and cultural stereotypes, Csikszentmihalyi developed the Experience Sampling Method (ESM) in 1979 (Larson & Csikszentmihalyi, 1983). The objective of this method was to obtain self-reports for representative moment samples in people’s lives. Participants in the study would carry a pager, and when signaled, complete a report (using pre-printed forms in a journal-style notebook, leveraging a variety of questions and measures), regardless of activity (if possible to do so safely). The intention was to collect as broad a range of data as possible regarding the participants’ lives during a typical week. The ESM is still used by researchers today, albeit via a smartphone, tablet, or computer-based application (dos Santos et al., 2018; Peifer & Engeser, 2021).

Jackson and Marsh (1996) proposed a Flow State Scale (FSS), seeking to examine participants in athletic activities, including sports, and physical educational activities. In questionnaire format, Jackson and Marsh’s FSS was composed of 36 questions, encompassing Csikszentmihalyi’s nine dimensions of flow (Jackson & Marsh, 1996; Csikszentmihalyi & Csikszentmihalyi, 1988). Jackson and Marsh’s work was further leveraged by subsequent researchers to create a more general approach to a flow scale that could be more broadly applied

(Rheinberg, 2008). Rheinberg noted that all of the methodologies developed, however, suffered from intrusiveness and had a high cost in terms of the time needed to complete the various questionnaires. He recommended the use of the Flow-Kurzskala Scale, which leveraged far shorter questionnaires, and argued their approach could be applied to a variety of contexts.

Heutte et al. (2016) sought to examine the flow experience in students, proposing to study the optimal functioning of learners who are part of a community, and the communities and education or training systems within which they learn. Combining several of the dimensions described by Nakamura and Csikszentmihalyi (2009), they defined *Autotelism-Flow* as a subjective experience, combining *concentration on the task at hand, merging of action and awareness, loss of self-consciousness, sense of control, time distortion, and autotelic experience* (the activity being intrinsically rewarding). They relied on the work of Hoffman and Novak (2009), in which they “found significant disparities concerning both (1) the definition/conceptualization of flow dimensions, and (2) the antecedents, the experience of flow and its effects” (Heutte et al., 2016, p. 129) to understand how flow was categorized and examined and to build their model. For their studies, Heutte et al. (2016) developed the EduFlow Scale, focused on *cognitive absorption, time transformation, and autotelic activity and well-being*, choosing these as the relevant dimensions of the original nine dimensions of the flow experience.

Flow scales have also been developed to examine the flow experience in participants in DGBLs. Fu et al. (2009) proposed the EGameFlow scale with eight flow dimensions (*concentration, clear goals, feedback, challenge, autonomy, immersion, social interaction, and knowledge improvement*); this instrument had 42 items, using a Likert-style 6-point format. Kiili et al. (2012) proposed the Flow Framework for Game-Based Learning, composed of nine items,

using a 6-point Likert-type format, which examined nine dimensions of flow (*challenge, goal, feedback, playability, concentration, time distortion, rewarding experience, loss of self-consciousness, and sense of control*), and a construct labelled “*flow experience*” (p. 88). Their work was based on the GameFlow questionnaire previously developed by Kiili and Lainema (2008), which sought to measure and define the flow experience of gamers.

Yoshida et al. (2013), in their examination of occupational tasks, created an FSS composed of fourteen items. It, too, was based on Csikszentmihalyi’s nine dimensions of flow. Novak et al. (2000) created an FSS to examine users in online environments. Martin and Jackson (2008) proposed yet another FSS to evaluate participants’ subjective experience of flow (albeit using only two measures). Moneta (2021) advocates using a combination of the Flow Questionnaire (Csikszentmihalyi & Csikszentmihalyi, 1988), the ESM (Larson & Csikszentmihalyi, 1983), in their proposed “componential approach” (p. 50), which examines flow as a multidimensional state-trait variable (referencing back to Csikszentmihalyi’s nine dimensions and their interactions).

The lack of consensus on how to identify, define, or measure the flow experience continues to stymie researchers, and to cause confusion in readers of research. Peifer and Engeser (2021) postulate “most or all researchers” (p. 428) would agree with a standard set of measurement dimensions, especially if “special research questions concerning moderators or antecedents of flow” (p. 428) could be added, and they express confidence this measurement set will be defined.

Summary of Literature Review

This literature review began with an examination of DGBLs, their categorization, and how that categorization has evolved over the years. Next, the study of the impact of DGBLs, and

the study of the impact of the LFE on DGBL players was presented. This led to an examination of the study of the flow experience, its dimensions, and several models describing the flow experience. These models ranged from Guo and Ro (2008)'s depiction of their conceptualization of the LFE in the business classroom to Csikszentmihalyi (1975)'s original visualization of the conditions necessary to enable flow and his revised model (Csikszentmihalyi & Nakamura, 1989). These were followed by Schell (2008)'s model, which expanded Csikszentmihalyi's 1975 model to emphasize the ebb and flow of the LFE, and finally, Massimini and Carli (1988)'s model, which further expanded the Csikszentmihalyi and Nakamura model with greater details.

The conceptualization of the flow experience has also evolved over the years; the many terms and the theorists proposing them were discussed. Of the nine dimensions proposed by Csikszentmihalyi (1990), *balance of skills and challenge; clear goals; swift, unambiguous feedback; merging of action and awareness, concentration on the task at hand, sense of control, distorted sense of time, loss of ego, and autotelic experience*, the first three of typically grouped together as antecedents of flow, while the latter six are considered the subjective state of the flow experience (Csikszentmihalyi, 1990; Engeser & Schiepe-Tiska, 2021; Nakamura & Csikszentmihalyi, 2002). Summaries of different clusters of flow dimension names were presented, along with the theorists proposing them. Finally, the evolution of the methods by which flow has been assessed was presented and discussed.

While DGBLs have been studied for over two decades, and flow and its impact on learners and their learning have been studied for over four decades, a review of the literature revealed a gap in terms of the conceptualization and assessment of the LFE during DGBL gameplay. This gap was revealed not only in the studies conducted in the DGBL learning environment, but in the study of flow across disciplines, resulting in difficulties associated with

generalizing findings (Peifer & Engeser, 2021). As the study of the LFE during DGBL gameplay and its impacts expands to disciplines beyond psychology, education, and educational psychology, it is increasingly necessary to organize and interpret the previous research, and to create an update of the existing base of scholarship. The gap thus identified in this process drove the development of the research questions and the selection of the methodology for this study.

CHAPTER THREE

Methodology

Study Purpose

The purpose of this study was to conduct an integrative review examining the study the learner flow experience (LFE) of learners engaging with digital game-based learning (DGBLs) applications, specifically examining the LFE conceptualization and assessment.

Research Questions

This integrative review was guided by two research questions:

1. How has the learner flow experience been conceptualized in empirical literature in the study of learners engaging with digital game-based learning?
2. How has the learner flow experience been assessed in empirical literature in the study of learners engaging with digital game-based learning?

Study Design

The integrative review methodology is particularly appropriate for this study. Torraco (2005, 2016) defined the integrative review as “a distinctive form of research that generates new knowledge about the topic” (Torraco, 2016, p. 404) through review, critique, and synthesis of the literature in an “integrated way such that new frameworks and perspectives on the topic are generated” (Torraco, 2005, p. 356). Callahan (2010) expanded Torraco’s definition to specify that an integrative review is further characterized by its “concentrated focus” (p. 301) and the use of a systematic methodology in the development of the review and in the creation of the synthesized information.

An integrative review differs from a systematic literature review in several respects

(Toronto, 2020). In general, literature reviews have the common purpose of summarizing what is known about a topic. In particular, both integrative and systematic literature reviews have the common purpose of communicating this synthesis to a targeted community, and each must follow a documented systematic process to achieve their purposes. However, an integrative review takes a broader approach to the examination of a topic, which may include both empirical and theoretical sources to reach its aims. Further, the systematic process that drives an integrative review is used “to identify, analyze, appraise, and synthesize all selected studies” (Toronto, 2020, p. 2). Although statistical analysis methods are not included in the review process, observed significant patterns are to be identified and included in the findings. Callahan (2010) offered that integrative reviews allow the author to “systematically trace much (or maybe even all) of the literature on a selected topic back to its roots” (p. 301).

Torraco (2005) identified two types of integrative reviews, the first of which examines a mature topic that has a broad and diversified base of literature which has developed over the years. The second kind examines “new or emerging topics” (p. 357) that would benefit from a comprehensive review of the literature. In either case, it is expected that the knowledge constructed from the synthesis of the literature will result in a reconceptualization offering a new perspective on the topic and drawing conclusions from diverse sources (Toronto, 2020; Torraco, 2005). The focus of this study is the well-developed topic of the LFE as it occurs in DGBL players during gameplay; the goal of this study is to make recommendations and note implications for research, practice, education, and application (Toronto, 2020).

Torraco (2005) describes five stages for the integrative review process: (1) identification of an appropriate topic, (2) justification of the literature review methodology selected, (3) literature search, (4) analysis and critique of the literature, and (5) synthesis of results.

Whittemore and Knafl (2005) also describe a five-stage approach: (1) problem identification, (2) literature search and review, (3) data evaluation, (4) data analysis (which itself is broken down into five distinct steps), and (5) presentation. Most recently, Toronto (2020) expanded and redefined the integrative review process, listing six necessary steps: (1) formulate purpose and/or review question, (2) systematic search and selection of literature, (3) quality appraisal of selected literature, (4) analysis and synthesis, (5) discussion and conclusion, and (6) dissemination of findings.

Specifically, for this study, the Whittemore and Knafl (2005) and Toronto (2020) approaches were combined to ensure rigor throughout the process of analysis, following the stages listed in Table 4. In this table, Toronto's fourth and fifth stage and Whittemore and Knafl's fourth stage have been recombined to specifically emphasize the work necessary to develop and apply a logical classification system for issues, variables, and sample characteristics that may be identified as part of the study and to ensure an extensive knowledge base is established (Broome, 2000).

Table 4

Overview of Study Stages

Stage	Action in Stage	Tasks in Stage
1	Problem identification	Identify problem in literature ^{a,b} Develop research questions ^a Identify review purpose ^{a,b}
2	Systematic literature search and data set selection	Define search criteria ^{a,b} Select appropriate databases ^{a,b} Initiate search ^{a,b} Develop inclusion and exclusion criteria to determine relevant sources ^{a,b} Identify initial variables of interest ^{a,b}
3	Literature appraisal	Evaluate quality of primary sources using initial variables ^{a,b} Identify potential keywords to aid in filtering ^{a,b} Explore themes to refine approach to problem ^a

Stage	Action in Stage	Tasks in Stage
4	Data analysis	Data reduction via overall classification system ^b Extract and code data ^{a,b} Create matrices to enhance pattern visualization ^{a,b} Identify patterns, themes, and relationships ^{a,b}
5	Analysis and synthesis	Examine patterns, themes, and relationships identified ^{a,b} Synthesize information gathered ^a Draw conclusions ^{a,b} Identify recommendations and implications ^{a,b}
6	Present and discuss findings	Create concise summary of major findings and key contributions ^a Support conclusions, recommendations, and implications ^{a,b} Identify and detail limitations ^{a,b} Write results and research agenda ^{a,b}

^a Toronto, 2020

^b Whitemore & Knafl, 2005

Study Process

The process of following a comprehensive method and reporting in such a way that the method can be replicated is necessary for an integrative review to be considered rigorous (Toronto, 2020). To ensure rigor, the six stages followed are designed to execute robust, replicable procedures.

Stage 1: Problem identification

The identified problem and defined questions were described previously in this paper, and together drove the selection of the integrative review as the appropriate research methodology. Next, the purpose of the review was developed: to conduct an integrative review examining the study of the LFE when they are engaging with DGBLs by researchers in disciplines both within fields normally associated with educational research and extending to the fields of computer science, data science, user experience design, and game design. The goal of this review was to generate new knowledge about (a) how the LFE conceptualized in the DGBL environment, (c) how the LFE and its dimensions have been assessed after DGBL play, (d)

patterns and issues in the existing data, and (e) a research agenda, as well as practical suggestions.

Stage 2: Systematic literature search and data set selection

Stage 2 started with the identification of keywords, which informed the direction of a computerized data search. These efforts were followed by a manual search of databases using the references and bibliographies of the articles identified and reviewed (Cooper, 1986). This data collection phase requires the use of “well-defined literature search strategies” (Whittemore & Knafl, 2005, p. 548). Use of clearly defined search strategies reduces the potential for insufficient or biased search results, and may increase the accuracy of the papers included in the data set in terms of meeting the needs of this study (Cooper, 1998; Whittemore & Knafl, 2005).

To conduct this integrative review, academic databases, including EBSCOhost databases, specifically: ERIC, Education Research Complete, PsychINFO, and Computers & Applied Sciences Complete; and JSTOR databases, specifically including Education, Psychology, and Computer Science, were searched. The WorldCat and IEEEExplore databases were also searched. In addition, a higher education librarian was engaged to ensure the selected databases would yield the most results, and to assist in the refinement of the search strategies.

The key terms used for this search were extensive. Even though this integrative review is focused on DGBLs, other terms such as computer-based learning games, computer games for learning, and serious computer games have been used to describe DGBLs and thus were also included in the keyword searches. The list of keyword search terms may be found in Appendix A of this document. The terms relating to DGBLs were chosen after evaluating similar literature reviews (Bittencourt et al., 2016; dos Santos et al., 2018). The consultation with the higher education librarian assisted in the process of refining and modifying the list contained therein.

The combination of the terms identified in Appendix A yielded a wide range of literature to review; limiting the search to peer-reviewed empirical studies published in English in the last ten years helped focus efforts, reducing the number of results in this data set to 4,273. Once this data set was collected, a systematic process was followed to screen and document the data sets of papers identified during searches and the reasons for their inclusion in or exclusion in the final data set for this study. To answer the research questions as posed, it was essential that only relevant empirical studies were reviewed as part of this study (Martin et al., 2014; Pentland et al., 2011); theoretical articles were collected and housed in a separate data set for examination and support data during the study process. The inclusion criteria used to examine the article titles and abstracts of potentially relevant papers identified in the first database searches are in Table 5.

Following the search of the computerized databases, an “*ancestry approach*” (Cooper, 1986, p. 41) was applied. Cooper describes this method as a manual review of the references and bibliographies of the papers identified and reviewed, with the expectation of discovering additional valuable sources for the study. Utilizing this ancestry approach, the references cited in the studies collected identified additional articles. A manual search of all of the issues of the most-cited journals was also executed to ensure no articles were overlooked during the search process. All potentially eligible articles were included in the data set examined.

The full systematic process, its rationale, and its results are documented in Table 6. The list of the articles that were ultimately selected for the data set may be found in Appendix C.

Table 5*Inclusion Criteria for Data Set*

Criteria
Empirical Study
Study focused on the digital game-based learning environment
Study focused on the examination of flow in learners
Study focused on the examination of learning
Study focused on the intersection of the flow experience in learners, learning, and DGBL learning environment
Study published between 2011 and 2021 in a peer-reviewed journal
Study published in English

Table 6*Summary, Selection Actions, Articles for Data Set*

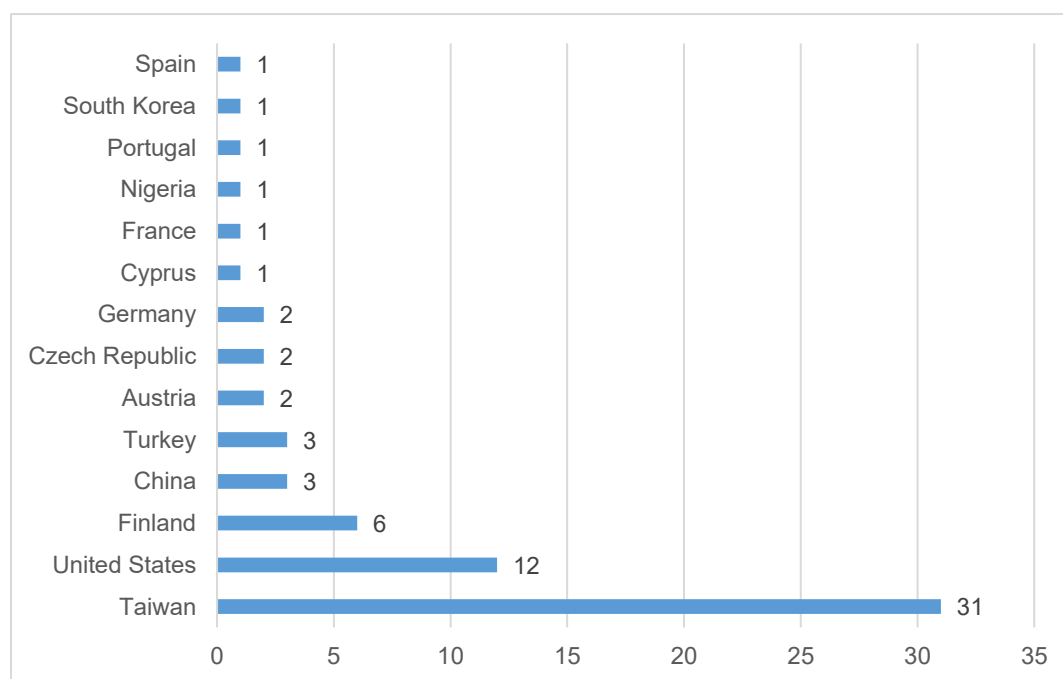
Quantities	Action	Reason for Inclusion / Exclusion
4,273	articles identified through database searches as potentially relevant; references imported into citation manager (Zotero)	
980	references identified as possibly relevant via examination of article title	
	100 duplicates removed	
880	studies screened via title and abstract against inclusion criteria	
	667 studies excluded	
213	studies assessed via full-text analysis against inclusion criteria	
	157 studies excluded	
		72 Did not examine the flow experience in learners
		30 Did not examine DGBLs
		16 Theoretical pieces, not empirical studies
		14 Conference paper - not peer reviewed article
		11 Did not examine the intersection of DGBLs and flow
		6 Did not examine learning
		4 Did not examine the intersection of DGBLs and learning
		4 Dissertation – not peer reviewed article
	10 studies added during ancestry review / full text analysis	
66	studies identified for final data set	

Characteristics of the Studies Included in the Data Set

Once the peer-reviewed articles were selected for inclusion in the data set, an analysis of their characteristics was performed. The first analysis identified the countries in which the studies were conducted, and the journals and years of their publications identified. The locations and types of the learner populations across the empirical studies was also examined. The number of studies conducted with learners in Taiwan represented 45.5% of the studies included in this data set; studies conducted in the United States represented 18.2%, while 9% of the studies were conducted in Finland. The balance of the studies (27.3%) occurred in the remaining 11 countries. One study was conducted in Africa, nineteen were conducted in Europe, thirty-four were conducted in Asia, and twelve in the United States. No studies were found for inclusion in the data set that were published from Australia, South America, Canada, or Mexico. One study (Kiili et al., 2015) was conducted in two countries (see Figure 7).

Figure 7

Counts of Studies Included in Data Set, Organized by Country of Study



The next analysis examined the journals in which the empirical articles identified for the data set were published. Thirty-one different journals are represented in the data set; 17 of the journals appear in the data set once (see Figure 8).

Figure 8

List of Journals in which Studies Included in Data Set Appeared



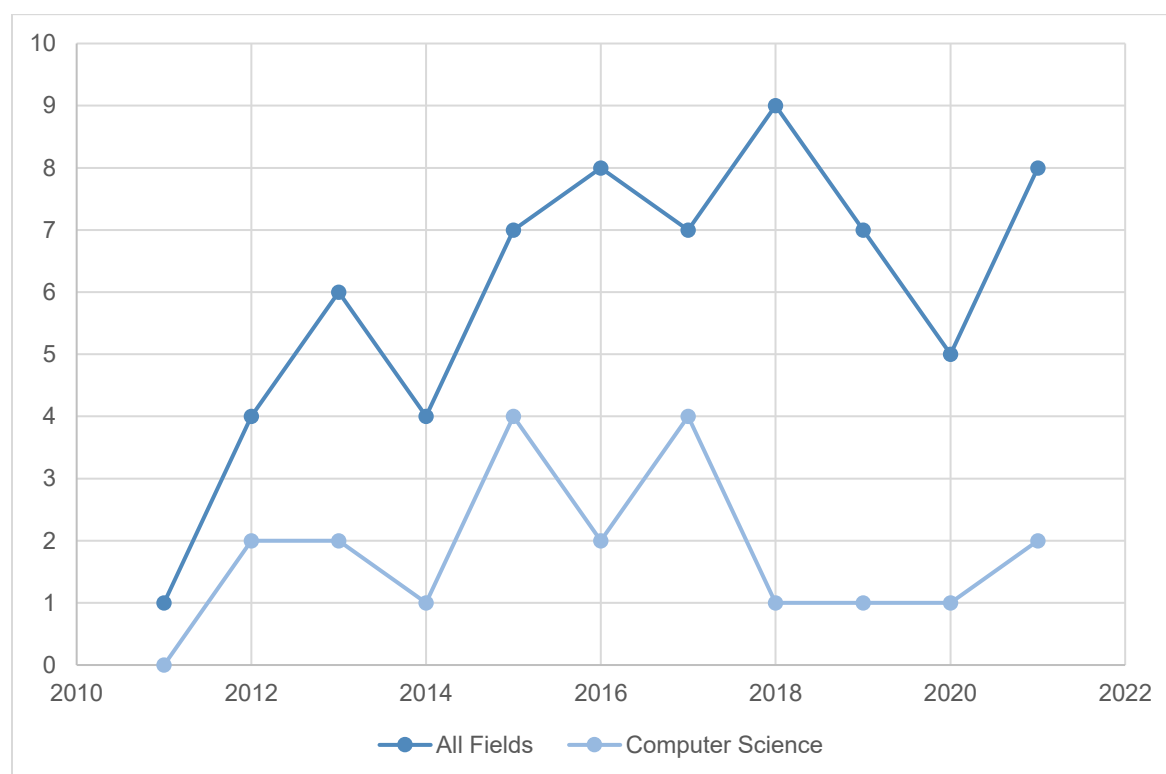
In the data set, the journal *Computers & Education* was the source of eight of the articles.

Computers in Human Behavior was the source for seven, the *International Journal of Serious*

Games, five, and each of *Educational Technology Research & Development*, *Interactive Learning Environments*, and the *Journal of Computer Assisted Learning* was the source for four of the articles. The years of publication are depicted in Figure 9.

Figure 9

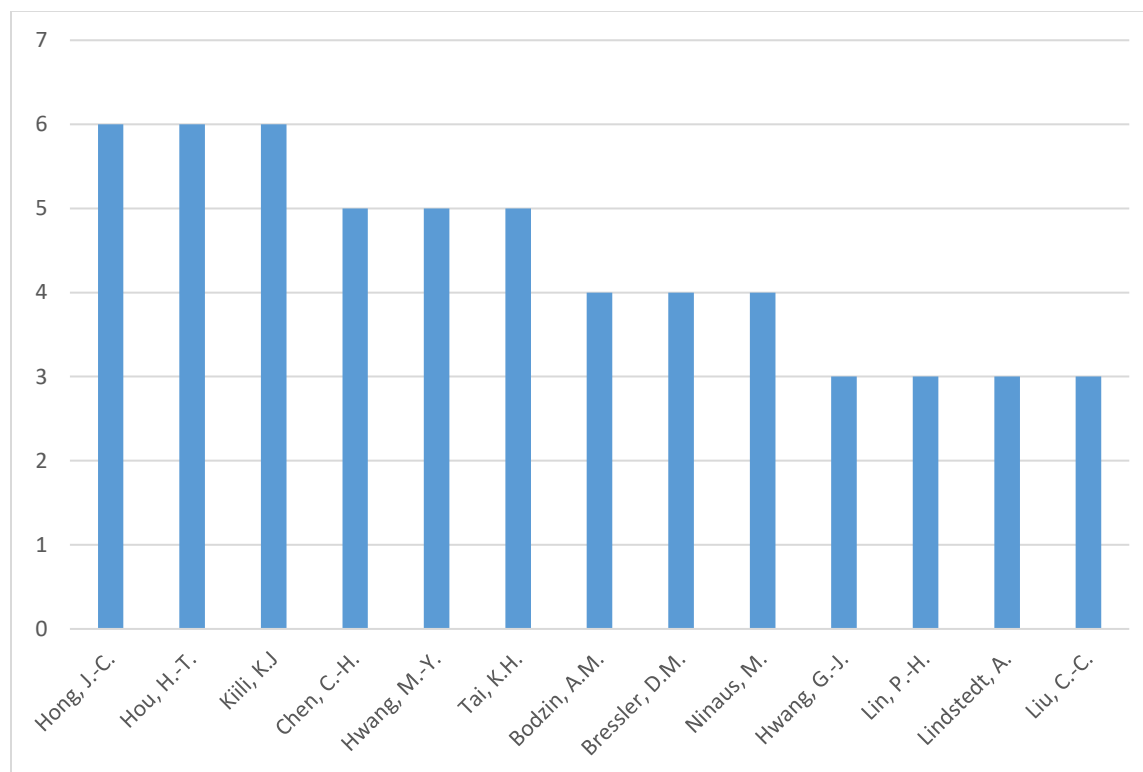
Number of Publications by Year in Data Set



As the articles in the data set were analyzed, a number of authors were noted as appearing more frequently than others. Across the 66 studies, a total of 171 individual authors were cited; 32 of them appeared more than once, 13 appeared three times or more (see Figure 10).

Figure 10

Authors Contributing Most Frequently in Included Studies

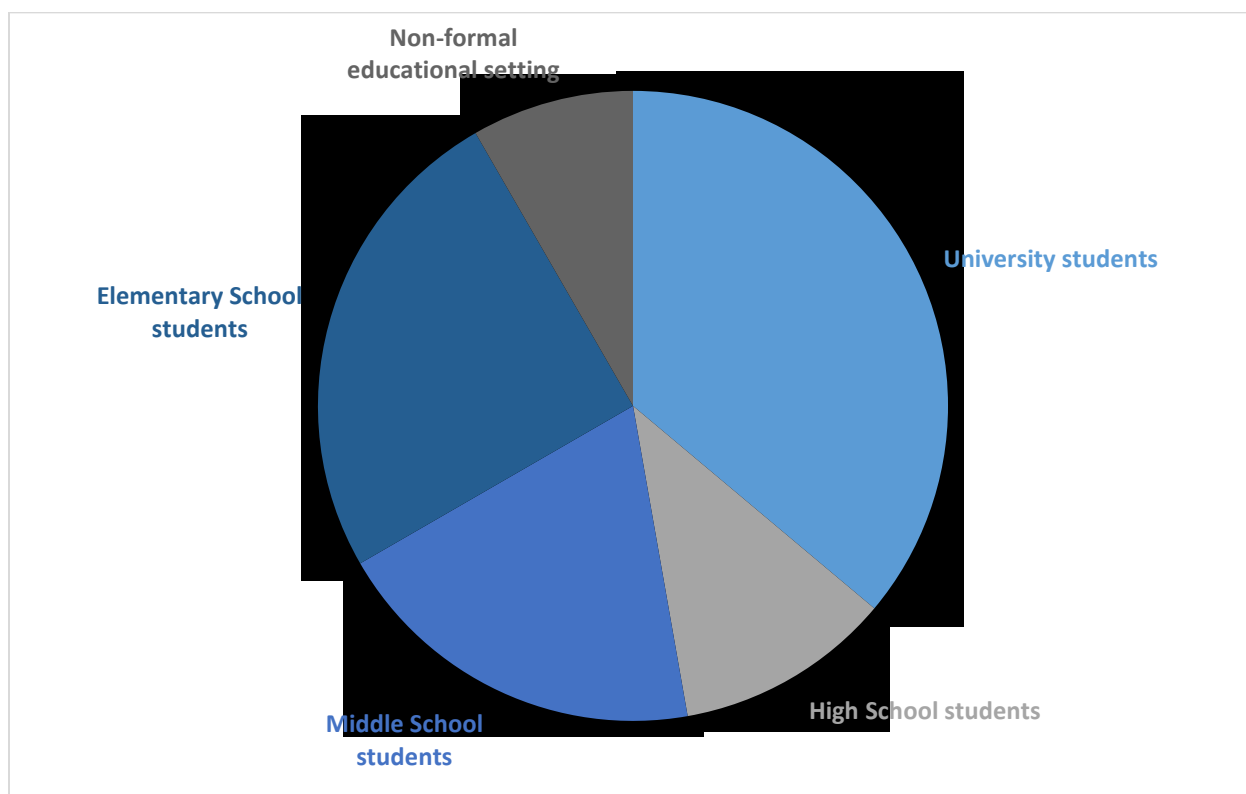


Finally, an analysis of the learners who participated in the studies was performed. They were of a wide range of ages, ranging from seven to over 60. Twenty-five of the studies were conducted using undergraduate students as participants, eight focused on high school (ninth through twelfth grade) students, thirteen focused on middle school students (sixth through eighth grade), and 18 focused on elementary school students (first through fifth grade). Five of the elementary school focused studies included sixth graders because those elementary schools extended to that grade. Six of the studies focused on non-formal educational settings, including afterschool programs and volunteer populations (Bressler & Bodzin, 2013; Faiola et al., 2013; Huang et al., 2019; Liu, 2017; Oksansen, 2013; Tcha-Tokey et al., 2018). Of these populations, three supplemented participant groups in otherwise formal educational settings (Bressler &

Bodzin, 2013; Huang et al., 2019; Oksanen, 2013). The number of participants in the individual studies ranged from a low of twenty-two students (Tsai et al., 2016) to 1,011 individuals submitting validated responses (Silva et al., 2019). In Figure 11, a visualization of the learner groupings is presented; the learners studied in formal educational settings are grouped by education level, while all non-formal educational settings are gathered into a single group for the purpose of this visualization.

Figure 11

Learner Groups Organized by Educational Setting



Note: Three studies included students from multiple educational settings (Bressler & Bodzin, 2013; Procci et al., 2012; Rachmatullah et al., 2021)

Upon the completion of the analysis of the selected data set, the process of identifying the initial codes and data extraction began.

Stage 3: Literature Appraisal

Cooper (1998) offers that the selection of initial codes when conducting an integrative review eases the process, and improves the outcome of the study. It is important that relevant data be extracted from the data set identified in Stage 2, and that the data be stored in a table to allow for the visualization of themes, patterns, connections, and relationships (Whittemore & Knafl, 2005). The empirical studies were examined to identify the commonalities and differences in the application of these theoretical structures and the ways in which the researchers applied the theories in practice. Theoretical articles referenced by the empirical researchers in their studies were leveraged to establish, document, and understand definitions provided in studies of the LFE, the flow dimensions, and the proposed assessment methodologies for identifying the incidence of flow in individuals participating in an activity.

The initial variables used in this stage were: (1) *theoretical framework of flow*, (2) *flow variables examined*, (3) *assessment tool*, and (4) *assessment variables measured*. These data were stored in worksheets in a Microsoft Excel workbook. The information regarding how the LFE was examined in each individual empirical study was collected from the methods discussion of the articles in the data set, as was the information regarding the assessment tool(s) used. The variables measured via the assessment tool(s) used were captured via an examination of both the methodology and results sections.

The *theoretical framework of flow* variable captured the theorists upon whose work the researchers are basing their identification of the LFE, its variables and their descriptions, and the methods by which these should be assessed (e.g., Csikszentmihalyi, 1975; Jackson & Marsh, 1996). This information was found in a variety of different sections of the included articles, including the background, theoretical framework, methodology, and discussion sections.

The variable *flow variables examined* captured the flow variables the researcher identifies as being of interest to their study, using the nine dimensions identified by Csikszentmihalyi (1990) as subcategories (*balance of skills and challenge, clear goals, swift, unambiguous feedback, merging of action and awareness, concentration on the task at hand, sense of control, distorted sense of time, loss of ego, and autotelic experience*) and an additional subcategory of “Other” as *a priori* codes. The “Other” subcategory was used to capture study variables that did not match the nine previously identified subcategories (see Appendix B). For all subcategories, the information captured took the form of a word or short phrase that was identified in the appropriate column of the coding worksheet. For example, if the researcher specified the examination of the flow dimension “*immersion*”, it was captured in one of the “Other” columns, while the examination of “*challenge/skill balance*” would be captured in the “*balance of challenges and skills*” category. The variables captured in the “Other” subcategory were: *absorption, action orientation, autonomy, confidence, competence, curiosity, engagement, enjoyment, extrinsic motivation, flow antecedent, flow experience, fluency of performance, gamefulness, immersion, interest, intrinsic motivation, judgment, perceived ease of use, perceived uncertainty, playability, satisfaction, telepresence, and usability.*

The variable *assessment tool* captured the assessment tool type used by the researcher in the course of their study (e.g., post-experience questionnaire, eight questions on a five-point Likert scale; post-experience questionnaire, three questions on a six-point Likert scale, four open-ended questions), and the theorist(s) from whose work they sourced the assessment instrument. Finally, the variable *assessment variables measured* was used and documented in the same way as the *flow variables examined* variable, whereby the information provided by the researchers in the discussion of their methodology was captured in terms of the *a priori*

dimensions and the “*Other*” subcategories. The information coded included the name of the variable as identified in the study and the questions or statements the researchers used in their assessment tools to solicit the feedback they needed to assess the participants’ LFE. See Appendix B for the variable names coded to the “*Other*” subcategories for each of assessments and conceptualizations.

Stage 4: Data analysis

In research reviews, data from “primary sources [must be] ordered, coded, categorized, and summarized into a unified and integrated conclusion about the research problem” (Cooper, 1998, as cited in Whittemore & Knafl, 2005, p. 550). Whittemore and Knafl (2005) further argued that a “thorough and unbiased interpretation” (p. 550) of the data collected from primary sources, and the synthesis of the evidence are the goals of this stage. The strategies to be used, they continue, “should be explicitly identified before undertaking the review” (p. 550). The constant comparison method converts information extracted from sources into “systematic categories, facilitating the distinction of patterns, themes, variations, and relationships” (p. 550). Cresswell and Poth (2018) describe this iterative process as a “data spiral” (p. 186), during which the researcher examines and revisits the source information to manage, organize, describe, classify codes, classify themes, develop and assess interpretations of the information, represent and visualize the data, and finally, to create an account of the findings. There are four steps in the data analysis using the approach of constant comparison: (1) reduce data via overall classification system, (2) extract and code data, (3) create matrices to enhance pattern visualization, and (4) identify patterns, themes, and relationships (Whittemore & Knafl, 2005). Each of the steps is described in the following paragraphs.

Reduce data via overall classification system.

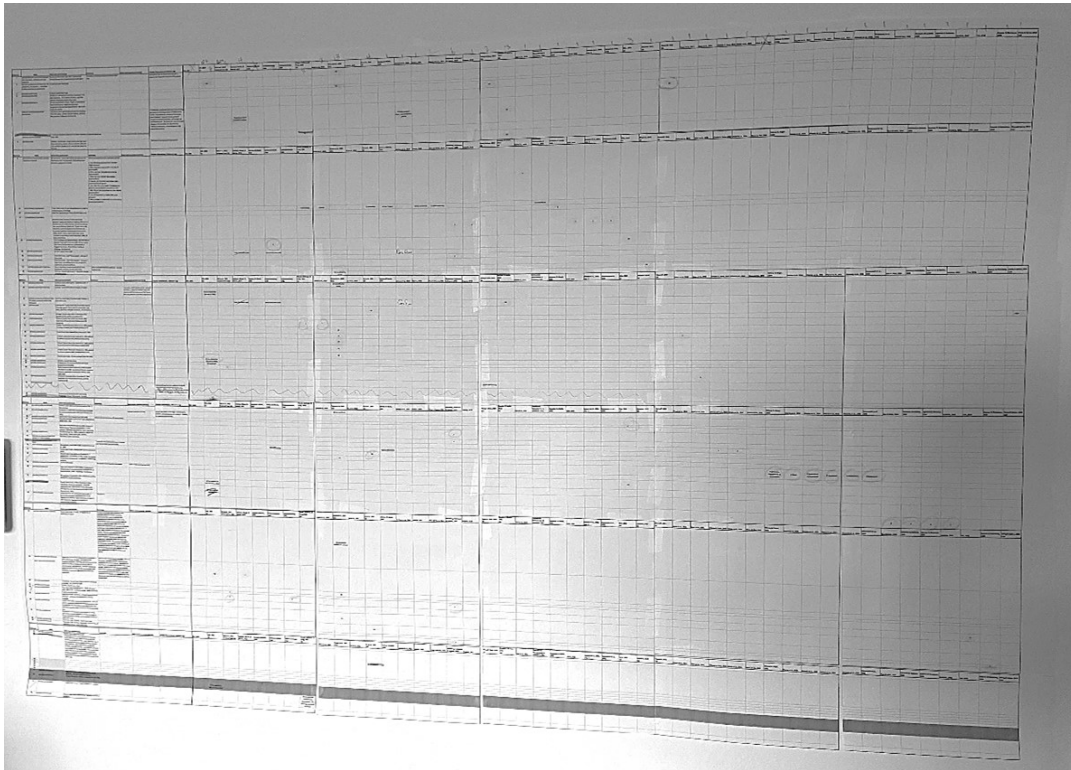
Whittemore and Knafl (2005) advise researchers in this phase to divide their sources into “subgroups according to some logical system to facilitate analysis” (p. 550). The primary data was organized by the research question with which it was associated during the extract process.

Extract and code data.

The data extracted from each article according to the initial variables was housed in a Microsoft Excel workbook, allowing for the simplification, abstraction, focusing, and organization of data into a “manageable framework” (Whittemore & Knafl, 2005, p. 550). The process began with a close examination of each of the 66 studies included in the data set, with the intention of identifying the information to be extracted. This data included the theoretical frameworks and their sources, and the assessment approaches and tools utilized, as well as the *a priori* codes for each of the conceptualization and the assessment categories.

Create matrices to enhance pattern visualization.

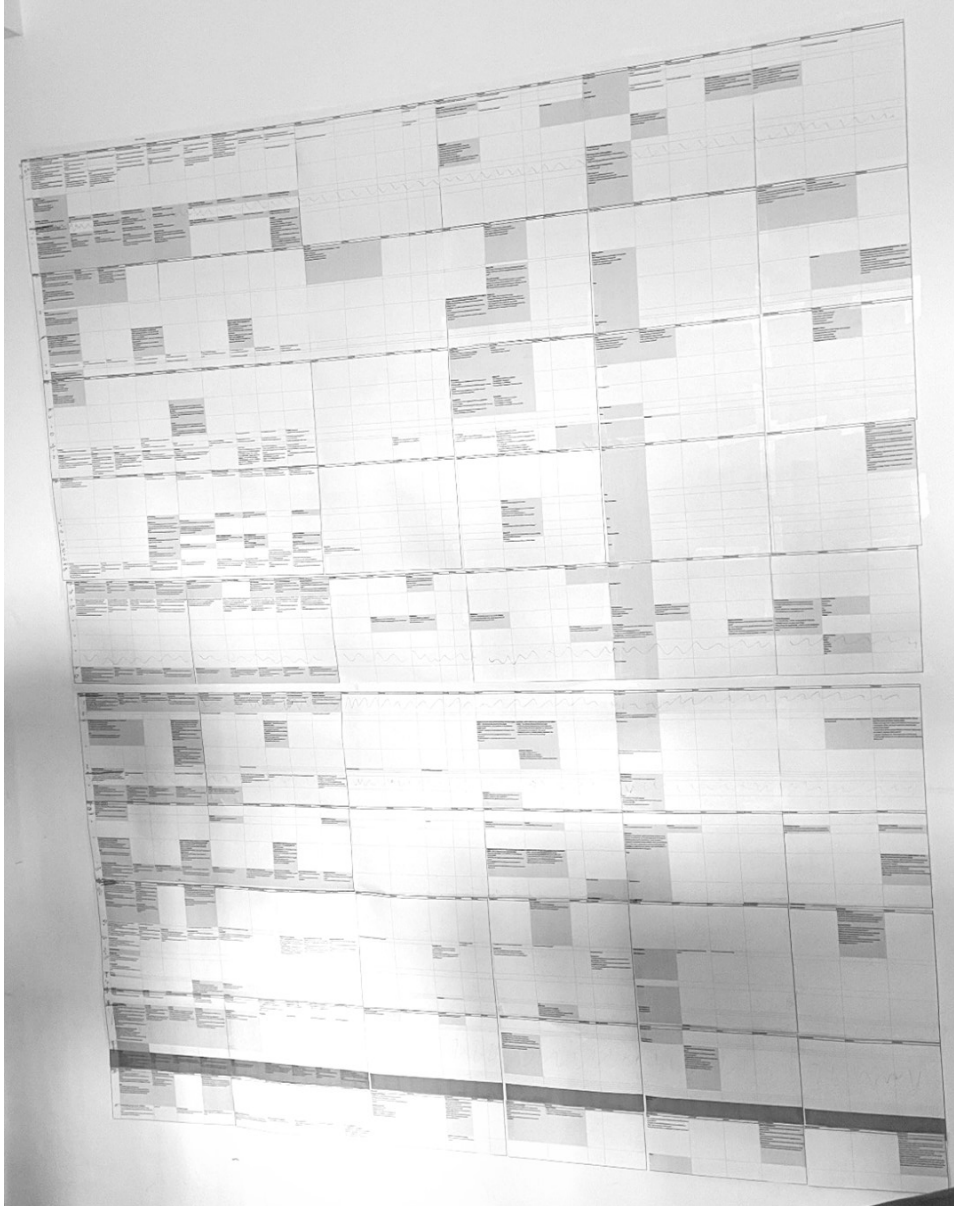
The extracted data was organized into matrices, arranged around categories related to the initial variables. These categories were: *flow framework*, *flow variables*, *variable definitions*, *assessments used*, and *variables measured*. Each of these individual worksheets contained the specific variable values identified during the data extraction and coding process (see Figure 12).

Figure 12*Graphical Display, Assessments Used in Studies****Identify patterns, themes, and relationships.***

The final step of this stage involved an “iterative process of examining [the] data displays of primary source data in order to identify patterns, themes, or relationships” (Whittemore & Knafl, 2005, p. 551). Conceptual maps and tables were used to illuminate the relationships, clustering, common and unusual patterns, or for “building a logical chain of evidence” (Whittemore & Knafl, 2005, p. 551). This process began with highlighting and color-coding the information in the initial graphical displays to enhance readability and understandability (see Figure 13). The graphical display enhanced the visualization of the individual flow dimensions as conceptualized or as assessed in the studies included in the data set. It also facilitated the identification of patterns of approach and clusters of usage.

Figure 13

Graphical Display, Assessment Variables and Statements



An iterative process of articulation was used to identify and organize my thought processes around the goals of answering the posed research questions. This articulation of the information in the graphical displays formed the foundation of the analytical approach used to

identify the patterns and relationships of the “*Other*” variables to the *a priori* variables.

Repeating the process as new insights were unearthed and captured in the dissertation diary allowed for a more complete analysis of the data extracted. Finally, an iterative process of sorting, filtering, and re-structuring the coded data was then employed to further enhance and expand the results derived based on the insights derived during the articulation process. In each case, the purpose was to specifically address the research questions posed and the related insights.

Stage 5: Analysis and synthesis

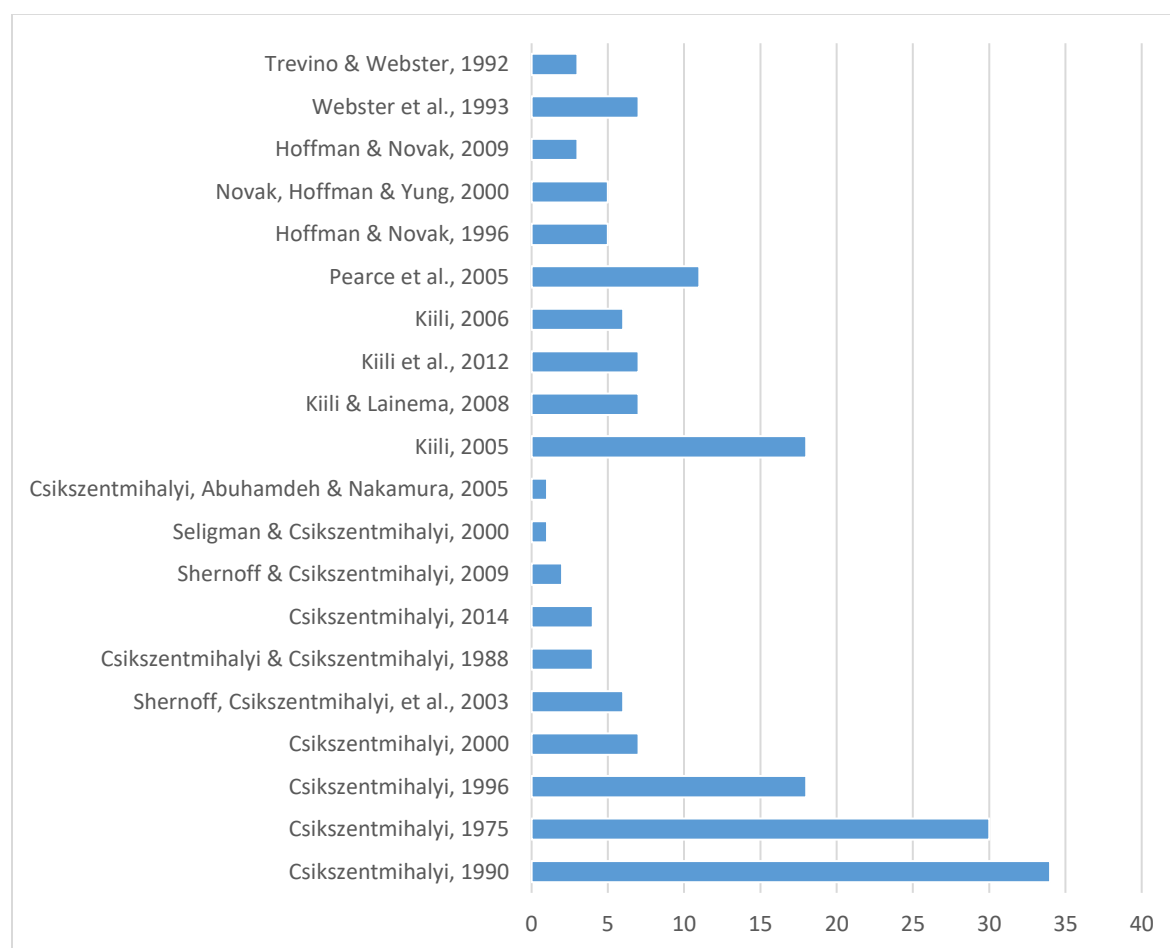
Wittemore and Knafl (2005) include the analysis and synthesis of the data as part of their data analysis process. Here, however, it is identified separately from the processes in Stage 4 to ensure the data are clearly delineated before conclusions are drawn. This stage began with an examination of the studies included in the data set and their characteristics. Next, a critical examination of the patterns, themes, and relationships was identified. This process was performed such that the patterns and relationships identified in stage four might be conceptualized at a higher level “of abstraction, subsuming the particulars into the general” (Whittemore & Knafl, 2005, p. 551). Each category subgroup identified for the matrices created in Stage 4 was analyzed and the important conclusions of each subgroup was summarized and integrated into a comprehensive portrayal of the information gathered. Each set of assessment questions provided by the researchers was verified against the identified source framework (when possible). The source questionnaires referenced in the studies were compiled into a single document to enable more thorough analyses. A record of all analysis decisions, hunches, thoughts, and ideas directly related to the interpretation of the data was kept in the dissertation diary. The specific processes employed for each Research Question follows.

Preparing to Address Research Question 1

To prepare to answer Research Question 1, each of the 66 studies in the data set was examined to identify the key theorists upon whose work the study of the LFE in learners playing DGBLs was predicated. 267 individual sources were cited in the theoretical frameworks of flow and the LFE during DGBL gameplay and its impact on learning. In terms of the theoretical frameworks for the LFE that were used in the studies included in the data set, Csikszentmihalyi, the father of the study of the flow experience, was the author or co-author of ten of the most commonly cited articles, with a total of 107 citations across the data set. Kiili, the most prolific of the researchers in the field of the study of the LFE in DGBL players, was author or co-author of four of the articles most commonly cited, with a total of thirty-eight citations across the data set. Hoffman was third most cited, with thirteen citations, Pearce was the fourth, with eleven citations, and Webster was represented with ten citations. See Figure 14 for the frequency analysis of these researcher citations.

Figure 14

Frequency Analysis, Most Cited Sources for Flow Theoretical Framework in Data Set



Next, I sought to identify how the LFE was conceptualized in the articles included in the data set, in an iterative process. First, I examined of the flow dimension variables identified by the researchers in their studies, and then, I identified and analyzed the researchers' explanations of the flow dimension variables were identified and analyzed. Next, I iteratively compared these explanations, bringing them back to the context in which they were proposed and the structure of the nine flow dimensions identified by Csikszentmihalyi (1990). Finally, the flow dimension variables initially included in the "Other" category were identified as synonyms to the *a priori*

nine flow dimensions on the basis of their respective explanations by the article authors.

Addressing Research Question 1

During the initial coding process of the flow experience variables defined in the studies, the *a priori* codes used to organize the conceptualization data collected were the nine flow dimensions defined by Csikszentmihalyi (1990), and the separate category labeled “*Other*”. The variables identified in the “*Other*” subcategory were further examined to establish an understanding of the intent of the researchers in the data set through the lens of the *a priori* codes. This examination revealed that many of these additional variables were also synonyms for the *a priori* flow dimensions, and, as such, are discussed within the findings associated with the *a priori* code to which it is comparable. Appendix B lists the synonyms identified during this process.

Addressing Research Question 2

To answer Research Question 2, I sought to capture how the learner flow experience had been assessed in the studies included in the data set, a process requiring an iterative process of examination of the information presented in the studies. First, an examination of the types of assessment tools used by the researchers in their studies was conducted, then, the post-play assessment tools sources for each study were analyzed. Next, the frequencies of the individual flow variables measured in each study and how each was captured and examined in an iterative process. Following further analyses, the themes for the variables were explored. Finally, the flow dimension variables initially included in the “*Other*” category were identified as synonyms to the *a priori* flow dimensions based on the statements or questions utilized in the studies.

Assessment Instruments Used in Studies. In the 66 peer-reviewed articles that were included in this integrative literature review, the majority of the researchers relied on post-play

assessment tools (referred to as questionnaires or surveys in the articles) administered to their participants. Some of the articles expanded their discussion of the numerical findings with qualitative data gathered from semi-structured interviews (Berry, 2021; Bui et al., 2020; Liu & Song, 2021; Theodoulou et al., 2015; Wang et al., 2017; Yang & Quadir, 2018; Zheng & Spires, 2014; Zou et al., 2021), answers to open-ended questions (Chen et al., 2018; Liu et al., 2011; Theodoulou et al., 2015), and analysis of teacher or observer logs (Bressler & Bodzin, 2013; Bressler & Bodzin, 2016; Liu et al., 2011; Zou et al., 2021). In some cases, the researchers provided the questions used for the qualitative portions of their study; those questions were leveraged in the findings for Research Question 2.

Across the articles, 48 sources for the Likert-style scaled assessment instruments used were identified. These Likert scales ranged from 5-point to 7-point scales, while the number of items presented to the participants to rank ranged from two to 59. The researchers used the quantitative data gathered from the Likert-style measurement scales to establish whether the participants achieved flow, and to what extent it was experienced. The data thus gathered for the individual variables examined was often recombined to establish levels related to constructs such as *flow experience* or *flow antecedent*.

Assessment Instrument Sources. In most cases, the researchers listed the inspiration or source for the post-play assessment instrument that they developed or used for their studies. Faiola et al. (2013), Hong et al. (2016), Hong et al. (2017), and Hong et al. (2019) did not. However, in each of these studies, the statements presented to their participants on the assessment instrument were included in the study. Thirty-nine of the studies included in the data set either did not include the statements or questions from their assessment instrument or only included example questions or statements (e.g., Hwang et al., 2012). All of those studies

specifically cited the source for their approach to measuring the flow experience of their participants, and all but one (Theodoulou et al., 2015) specified the number and nature of the statements presented to the participants.

All but nine of the researchers' works offered that their assessment instrument was adapted from, translated from, and/or modified from an original source material (Baumann et al., 2016; Brom et al., 2014, 2016; Hwang et al., 2012; Ninaus et al., 2015; Ninaus et al., 2020; Procci et al., 2012; Silva et al., 2019; Tcha-Tokey et al., 2018). While 48 individual sources were cited, several were used most frequently as inspiration or as a source for the post-play assessment instrument: Pearce et al. (2005) was cited eleven times; Kiili (2006) was cited seven times; Kiili and Lainema (2008) was cited three times; Kiili et al. (2012) was cited three times; and Rheinberg et al. (2003) was cited seven times. Jackson, Eklund, and Martin (2010)'s book was cited seven times as the source for four different flow measurement scales. Bressler and Bodzin (2013) and Hong et al. (2016) adapted their individually developed assessment instrument for their studies included in the data set. Yeh and Lin (2016) developed their survey for a study they performed for the Taiwanese government, but did not include the statements in their article, nor was the source study available.

Assessment Variables. Twenty-nine of the studies provided the statements or questions they used to solicit input from learners in terms of their experiences while participating in the studies. Of the thirty-seven that did not, all but three (Aremu & Adebagdo, 2016; Theodoulou et al., 2015; Yeh and Lin, 2016) provided information, often supplemented with example statements (e.g., Chen et al., 2018; Hwang et al., 2012; Hwang et al., 2015), that clearly identified the previously-created assessment instruments they adapted or modified for their studies. Aremu and Adebagdo (2016), Theodoulou et al. (2015), and Yeh and Lin (2016)

provided no example questions to elaborate on the approach used in their assessments. These identified instruments were sought out as supplemental materials in the course of developing the response for this research question.

An iterative process of analysis was conducted, comparing the variables measured by the researchers and the statements used to determine the player experience of those variables across the studies included in the data set. This was used to establish the presence of or level of experience of each of the variables allowed me to code most of the “*Other*” variables within the structure of the *a priori* variables of the flow experience, identifying these variables as synonyms of the original nine flow dimensions. Four studies either did not examine the *flow experience* as an independent variable or as a construct in reporting their findings (Chen & Lee, 2018; Hamari et al., 2016; Li et al., 2012; Wang et al., 2017). Instead, they examined specific variables or constructs they defined in their methodology. Two studies, Li et al. (2012) and Liu et al. (2011), used a single Likert-style scaled survey statement for each of *perceived challenge* and *perceived skill* to identify whether the flow state had been achieved during the course of play, arguing that “a balance of perceived challenge and skill would be considered as flow, since Csikszentmihalyi’s flow is based on the balance between perceived skills and challenges during an activity” (Liu et al., 2011, p. 1912).

Finally, the findings associated with the nine *a priori* variables and the *flow experience* construct were examined to identify the synonyms and themes of each.

Stage 6: Present and discuss findings

Whittemore and Knafl (2005) do not place limits on the method by which the conclusions of integrative reviews may be presented. They instead advocate for researchers to present their findings in a comprehensive framework that “captures the depth and breadth of the topic and

contributes to a new understanding” (Whittemore & Knafl, 2005, p. 552). The ultimate goal is “a holistic understanding” (p. 552) of the topic. Thus, a concise summary of major findings and key contributions was created, and all conclusions, recommendations, and implications were supported using evidence generated during the previous stages. The synthesis of the findings into a set of researcher guides represents the significant contribution of this study. They can be found in Appendix D. Findings for this study are in Chapter 4, and the discussions of the findings, the limitations of the study, and the contribution of this study, as well as future direction for research are in Chapter 5.

CHAPTER FOUR

Findings

This chapter is a presentation of the findings of this integrative review, following the iterative comparisons of patterns and distinctions of the studies included in the data set.

Findings of Research Question 1

Research Question 1:

How has the learner flow experience been conceptualized in empirical literature in the study of learners engaging with digital game-based learning?

The findings for Research Question 1 are organized in terms of Csikszentmihalyi's (1990) flow experience dimensions and include a summary of the synonyms for those dimensions utilized by the researchers and the major themes of their conceptualization. The flow dimension "synonyms," (the varying terms used by the researchers to identify the flow dimensions), identified by their use in their conceptualization and examination of the DGBL player LFE, may be found in Appendix B. The first three dimensions, *balance of skills and challenge*, *clear goals*, and *swift, unambiguous feedback*, are often grouped together and referred to as antecedents or precursors to the flow experience (Csikszentmihalyi, 1975, 1990, 1997). The latter six dimensions of the flow experience, *merging of action and awareness*, *concentration on the task at hand*, *sense of control*, *distorted sense of time*, *loss of ego*, and *autotelic experience* are often grouped together as the subjective state of the experience (Nakamura & Csikszentmihalyi, 2002).

Balance of Challenge and Skills. The analysis of the definitions of this flow dimension across the studies included in the data set revealed several themes: (1) *Balance* is the learner perception of their skills in terms of the perceived challenges, reflecting the player's ability to

use their *skills* to meet the challenges. This perceived balance creates a sense of competence in the player, and establishes their achievement expectations. (2) Game challenges should adapt to player skills, and as their skills improve, the challenges should also increase, and (3) the flow state occurs and is conditioned by this dynamic balance.

Variable terms that emerged as synonyms for this flow dimension were: *Action Orientation, Balance between One's Skills and the Activity's Demands, Balance between Skills and Challenge, Challenge, Challenge / Skill Balance, Challenge and Complexity, Challenge and Perceived Skill, Challenge Enabling Absorption, Challenge Matched to Skill, Challenges Trigger User Skills, Competence, Confidence, Correlation between Challenges and Skills, Feeling of Frustration, Mastery, Perceived Balance of Challenge and Skills, Perceived Challenge, Perceived Competence, Perceived Match of Challenges to Skills, Perceived Skill, Perceived Skills Should Match Challenge, Perceived Uncertainty, Perception that Challenges Are Matched to One's Skills, Perception that Skills are Well Suited to Given Challenges, Playability, Playfulness, Skill, Speed and Ease of Use, Tension, Usability, and Usability by Players.*

Clear Goals. The analysis of the definitions of this flow dimension revealed several themes: (1) the perceived presence of clear goals is expected to facilitate player success; (2) the goals presented to the DGBL player should be related to the learning objectives of the game; and (3) knowing in-game DGBL goals prior to play facilitates player achievement of the learning goal(s).

Variable terms that emerged as synonyms for this flow dimension were: *Clarity of Goals, Clarity of Objectives, Clear and Known Goals, Clear Establishment of Goals, Clear Set of Goals, Coherence of the Activity, Fluency, Focused on Goals, Goal Clarity, Goals, Goals and Rules, Open and Clear Goals, Perceived Goals, Rules and Concrete Goals, Rules and*

Constraints, and Rules and Set Goals.

Swift, Unambiguous Feedback. The analysis of the definitions of this flow dimension revealed several themes: (1) the provision of relevant, immediate feedback during gameplay keeps the player focused on their activities; (2) in-context swift and unambiguous feedback helps the learner monitor performance and progress during DGBL gameplay; and (3) the players must perceive the in-game feedback provided as useful, actionable, and meaningful. Feedback was noted as allowing the players to use the feedback to understand their progress; it was not, however, used by the players as a source of reflection.

Variable terms that emerged as synonyms for this flow dimension were: *Cognitive and Immediate Feedback, Continuous and Immediate Feedback, Feedback, Frequent and Targeted Feedback, Immediate and Appropriate Feedback, Immediate Feedback, and Unambiguous Feedback.*

Merging of Action and Awareness. The analysis of the definitions of this flow dimension revealed two themes: (1) during DGBL gameplay, the player activity becomes spontaneous and almost automatic; and (2) during DGBL gameplay, the player becomes increasingly involved in the game environment.

Variable terms that emerged as synonyms for this flow dimension were: *Action / Awareness Merging, Activity Becomes Spontaneous and Almost Automatic, Complete Immersion, Immersion, Merging of Action and Awareness, Playability, Sensory and Imaginative Immersion, and Telepresence.*

A unique issue to this dimension include a disagreement about the first theme. Kiili et al. (2012) and Kiili et al. (2014) offered a criticism of this theme, stating the merging of action and awareness yielding spontaneous or almost automatic responses was inappropriate in the DGBL

learning environment. They viewed the evolution of the player activities to the level of spontaneity as undesirable, offering “in contrast, the principles of experiential and constructive learning approaches gives emphasis to the fact that learning is an active and conscious knowledge construction process (Kiili et al., 2014, p. 36). In response, Kiili et al. (2012 & 2014) opted to use the variable name *immersion* to examine this dimension in their articles. In their identification of the variable *immersion*, Kiili et al. (2012) described the phenomenon as “immersion means becoming physically or virtually a part of the experience itself” (p. 85); Bui et al. (2020) shared this view.

Concentration on the Task at Hand. The analysis of the definitions of this flow dimension revealed three themes: (1) concentration is a state of intense and focused attention on the task, (2) when concentrating, the DGBL player has no cognitive resources remaining for irrelevant information; and (3) the LFE is characterized by a high degree of concentration on the part of the DGBL player during gameplay.

Variable terms that emerged as synonyms for this flow dimension were: *Attention Paid to a Particular Task, Concentration, Concentration on the Event at Hand, Concentration on the Task, Concentration on the Task at Hand, Deep Concentration, Fluency of Performance, Focused Attention, Heed, High Concentration, High Degree of Concentration, Highly Focused Concentration on the Activity, Increased Focus of Attention, Intense and Focused Concentration, Intense Concentration, Perceived Concentration, State of Full Concentration, and Total Concentration.*

Sense of Control. The analysis of the definitions of this flow dimension revealed several themes: (1) *sense of control* relates to DGBL players’ feelings of behavioral and progress autonomy; and (2) *sense of control* relates to the possibility or perception of control, rather than

to an actuality; (3) DGBL players may enter the flow state when they interact with and feel empowered within the DGBL environment; and (4) DGBL players experience choice, freedom, and opportunities to participate in self-selected activities, all of which directly relate to the discussions of *sense of control* across the studies included in the data set.

Variable terms that emerged as synonyms for this flow dimension during the analysis were: *Autonomy, Control, Deep Sense of Control, Domination, Judgment, Opportunity to Control Situation, Perceived Autonomy, Potential Control, and Sense of Control.*

Distorted Sense of Time. The analysis of the definitions of this flow dimension revealed a single theme: (1) during DGBL gameplay, players experience an altered awareness of the passage of time. The researchers who described this dimension referred to players losing their sense of time, perceiving time as having no meaning, or as passing more quickly or slowly.

Variable terms that emerged as synonyms for this flow dimension were: *Altered Sense of Time, Distorted Temporal Experience, Loss of Time, Time, Time Distortion, Time Passing Rapidly, Time Transformation, Transformation of Time, and Unaware of Time Spent / Flow of Time Spent.*

Loss of Ego. The analysis of the definitions of this flow dimension revealed two themes: (1) during DGBL gameplay, players can ignore the perceptions or opinions of others; and (2) while playing, extraneous information is excluded and the learning experience may be increased.

Variable terms that emerged as synonyms for this flow dimension were: *Absorption, Active Engagement, Emotional Engagement, Engagement, Engagement (equated as a state of full concentration), Engagement and Competition, Interaction, Loss of Ego, Loss of Self-Consciousness, Loss of Oneself, Peer Interaction, Perceived Relatedness, and Socialization as Connected to Engagement.*

Autotelic Experience. The analysis of the definitions of this flow dimension revealed three themes: (1) the *autotelic experience* results from the participation in an activity which produces its own rewards without any outside reward; (2) the *autotelic experience* refers to an activity that is done simply because it is worth doing; and (3) the *autotelic experience* is the consequence of the flow experience.

Variable terms that emerged as synonyms for this flow dimension were: *A Feeling that the Activity is Innately Rewarding, Achievement, Autotelic Experience, Autotelic State, Curiosity, Emotion, Enjoyment, Experience Consequence, Extrinsic Motivation, Flow Consequence, Frame Story, Fun, Interest, Intrinsic Motivation, Intrinsically Rewarding Experience, Learning, Motivate to Higher Performance Levels, Motivation, Negative Affect, Perceived Enjoyment, Perceived Learning, Playfulness, Positive Affect, Positive Emotions, Positive Enjoyment, Positive Value, Replay Intention, Rewarding Experience, Satisfaction, Self-actualization, Sense of Discovery, Situational Interest, Skills Development as Outcomes, Tension, User Enjoyment and Utilitarian Motivation.*

A unique issue to this dimension was the inclusion of a variety of theoretical approaches. Three articles (Hamari et al., 2016, Hong et al., 2018; Kiili et al., 2021) identified *interest* or *situational interest* in their examination of the flow experience. Hamari et al. (2016) explained the variable, stating “interest directs attention, reflects intrinsic motivation, stimulates the desire to continue engagement in an activity, and is related to school achievement” (p. 72). While a conflation of *intrinsic motivation* and *flow experience* was observed in some of the articles in the data set (e.g., Buil et al., 2017), some researchers referred to theorists including Csikszentmihalyi and Moneta (1996) (Hwang et al., 2012) and Ormrod (2011) (Yang & Quadir, 2017) to establish their definitions of *intrinsic, extrinsic, and utilitarian motivation*. These definitions were noted

and analyzed during the process of identifying the themes for this flow dimension, and were included in the findings.

Flow Experience. The analysis of the definitions of the flow experience as a constructed dimension across the studies included in the data set revealed one theme: (1) the flow experience is the optimal experience, a psychological state during which when involved in a goal-driven activity that nothing else seems to matter, and is one in which the DGBL player continues gameplay for its own sake. The activity triggering the flow experience may not be perceived as enjoyable during the moment of occurrence, but it is viewed as enjoyable or satisfactory after its conclusion.

Variable terms that emerged as synonyms for this flow dimension during the analysis were: *Absorption of Activity, Flow, Flow Experience, Flow Experience Construct, Flow Level, Flow State, Fluency of Performance, and Multimedia Flow.*

It is important to note that no consensus exists about the best measures with which to establish or capture the *flow experience* construct or about the best terms to use to describe this construct.

Summary of Research Question 1

Organized in terms of Csikszentmihalyi's (1990) nine flow dimensions, the analysis of the definitions and theoretical frameworks utilized across the studies included in the data set revealed the themes and synonyms presented in this section. The situation of little agreement on the exact terms that should be used to name the flow experience variables, the definition for these variables, or how these variables should be conceptualized prior to designing a study to examine this state in players of DGBLs across the 66 articles included in the data set was recognized and illustrated. Of the many variables identified across the studies, all but one of the

“*Other*” variables were identified as synonyms for the *a priori* dimensions based on the information presented in the studies. The additional variable is the construct *flow experience*.

Not examined as part of this question were flow antecedent constructs, although some of the studies included in the data set did so. As a construct, typically identified as comprised of *balance of challenge and skills, clear goals, and swift unambiguous feedback* (Csikszentmihalyi, 1990), it is not a primary flow dimension or expression of the LFE itself.

Findings of Research Question #2

Research Question 2:

How has the learner flow experience been assessed in empirical literature in the study of learners engaging with digital game-based learning?

Assessment Variables Measured

During the initial coding process for the examination of the assessment variables measured in the studies included in the data set, the *a priori* codes representing Csikszentmihalyi (1990)’s nine flow dimensions were used (*balance of skills and challenge, clear goals, swift, unambiguous feedback, merging of action and awareness, concentration on the task at hand, sense of control, distorted sense of time, loss of ego, and autotelic experience*), with the addition of a separate category labeled “*Other*.” The variables captured in the “*Other*” subcategory were: *absorption, action orientation, autonomy, confidence, competence, curiosity, engagement, enjoyment, extrinsic motivation, flow antecedent, flow experience, fluency of performance, gamefulness, immersion, interest, intrinsic motivation, judgment, perceived ease of use, perceived uncertainty, playability, satisfaction, telepresence, and usability*. The flow dimension “synonyms,” (the varying terms used by the researchers to identify the flow dimensions), identified by their use in their assessment and examination of the DGBL player LFE, may be

found in Appendix B.

Categorizing the different variables as synonyms of the original *a priori* variables was made possible through an analysis of the statements presented to the participants on the post-play questionnaires or surveys. All but one the studies (Theodoulou et al., 2015) of used some form of a post-play questionnaire or survey, leveraging a Likert-style scale, asking the participants in the study to establish their level of agreement with the statements presented. Theodoulou et al. (2015) used a post-play interview; their questions were included in their methods, which allowed them to be organized with the statements or questions from the Likert-style scaled assessment tools. The findings associated with the variables and their synonyms, organized in terms of the nine *a priori* variables and the construct *flow experience* follows. Assessment tool statements that might be viewed as negative (e.g., “*I was frustrated,*” “*I was anxious,*” “*I was bored*”) were reverse coded by the researchers, reflecting a desire on their part to view the flow experience from a positive point of view. For the purpose of these analyses, a positive form of the statement was used. In the paragraphs that follow, the themes and synonyms for each are provided, and issues unique to several flow dimensions are also identified.

Balance of Skills and Challenge. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) the learner’s positive perception of skill level in terms of DGBL challenges, (2) the learner’s perception of game challenges, (3) the learner’s positive perception of their skills, (4) the learner’s perception of their skill improvement during DGBL gameplay, (5) the learner’s perception of the game as easy to understand and play, and (6) the learner’s positive emotions resulting from DGBL gameplay.

The synonyms of this flow dimension included: *Action Orientation, Balance, Balance of Skills and Challenge, Challenge, Challenges, Competence, Confidence, Feelings of Frustration,*

Fluency of Performance, Gamefulness, Intrinsic Cognitive Load, Perceived Challenge, Perceived Ease of Use, Perceived Skill, Perceived Uncertainty, Personal Skills Well-Suited to Given Challenges, Playability, Skills, Technology Adoption, Tension, and Usability.

A unique issue to this variable was the variety of synonyms encountered in the data set for this dimension. This occurrence may be because over the decades, Csikszentmihalyi consistently described the flow experience graphically using a comparison of *skills* (horizontal axis) in relation to *challenges* (vertical axis) to establish the zone in which the flow state occurs (Csikszentmihalyi, 1975, 2009; Csikszentmihalyi & Csikszentmihalyi, 1988; Csikszentmihalyi & Nakamura, 1989), as did others (Massimini & Carli, 1988; Schell, 2008).

Another issue unique to this dimension was the approach of some researchers to split the concepts into two separate measures. In the studies included in the data set, when the flow dimensions of *challenges* and *skills* are measured as individual variables, no measure of the *balance of challenges and skills* are made. Bressler et al. (2018), Brom et al. (2016), Bui et al. (2020), Chang et al. (2017), Chen and Lee (2018), and Oksanen (2013) all examined *challenges* and did not examine *skills*. Tcha-Tokey et al. (2018) studied *skills* but did not examine *challenges*. Liu (2017) measured *playability* and *perceived uncertainty* as well as each of *challenges* and *skills*.

Clear Goals. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) a perception by the learner that the DGBL game goals were clearly defined within the context of the game, (2) the perception by the learner that these game goals made the requirements for success while playing the DGBL easy to understand and achieve, and (3) the perception by the learner that successful DGBL gameplay was facilitated by the existence of clear goals. The themes reflect a focus of the researchers on the learner and their perceptions

during DFBL gameplay.

The synonyms of this flow dimension included: *Clear Goals, Goal, Goals, and Goal Clarity.*

Unique to this dimension was the focus on Jackson and Marsh (1996)'s approach towards the presence of *clear goals* as opposed to Csikszentmihalyi (1975, 1990)'s approach. Jackson and Marsh (1996) noted in their study, when studying the occurrence of the flow state in participants in an activity, that it is not enough to declare that clear goals have been established for a game or an activity. Instead, the participants must perceive that the goals of the DGBL are both clearly defined and achievable within the game. The themes for this flow dimension reflect a focus of the researchers on the learner and their perceptions of the presence of *clear goals* in relation to the game during DGBL gameplay.

Swift, Unambiguous Feedback. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) the learner's perception of in-game feedback as being received in a timely manner during gameplay, (2) the learner's perception of the quality of the in-game feedback in terms of the facilitation of successful DGBL gameplay, and (3) the learner's perception of the usefulness of the in-game feedback in terms of their progress during DGBL gameplay.

The synonyms of this flow dimension included: *Feedback, Human-to-Machine Interactivity, Immediate Feedback, Immediate and Unambiguous Feedback, Swift and Unambiguous Feedback, and Unambiguous Feedback.*

As in the previous dimension, the researchers' focus on the learner and their perception of their level of success during DGBL gameplay was demonstrated. Thus, the feedback received within the game during gameplay was seen as establishing a method by which the player may

measure progress towards successfully completing the DGBLs and achieving the learning goals.

Merging of Action and Awareness. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) the learner perception of the DGBL gameplay as occurring naturally and spontaneously, (2) the learner perception of their thought processes during DGBL gameplay as progressing smoothly and fluidly, (3) the learner perception that the right thoughts and reactions occurred of their own accord during DGBL gameplay, (4) the learner perception of their merging with / being immersed in game environment, and (5) the perception of the learners that any concerns external to the game environment (time, disturbances, other obligations) were immaterial.

The synonyms of this flow dimension included: *Action / Awareness Merging, Emotional Investment, Immersion, Merging of Action and Awareness, Playability, Sensory and Imaginative Immersion, and Telepresence*

Unique to this dimension, a new term specific to the experience of a virtual environment was identified. *Telepresence*, originally defined by Steuer (1992), as “the experience of presence in an environment by means of a communication medium” (p. 76), refers to the mediation of the players’ experience by the DGBL environment, resulting in a sense of experiencing an alternative reality independent of the platform within which it is experienced. It is included in this flow dimension based on the statements used to evaluate its occurrence.

Concentration on the Task at Hand. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) the player perception that the DGBL fostered their ability to center their attention on task(s), (2) the player perception that the DGBL enabled the player’s ability to exclude other stimuli, and (3) the player perception that the DGBL activities enhanced their ability to concentrate during gameplay.

The synonyms of this flow dimension included: *Concentration, Focused Attention, Focus on Task, Focusing on Task, Heed, Perceived Concentration, and Total Concentration on Task at Hand.*

Sense of Control. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) a perception on the part of the player that they had control of their actions and consequences, including learning, (2) a perception on the part of the player of their ability to play and succeed during DGBL gameplay, and (3) a perception of autonomy on the part of the player.

The synonyms of this flow dimension included: *Autonomy, Control, Domination, Gamefulness, Judgment, Perceived Autonomy, and Sense of Control.*

Distorted Sense of Time. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) the player's perception of time alteration during DGBL gameplay, and (2) the player's perception of their loss of awareness of time passage during DGBL gameplay.

The synonyms of this flow dimension included: *Altered Sense of Time, Distorted Sense of Time, Loss of Time, Time Distortion, and Transformation of Time.*

Loss of Ego. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) a perception on the part of the player that nothing else mattered during DGBL gameplay, (2) a perception on the part of the player that their thoughts were clear (clarity of thought) during DGBL gameplay, (3) a perception on the part of the player that maintaining their focus during DGBL gameplay was effortless, (4) a perception on the part of the player that they enjoyed freedom from worry about performance or others' perceptions was experienced during DGBL gameplay, and (5) a perception on the part of the player of a sense of

the importance of the game during DGBL gameplay.

The synonyms of this flow dimension included: *Absorption*, *Absorption by Activity*, *Engagement*, *Interaction*, *Loss of Ego*, *Loss of Self-Consciousness*, *Perceived Attractiveness*, and *Personal Involvement*.

Autotelic Experience. The themes revealed during the analysis of the associated assessments of this flow dimension were: (1) the player perception that during gameplay, the DGBL player enjoyed the experience of being in the zone, (2) the player perception that during gameplay, the DGBL player expressed a wish to recapture rewarding gameplay experience, (3) the player perception that DGBL gameplay provided them a positive emotional response, as an intrinsically rewarding experience, and (4) the player perception that during or because of the DGBL gameplay, they enjoyed a positive impact on their learning outcomes.

The synonyms of this flow dimension included: *Autotelic*, *Autotelic Experience*, *Curiosity*, *Emotion*, *Enjoyment*, *Experience Consequence*, *Extrinsic Motivation*, *Frame Story*, *Gameplay Interest*, *Interest*, *Intrinsic Motivation*, *Intrinsically Rewarding Activity*, *Intrinsically Rewarding Experience*, *Motivation*, *Negative Affect*, *Peer Interaction*, *Perceived Enjoyment*, *Perceived Usefulness*, *Playfulness*, *Positive Affect*, *Positive Emotions*, *Positive Value*, *Replay Intention*, *Rewarding Experience*, *Satisfaction*, *Self-Actualization*, *Tension*, and *Utilitarian Motivation*.

Unique to this dimension was the return to the roots of the study of flow within the field of motivation, with the identification and assessment of *Extrinsic Motivation*, *Intrinsic Motivation*, and *Utilitarian Motivation*. Also unique to this dimension was the inclusion of words that were not as easily or clearly defined, including *Curiosity*, *Enjoyment*, and *Interest*. However, the statements or questions used to identify these variables were all clearly appropriate to this

dimension, and were thus included.

Flow Experience. The themes revealed during the analysis of the associated assessments of this flow construct were: (1) the player experience of enjoyment, (2) the player experience of loss of ego (as defined earlier in this response to this research question), and (3) a perception of the part of the player of having experienced a merging of action and awareness (this statement was often combined with time distortion).

The synonyms of this flow dimension included: *Flow Construct*, *Flow Experience*, *Flow*, *Flow State*, *Multimedia Flow*, and *Overall Experience of Being in Flow*.

As the only construct examined in this analysis, *flow experience* is unique. Thirteen studies sought to directly measure the flow experience in their participants: Baumann et al. (2016), Berry (2021), Bressler and Bodzin (2013), Bressler and Bodzin (2016), Bui et al. (2020), Chou et al. (2021), Huang et al. (2019), Hwang et al. (2012), Liu (2017), Oksanen (2013), Rachmatullah et al. (2021), Silva et al. (2019), and Tcha-Tokey et al. (2018). The other studies that sought to establish the existence of the LFE used a mean of the Likert-style scale values of the variables measured during their studies to evaluate this variable, driving the decision to identify this construct as an additional flow dimension for this study.

Summary of Research Question 2

Organized in terms of Csikszentmihalyi (1990)'s nine flow dimensions, an analysis of the statements or questions in the post-play assessment tools utilized across the studies included in the data set revealed the themes presented in this section. Sixty-three of the articles included in this integrative literature review provided adequate information to clearly understand which flow dimensions researchers sought to measure and how they assessed those variables. The remaining three did not provide information regarding their theoretical sources or example questions from

their post-play questionnaires or surveys, however, their findings provided insights into their process. The situation of little agreement on the exact terms that should be used to name the flow experience variables, the definition for these variables, or how these variables should be assessed within a Likert-style scaled survey or questionnaire was recognized and illustrated. Of the assessment variables measured, all but one was identifiable as synonyms of the a priori variables, *balance of skills and challenge, clear goals, swift, unambiguous feedback, merging of action and awareness, concentration on the task at hand, sense of control, distorted sense of time, loss of ego, and autotelic experience*. The additional variable, *flow experience*, has been added.

Not examined as part of this question were flow antecedent constructs, although some of the studies included in the data set did so. As a construct, typically identified as comprised of *balance of challenge and skills, clear goals, and swift unambiguous feedback* (Csikszentmihalyi, 1990), it is not a primary flow dimension or expression of the LFE itself.

Synthesis into Researcher Guides

This synthesis of the findings brings together the information gathered in the process of conducting this study. The diverse nature of the synonyms encountered in the findings presented illuminated the need to develop a coherent framework within which the findings of studies into LFE during DGBL gameplay may be examined. This framework should also support the efforts of future researchers and DGBL design practitioners. In response, as an outcome of the synthesis process, I developed a set of guides to facilitate reading and comparing studies of the LFE in players of DGBLs. The presentation of these synthesized findings, created through an iterative analysis of the flow dimension terms found in assessments, their synonyms, assessment items used to measure those dimensions, and the parallel terms found in the conceptualizations of the flow dimensions is in Appendix D.

Each guide is preceded by a summary of the goals of the researchers whose studies are included in the data set. The guides created as an outcome of this study are in table form, providing:

- The name of the flow dimension
- A description of the flow dimension
- Associated keywords and key phrases
- The synonyms identified in the assessments
- The parallel synonyms identified in the conceptualizations
- The assessment statements or questions used across the studies, organized by originating theorist
- The source or inspiration of the originating theorist’s approach (if known)

When an individual flow dimension was not specifically examined in a particular assessment approach, this is noted as “<none identified; this model did not examine player perceptions of this flow dimension>.” The theorists represented in the guides include both the researchers whose studies were included in the data set for this study, and the theorists upon whose work they relied. As noted in the findings of Research Question 2, not all researchers provided the statements or questions used in their assessment tools, but nearly all did provide the source upon which their assessment tools were predicated. In all, twenty-six original sources for the post-play questionnaires or surveys were identified and their approach to the measurement of the LFE is included in these guides

Summary of Chapter 4

Research Question 1 sought to examine how the flow experience had been conceptualized for the study of the LFE in DGBL players. The flow-dimension-specific findings

were presented, examining the synonyms used in the studies for the flow dimensions, and the themes that arose during the analysis of the conceptualization of each of the flow dimensions.

Research Question 2 sought to examine how the LFE had been assessed in participants engaging in DGBL gameplay. Again, the findings were presented in within the framework of the nine *a priori* variables plus the flow experience construct. Categorizing the different variables as synonyms of the original *a priori* variables was made possible through an analysis of the statements presented to the participants on the assessment tools. The main themes for the definition of the measured variables were also presented.

Finally, the information gathered was synthesized into a set of guides for researchers which provide a description of each flow variable, keywords and/or key phrases associated with the variable, and the synonyms of the variable. These guides also include the assessment statements and questions as developed and published by the theorists referenced by the researchers in their studies. These guides represent a significant contribution to future researcher and future readers of research into the examination of the LFE during DGBL gameplay, allowing for cross-discipline conversations, collaborations, and common understanding.

CHAPTER FIVE

Conclusion

This integrative literature review examined the study of the flow state as experienced by learners engaging with DGBLs, specifically examining the conceptualization and assessment of the LFE in empirical research of the phenomenon. My goal was to identify the ways in which the LFE had been conceptualized and assessed using the lens of the nine *a priori* flow dimensions published by Mihalyi Csikszentmihalyi in 1990. The utilization of an integrative literature review process allowed me to deeply explore the manner in which researchers have been approaching the definition and assessment of these flow dimensions and their related constructs. The seeming definitional dissonance and mismatch of conceptualization and assessment ultimately was resolved, allowing me to organize the many flow dimension variable labels encountered in the studies into the structure of the nine *a priori* flow dimensions plus one additional construct. The need for guides to enable future researchers to compare and contrast studies across disciplines and approaches was identified during the process of answering the two research questions posed. These guides, one for each of the nine *a priori* flow dimensions and the additional construct (*flow experience*) were created as an outcome of this study. Instructional designers and game designers will benefit from using these guides as they seek to develop DGBLs that encourage and help facilitate learners achieving the flow state during gameplay, with the goal of increasing opportunities to realize and maximize learning outcomes associated with flow.

The integrative literature review was selected as the appropriate methodology for this study to address the need “to summarize what is known about a topic and to communicate the synthesis of the literature to a targeted community” (Toronto, 2020, p. 1) and to bring a “value-

added contribution to the new thinking in the field” (Torraco, 2005, p. 358). As flow is a mature, well-developed research topic, I examined a broad and diversified base of literature, both empirical and theoretical in nature, in a systematic manner. The goal of this study was to synthesize the findings and offer new perspectives on the topic, as well as to make recommendations and note implications (Callahan, 2010; Toronto, 2020; Torraco, 2005). The study was guided by two research questions:

1. How has the learner flow experience been conceptualized in empirical literature in the study of learners engaging with digitally based games for learning?
2. How has the learner flow experience been assessed in empirical literature in the study of learners engaging with digitally based games for learning?

Through an exhaustive search of available literature, 66 peer-reviewed empirical articles were identified for inclusion in the study data set, representing work conducted in fourteen countries and published in English between 2011 and 2021. Taiwan represented nearly half (45.5%) and the United States roughly one-fifth (18.2%) of the locations where the included studies were conducted. No studies conducted in Central America or South America were found, but it is possible that since this study limited the data set to research published in the English language, the data set was not complete. The participants in the studies varied in ages ranging from seven years old to over 60. The number of participants in the studies also varied widely, ranging from a low of twenty-two to 1,011 individuals submitting validated responses. Finally, the number of studies published each year examining the flow experience in learners engaged in DGBL gameplay has increased from only one in 2011 to eight in 2021, reflecting increasing interest in this field of study.

When initially reading the studies included in this data set, over 160 variable names were

encountered. The number and variety of terms used in the conceptualization and assessment of the flow experience and its dimensions seemed overwhelming and made it difficult to make generalizations or conduct analyses across the studies; however, the iterative process of examining the terms and their definitions and theoretical foundations revealed commonalities and similarities in the language used and assessments utilized.

Discussion of Findings of Research Questions 1 and 2

Research Question 1 sought to identify how flow had been conceptualized in the 66 empirical studies included in the data for this study. The synonyms, definitions, and discussions of each of the researcher-identified flow dimensions were further analyzed to understand if and how they meshed with the nine flow dimensions identified by Csikszentmihalyi (1990). This required the identification of how the LFE was conceptualized in the articles included in the data set. When initially reading the data set studies, the number and variety of terms used in the conceptualization of the LFE and its dimensions seemed overwhelming, and seemed to prevent generalization or analysis across the studies. However, the iterative process of examining the terms, their definitions, and their theoretical foundations revealed commonalities and similarities in the language used and definitions presented.

Likewise, Research Question 2 sought to identify how the flow experience and its dimensions had been assessed in these 66 studies. Again, I sought to establish if and how the researcher-provided definitions could be organized into the nine *a priori* dimensions. The organization of the synonyms into the flow dimension structure for Research Question 2 was accomplished via an iterative analysis of the statements used to assess each of the flow terms used by the researchers in their studies. Not all of the researchers provided complete lists of the assessment statements or questions used in their studies. However, since all but one empirical

study provided the source information for their assessment development, and often also provided (at a minimum) example statements used in their assessments, a further iterative analysis of the source material was integrated into the process, allowing for the ultimate categorization of the synonyms within the *a priori* flow dimension structure.

The Likert-style scale assessment tools used in these articles reflects the componential approach taken to the evaluation of the flow experience (Moneta, 2021). Most of the articles used the nine-factor component model as described in this study, while some used a single-factor component model. While both of these approaches to this method are psychometrically sound, it must be noted that the flow state does not happen consistently or for extended periods of time. Rather, the experience ebbs and flows, reflecting the changes in attention level of the participant (Moneta, 2021; Schell, 2008), yet the assessments used by the researchers were all administered post-play. This limitation was noted by several researchers in the studies included in the data set.

Discussion of the Synthesis and Creation of the Researcher Guides

As my analysis progressed, I noted a lack of consistency in the terms used to identify the LFE variables. Similarly, there seemed to be little consensus in the definitions of the variables or in their usage. This seeming lack of agreement in terminology and assessment statements required deeper analysis. The analysis revealed that nearly all of the variable terms encountered could be organized in terms of Csikszentmihalyi's (1990) flow dimensions and the additional construct, *flow experience*. For the few terms that did not fit within the schema, further analysis illustrated that those outlier terms were more appropriately described as requirements for effective game design, rather than as LFE dimensions.

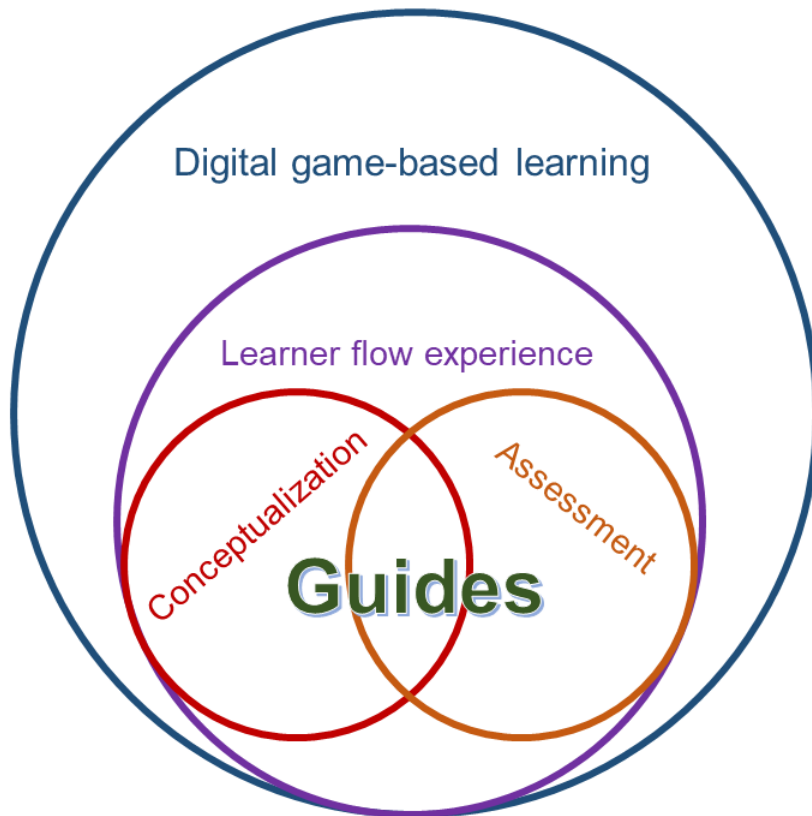
The study of the LFE in individuals during DGBL gameplay necessarily differs from that of athletes or those engaging in gameplay such as chess or activities such as dance. Procci et al.

(2012) demonstrated this definitively by evaluating the effectiveness of the use of the Long Dispositional Flow Scale (DFS-2) to evaluate the LFE in individuals during DGBL gameplay. The DFS-2 was developed by Jackson and Marsh (1996) to examine the flow state in participants in athletic activities, and at the time, specified that it was developed to address the specific experiences associated with athletic performance. Jackson et al. (2010) offers the study of flow experience in participants should be grounded in the activity or type of activity that is being studied, because the conditions surrounding or enabling flow will vary. Procci et al. (2012) concurred with this, based on the evaluation of their findings. This belief was a guiding precept in the development of the guides housed in Appendix D. Thus, suggestions for DGBL development in terms of each flow dimension is included in these guides.

The ability to organize the many variable terms encountered in this manner led to the recognition that researcher guides spanning each of the nine *a priori* flow dimensions and the additional construct were needed. Such guides could facilitate and enable researchers to compare and contrast across studies of the flow experience of learners during DGBL gameplay and could offer options to future researchers examining this phenomenon. More importantly, such guides could be used to facilitate meaningful conversations and collaborations between instructional designers and DGBL game designers whose common goal is to improve the likelihood that DGBL players may enter flow during gameplay and enhance their learning ability and/or game experience. Consistent with the goals of conducting an integrative literature review, these guides bring “value-added contribution to the new thinking in the field” (Torraco, 2005, p. 358). A graphical representation of the guides within the study structure is in Figure 15.

Figure 15

Graphical Representation, Created Guides within Study Purpose



By updating the evidence for the conceptualization of the flow experience, identifying the assessment tools utilized or localized for participants in the included studies, creating guides for the flow dimensions and constructs, and making suggestions for future direction for research of the topic, this study advances research of the LFE in a DGBL environment.

Unresolved Issues and Areas for Future Research

During the course of this study, a variety of approaches to the identification of the specific flow dimensions comprising the antecedents of flow were noted. Although beyond the scope of this study, inconsistent approaches to and understandings of the concept of the

antecedents to or precursors of flow were noted. Specifically, Csikszentmihalyi (1975, 1990) spoke to the dimensions of *balance of skills and challenge*; *clear goals*; and *swift, unambiguous feedback* as comprising the antecedents of flow. In contrast, Kiili et al. (2021) in their examination of the LFE in the DGBL environment offer that “in the context of educational game design, challenge-skill balance, clear goals, immediate and cognitive feedback, sense of control, and playability are identified as flow antecedents that should be carefully considered when designing game-based learning environments” (p. 95). If DGBLs are to be created such that the LFE during DGBL gameplay is encouraged, agreement on this subset of flow dimensions should be reached. The study of the antecedents of flow in terms of the LFE in the DGBL environment thus represents an opportunity for future research.

In addition, the methods by which the flow experience is measured represent an opportunity for future research. The variety of approaches noted during the study, and as highlighted during the creation of the researcher guides, suggests a need for integration and standardization. This need is also reflected in the naming and definition conventions of the flow dimensions themselves. It is clear that many opportunities for further research and for collaboration in these studies would be of benefit to the field.

Limitations

All research methodologies are subject to potential threats, including the integrative literature review methodology, and these limitations should be identified and discussed (Toronto & Remington, 2020). Further, van Merriënboer (2014), in his chapter “Research Paradigms and Perspectives on Learning” in the 4th edition of the *Handbook of Research on Educational Communications and Technology*, offers that researchers must be aware of their existing beliefs and understandings, and “the fact that [these] paradigms heavily affect their research methods

and findings” (p. 21). The study of the LFE in learners as a topic is not new, but it is steadily evolving. The lack of consensus on definitions and assessment methodologies within the extant body of literature complicates the goal of accurately categorizing or characterizing the dimensions of the flow experience.

In this study, the focus was on how the LFE is conceptualized and assessed in empirical studies of learners engaging with DGBLs, which immediately excluded researchers’ findings and implications drawn from their conclusions. This study’s focus necessarily also excluded other learning environments, which may influence the themes and patterns observed and the conclusions drawn. Future research into these areas may expand on the information gathered and presented in this study. The studies ultimately included may not reflect the full breadth of research into the LFE in a DGBL environment.

The review itself may be subject to weaknesses, including the introduction of unintended biases in article selection, coding, or review, because this study has a single author. The selected studies themselves will have limitations which will affect the final product of this study. Access to literature is another concern, as the databases used were determined by convenience of access through the university library resources and professional organization library resources, although the lending library resources did help mitigate access issues.

As a lone researcher, potential bias may have been introduced into the data set selection, the data collection from the data set, and the analysis of the information extracted. It is hoped that applying consistent procedures might reduce the impact of these issues. To mitigate these issues, comparisons to recent studies examining the state of the literature in the study of the flow experience, and the limitations and conclusions drawn therein were also conducted. It is hoped these checks enabled me to prevent the introduction of incorrect assumptions, or from

incorporating implicit misunderstandings into the results created for presentation (Weaver-Hightower, 2019).

To ensure the robustness of the study, including visibility into any potential biases, I described my role in detail and maintained transparency throughout the study.

Study Contribution and Conclusion

The significant contribution of this study is the development of easy-to-use guides to facilitate interdisciplinary communication and collaboration in DGBL game design by incorporating elements that encourage the LFE for increased or better learning outcomes.

In the future, instructional designers should work closely with researchers and practitioners in the computer science, human-computer interaction, and game design disciplines to ensure alignment and common approaches to this area of study. Instructional designers bring to the table an approach that focuses on the learners and the instructional goals, systematic approaches to the design of instruction, and methods by which assessments may be layered into activities or games. These tools and approaches provide front-end development processes that would neatly dovetail with the typical planning and scoping processes employed by game designers. The focus of the ID community on the individual and their interactions with learning environments and activities intersects well with the focus of the game designer on the interaction of the player and the in-game activities. The guides developed during this study could help facilitate the conversations, providing a common language and method whereby each may meet their DGBL development goals. Encouraging the LFE during DGBL gameplay for the purpose of increasing learning or creating a more enjoyable learning experience would be beneficial for players.

The guides developed as an output from this study can also be used as references for

future studies of the impact of the LFE on DGBL players' learning outcomes. Moreover, use of these guides may enhance collaboration efforts between instructional designers and DGBL game designers in creating effective DGBLs that increase learning or user engagement and enjoyment through the fostering of conditions that enable the phenomenon.

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- Zou, D., Zhang, R., Xie, H., & Wang, F. L. (2021). Digital game-based learning of information literacy: Effects of gameplay modes on university students' learning performance, motivation, self-efficacy and flow experiences. *Australasian Journal of Educational Technology, 37*(2), 152–170. <https://doi.org/10.14742/ajet.6682>

APPENDIX A

Search Terms Organized by Topic

Topic	Search Term set up for Boolean Searches
Flow theory	"flow theory" OR "flow state" OR "flow experience" OR "flow model"
Digital game-based learning	"digital game-based learning" OR "digital game based learning" OR "DGBL" OR "DBGL" OR "digital* based games for learning" OR "digitally-based games for learning" OR "computer learning game" OR "computer games for learning" OR "computer-based learning game" OR "educative computer game" OR "computer game-based learning" OR "educational computer game" OR "computer game-based education" OR "serious computer game" OR "game based learning"
Learning	"learning" OR "objective learning" OR "perceived learning" OR "learning outcome"
Learners	"elementary" OR "primary" OR "K-6" OR "middle school" OR "junior high" OR "6-8" OR "7-9" OR "high school" OR "secondary school" OR "9-12" OR "students" OR "learners" OR "undergraduate*" OR "graduate*" OR "adult learner"

Note: All search term strings in each topic subcategory were joined with an AND Boolean operator when searching the databases.

APPENDIX B

“Other” Variables Identified

“Other” Variables - Assessments	“Other” Variables - Conceptualizations
Absorption	Absorption
Action Orientation	Autonomy
Autonomy	Competence
Challenge / Perceived Challenge	Curiosity
Competence	Discovery
Confidence	Engagement
Curiosity	Enjoyment
Engagement	Extrinsic Motivation
Enjoyment	Flow Antecedent
Extrinsic Motivation	Flow Experience / Flow State
Flow Antecedent	Immersion
Flow State / Flow Experience	Interest
Fluency of Performance	Intrinsic Motivation
Gamefulness	Satisfaction
Human-to-Machine Interactivity	Telepresence
Immersion	
Interest	
Intrinsic Motivation	
Judgment	
Perceived Ease of Use	
Perceived Uncertainty	
Playability	
Satisfaction	
Skill / Perceived Skill	
Telepresence	
Usability	

APPENDIX C

Integrative Literature Review Data Set

Author(s)	Article Name	Journal	Year
Aremu, A., & Adebagbo, A.	Games, game flow, and gender as they affect mathematics achievement of pupils in Nigeria	Bulgarian Journal of Science & Education Policy	2016
Baumann, N., Lürig, C., & Engeser, S.	Retention and flow under guided and unguided learning experience in 3D virtual world	Motivation and Emotion	2016
Baydas, O., Karakus, T., Topu, F. B., Yilmaz, R., Ozturk, M. E., & Goktas, Y.	Retention and flow under guided and unguided learning experience in 3D virtual worlds	Computers in Human Behavior	2015
Berry, D.	Level-up learning: Video games in an online class	Teaching English as a Second Language Electronic Journal	2021
Bressler, D. M., & Bodzin, A. M.	A mixed methods assessment of students' flow experiences during a mobile augmented reality science game	Journal of Computer Assisted Learning	2013
Bressler, D. M., & Bodzin, A. M.	Investigating flow experience and scientific practices during a mobile serious educational game	Journal of Science Education and Technology	2016
Bressler, D. M., Bodzin, A. M., & Tutwiler, M. S.	Engaging middle school students in scientific practice with a collaborative mobile game	Journal of Computer Assisted Learning	2018
Bressler, D. M., Tutwiler, M. S., & Bodzin, A. M.	Promoting student flow and interest in a science learning game: A design-based research study of school scene investigators	Educational Technology Research and Development	2021
Brom, C., Buchtová, M., Šisler, V., Děchtěrenko, F., Palme, R., & Glenk, L. M.	Flow, social interaction anxiety and salivary cortisol responses in serious games: A quasi-experimental study	Computers & Education	2014
Brom, C., Šisler, V., Slussareff, M., Selmbacherová, T., & Hlávka, Z.	You like it, you learn it: Affectivity and learning in competitive social role play gaming	International Journal of Computer-Supported Collaborative Learning	2016
Bui, P., Rodríguez-Aflecht, G., Brezovszky, B., Hannula-Sormunen, M. M., Laato, S., & Lehtinen, E.	Understanding students' game experiences throughout the developmental process of the number navigation game	Educational Technology Research and Development	2020

Buil, I., Catalán, S., & Martínez, E.	Exploring students' flow experiences in business simulation games	Journal of Computer Assisted Learning	2017
Chang, C.-C., Liang, C., Chou, P.-N., & Lin, G.-Y.	Is game-based learning better in flow experience and various types of cognitive load than non-game-based learning? Perspective from multimedia and media richness	Computers in Human Behavior	2017
Chang, C.-C., Warden, C. A., Liang, C., & Lin, G.-Y.	Effects of digital game-based learning on achievement, flow and overall cognitive load	Australasian Journal of Educational Technology	2018
Chen, C.-H.	Impacts of augmented reality and a digital game on students' science learning with reflection prompts in multimedia learning	Educational Technology Research and Development	2020
Chen, C.-H., Law, V., & Huang, K.	The roles of engagement and competition on learner's performance and motivation in game-based science learning	Educational Technology Research and Development	2019
Chen, C.-H., Liu, J.-H., & Shou, W.-C.	How competition in a game-based science learning environment influences students' learning achievement, flow experience, and learning behavioral patterns	Educational Technology & Society	2018
Chen, Z.H., & Lee, S.-Y.	Application-driven educational game to assist young children in learning English vocabulary	Journal of Educational Technology & Society	2018
Chen, Z.-H., & Lee, S.-Y.	Application-driven educational game to assist young children in learning English vocabulary	Journal of Educational Technology & Society	2018
Cheng, M., Su, C.-Y., & Kinshuk.	Integrating smartphone-controlled paper airplane into Gamified Science Inquiry for Junior High School students	Journal of Educational Computing Research	2020
Chou, Y.-S., Hou, H.-T., Chang, K.-E., & Su, C.-L.	Designing cognitive-based game mechanisms for mobile educational games to promote cognitive thinking: An analysis of flow state and game-based learning behavioral patterns	Interactive Learning Environments	2021
Faiola, A., Newlon, C., Pfaff, M., & Smyslova, O.	Correlating the effects of flow and telepresence in virtual worlds: Enhancing our understanding of user behavior in game-based learning	Computers in Human Behavior	2013
Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T.	Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning	Computers in Human Behavior	2016
Hong, J.-C., Tai, K. H., & Ye, J. H.	Playing a Chinese remote-associated game: The correlation among flow, self-efficacy, collective self-esteem and competitive anxiety	British Journal of Educational Technology	2018

Hong, J.-C., Hwang, M.-Y., Chen, W.-C., Lee, C.-C., Lin, P.-H., & Chen, Y.-L.	Comparing the retention and flow experience in playing Solitary and Heart Attack games of San Zi Jing: A perspective of Dual Process Theory	Computers & Education	2013
Hong, J.-C., Hwang, M.-Y., Tai, K.-H., & Lin, P.-H.	Intrinsic motivation of Chinese learning in predicting online learning self-efficacy and flow experience relevant to students' learning progress	Computer Assisted Language Learning	2017
Hong, J.-C., Hwang, M.-Y., Tai, K.-H., Lin, P.-H., & Lin, P.-C.	Learning progress in a Chinese order of stroke game: The effects of intrinsic cognitive load and gameplay interest mediated by flow experience	Journal of Educational Computing Research	2019
Hong, J.-C., Hwang, M.-Y., Tsai, C.-R., Tai, K.-H., & Wu, Y.-F.	The effect of social dilemma on flow experience: Prosociality relevant to collective efficacy and goal achievement motivation	International Journal of Science and Mathematics Education	2019
Hong, J.-C., Tai, K.-H., Hwang, M.-Y., & Kuo, Y.-C.	Internet cognitive failure affects learning progress as mediated by cognitive anxiety and flow while playing a Chinese antonym synonym game with interacting verbal—Analytical and motor-control	Computers & Education	2016
Hou, H.-T.	Integrating cluster and sequential analysis to explore learners' flow and behavioral patterns in a simulation game with situated-learning context for science courses: A video-based process exploration	Computers in Human Behavior	2015
Hsieh, Y.-H., Lin, Y.-C., & Hou, H.-T.	Exploring the role of flow experience, learning performance and potential behavior clusters in elementary students' game-based learning	Interactive Learning Environments	2013
Hsu, T.-C.	Effects of gender and different augmented reality learning systems on English vocabulary learning of elementary school students	Universal Access in the Information Society: International Journal	2019
Huang, Y.-C., Backman, S. J., Backman, K. F., McGuire, F. A., & Moore, D.	An investigation of motivation and experience in virtual learning environments: A self-determination theory	Education and Information Technologies: The Official Journal of the IFIP Technical Committee on Education	2019
Hung, C.-Y., Sun, J. C.-Y., & Yu, P.-T.	The benefits of a challenge: Student motivation and flow experience in tablet-pc-game-based learning	Interactive Learning Environments	2015
Hwang, G.-J., Chiu, L.-Y., & Chen, C.-H.	A contextual game-based learning approach to improving students' inquiry-based learning performance in social studies courses	Computers & Education	2015
Hwang, G.-J., Wu, P.-H., & Chen, C.-C.	An online game approach for improving students' learning performance in web-based problem-solving activities	Computers & Education	2012

Kiili, K. J., de Freitas, S., Arnab, S., & Lainema, T.	The design principles for flow experience in educational games	Procedia Computer Science	2012
Kiili, K. J., Devlin, K., Perttula, A., Tuomi, P., & Lindstedt, A.	Using video games to combine learning and assessment in Mathematics Education	International Journal of Serious Games	2015
Kiili, K. J., Lindstedt, A., Koskinen, A., Halme, H., Ninaus, M., & McMullen, J.	Flow experience and situational interest in game-based learning: Cousins or identical twins	International Journal of Serious Games	2021
Kiili, K. J., Perttula, A., Lindstedt, A., Arnab, S., & Suominen, M.	Flow experience as a quality measure in evaluating physically activating collaborative serious games	International Journal of Serious Games	2014
Lai, C.-H., Chu, C.-M., Liu, H.-H., Yang, S.-B., & Chen, W.-H.	An examination of game-based learning from theories of flow experience and cognitive load	International Journal of Distance Education Technologies	2013
Li, F.-Y., Hwang, G.-J., Chen, P.-Y., & Lin, Y.-J.	Effects of a concept mapping-based two-tier test strategy on students' digital game-based learning performances and behavioral patterns	Computers & Education	2021
Li, Z.-Z., Cheng, Y.-B., & Liu, C.-C.	A constructionism framework for designing game-like learning systems: Its effect on different learners	British Journal of Educational Technology	2012
Liu, C.-C.	A model for exploring players flow experience in online games	Information Technology & People	2017
Liu, C.-C., Cheng, Y.-B., & Huang, C.-W.	The effect of simulation games on the learning of computational problem solving	Computers & Education	2011
Liu, H., & Song, X.	Exploring "flow" in young Chinese EFL learners' online English learning activities	System	2021
Liu, I.-F.	The study of intention to learn in game-based learning with a smartphone	International Journal of Distance Education Technologies	2020
Liu, T.-Y.	Using educational games and simulation software in a computer science course: Learning achievements and student flow experiences	Interactive Learning Environments	2014
Ninaus, M., Kiili, K. J., Wood, G., Moeller, K., & Kober, S.E.	To add or not to add game elements? Exploring the effects of different cognitive task designs using eye tracking	IEEE Transactions on Learning Technologies	2020

Ninaus, M., Moeller, K., McMullen, J., & Kiili, K. J.	Acceptance of game-based learning and intrinsic motivation as predictors for learning success and flow experience	International Journal of Serious Games	2017
Ninaus, M., Pereira, G., Stefitz, R., Prada, R., Paiva, A., Neuper, C., & Wood, G.	Game elements improve performance in a working memory training task	International Journal of Serious Games	2015
Oksanen, K.	Subjective experience and sociability in a collaborative serious game	Simulation & Gaming	2013
Özhan, Ş. Ç., & Kocadere, S. A.	The effects of flow, emotional engagement, and motivation on success in a gamified online learning environment	Journal of Educational Computing Research	2019
Procci, K., Singer, A. R., Levy, K. R., & Bowers, C.	Measuring the flow experience of gamers: An evaluation of the DFS-2	International Journal of Serious Games	2012
Rachmatullah, A., Reichsman, F., Lord, T., Dorsey, C., Mott, B., Lester, J., & Wiebe, E.	Modeling secondary students' genetics learning in a game-based environment: Integrating the expectancy-value theory of achievement motivation and flow theory	Journal of Science Education and Technology	2021
Silva, R., Rodrigues, R., & Leal, C.	Play it again: How game-based learning improves flow in accounting and marketing education	Accounting Education	2019
Sun, J. C.-Y., Kuo, C.-Y., Hou, H.-T., & Lin, Y.-Y	Exploring learners' sequential behavioral patterns, flow experience, and learning performance in an anti-phishing educational game	Educational Technology & Society	2017
Tcha-Tokey, K., Christmann, O., Loup-Escande, E., Loup, G., & Richir, S.	Towards a model of user experience in immersive virtual environments	Advances in Human-Computer Interaction	2018
Theodoulou, P., Avraamidou, L., & Vrasidas, C.	Flow and the pedagogical affordances of computer games: A case study	Educational Media International	2015
Topu, F. B., Reisoğlu, İ., Yılmaz, T. K., & Göktaş, Y.	Information retention's relationships with flow, presence and engagement in guided 3D virtual environments	Education and Information Technologies	2018
Tsai, M.-J., Huang, L.-J., Hou, H.-T., Hsu, C.-Y., & Chiou, G.-L.	Visual behavior, flow and achievement in game-based learning	Computers & Education	2016
Wang, Y., Rajan, P., Sankar, C. S. & Raju, P. K.	Let them play: The impact of mechanics and dynamics of a serious game on student perceptions of learning engagement	IEEE Transactions on Learning Technologies	2017

Yang, J. C., & Quadir, B.	Individual differences in an English learning achievement system: Gaming flow experience, gender differences and learning motivation	Technology, Pedagogy and Education	2018
Yeh, Y.-C., & Lin, C. S.	Achievement goals influence mastery experience via two paths in Digital Creativity Games among elementary school students	Journal of Computer Assisted Learning	2018
Yeh, Y.-C., Lai, S. C., & Lin, C.-W.	The dynamic influence of emotions on game-based creativity: An integrated analysis of emotional valence, activation strength, and regulation focus	Computers in Human Behavior	2016
Zheng, M., & Spires, H. A.	Fifth graders' flow experience in a digital game-based science learning environment	International Journal of Virtual and Personal Learning Environments	2014
Zou, D., Zhang, R., Xie, H., & Wang, F. L.	Digital game-based learning of information literacy: Effects of gameplay modes on university students' learning performance, motivation, self-efficacy and flow experiences	Australasian Journal of Educational Technology	2021

APPENDIX D

Summary Guides, Flow Dimensions and Flow Experience

The guides, as presented in this Appendix, were created as an outcome of this study. Each guide is preceded by a summary of the goals of the researchers whose studies are included in the data set. Each guide provides:

- The name of the flow dimension
- A description of the flow dimension
- Associated keywords and key phrases
- The synonyms identified in the assessments
- The parallel synonyms identified in the conceptualizations
- The assessment statements or questions used across the studies, organized by originating theorist
- The source or inspiration of the originating theorist's approach (if known)

When an individual flow dimension was not specifically examined in a particular assessment approach, this is noted in the guide as “<none identified; this model did not examine player perceptions of this flow dimension>”.

Balance of Challenge and Skills

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine learners' perceptions of their skills in terms of the challenges presented by the DGBL. They further sought to understand the learner's perception of their skill improvement during DGBL gameplay. The suggestion that DGBL in-game challenges should adapt to player skills, and that as their skills improve, the challenges should also increase was also identified.

Table D1

Summary Guide, Balance of Challenge and Skills

Flow Dimension: Balance of Challenge and Skills	
Description: The DGBL player should perceive a balance of their skills against the challenges provided by the game, fostering a sense of competency and capability. The DGBL's design should provide the capability to dynamically adjust in-game challenges to the player's skills as their proficiency and ability improve.	
Keywords / Key Phrases: Capability, Competence, Challenge/Skills Match	
Synonyms, Assessments:	
Action Orientation Balance Balance of Skills and Challenge Challenge Challenge / Skill Balance Challenges Competence Confidence Feelings of Frustration Fluency of Performance Gamefulness	Intrinsic Cognitive Load Perceived Challenge Perceived Ease of Use Perceived Skill Perceived Uncertainty Personal Skills Well-Suited to Given Challenges Playability Skills Technology Adoption Tension Usability
Parallel Synonyms, Conceptualizations:	
Action Orientation Balance between one's skills and the activity's demands Balance between skills and challenge Challenge Challenge / Skill Balance Challenge and Complexity Challenge and Perceived Skill	Perceived Ease of Use Perceived match of challenges to skills Perceived Skill Perceived Skills Should Match Challenge Perceived Uncertainty Perception that challenges are matched to one's skills Perception that skills are well suited to given

<p>Challenge Enabling Absorption Challenge Matched to Skill Challenges Trigger User Skills Competence Confidence Correlation between Challenges and Skills Feeling of Frustration Mastery Perceived balance of challenge and skills</p>	<p>challenges Playability Playfulness Skill Speed and ease of use Tension Usability Usability by the Players</p>
<p>Assessment Statements / Questions Used Across Studies, Organized by Theorist:</p>	
<p>Bressler & Bodzin, 2013 “I was challenged and I felt I could meet the challenge”</p>	
<p>Buil et al., 2017 “Playing the business simulation game challenges me” “Playing the business simulation game challenges me to perform to the best of my ability” “Playing the business simulation game provides a good test of my skills” “I find that the business simulation game stretches my capabilities to the limits” “I am extremely skilled at playing the business simulation game” “I consider myself knowledgeable about playing the business simulation game” “I know somewhat more than most of my colleagues about the business simulation game” “I know how to find what I am looking for when playing the business simulation game”</p>	
<p>Fu et al., 2009; EGameFlow Scale “Most of the gaming activities are related to the learning task” (Concentration Construct) “Workload in the game is adequate” (Concentration Construct) “The difficulty of challenges increase as my skills improved” (Challenge Construct) “The game provides new challenges with an appropriate pacing” (Challenge Construct) “The game provides different levels of challenges that tailor to different players” (Challenge Construct)</p>	
<p>Hamari et al., 2016 “Was it challenging?” (Challenge Construct) “Playing it stretched my capabilities to the limit” (Challenge Construct) “I was not very good at the game” (Skill Construct) “How skilled were you at the game?” (Skill Construct) “I was very skilled at the game” (Skill Construct)</p>	
<p>Heutte et al., 2016; EduFlow Model “I trust my ability to meet the high demands of the situation” (Cognitive Control Construct) “If I use again the same virtual environment, my interaction with the environment would be clear and understandable for me”</p>	
<p>Hong et al., 2019 “It is very hard for me to write the correct order of strokes based on the initial white-colored character that appeared on the screen” (Intrinsic Cognitive Load Construct) “It is very difficult for me to practice the correct order of strokes in the limited time given” (Intrinsic Cognitive Load Construct) “I was frustrated when practicing the correct order of strokes in the game” (Intrinsic Cognitive Load Construct)</p>	
<p>Huang et al., 2018 “I felt very capable and effective” (Competence Construct) “The experiences kept me on my toes but did not overwhelm me” (Competence Construct)</p>	
<p>Hung et al., 2015 “I familiarized myself with such characteristics of the game that I did not utilize in my playing strategy” “Game was challenging, but I believed that my skills would allow me to meet the challenge”</p>	

<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) "I felt I was competent enough to meet the demands of the situation" (note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) "I was challenged, but I believed my skills would allow me to meet the challenge" "My abilities matched the challenge of what I was doing" "I felt I was competent enough to meet the demands of the situation" "The challenge and my skills were at an equally high level" (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Kiili, 2006; Flow Scale for Games "I was challenged, but I believed my skills would allow me to meet the challenge" "The challenge that the game provided and my skills were at an equally high level" "The use of the user interface was easy to acquire"</p>
<p>Kiili et al., 2012 "I was challenged, but I believed my skills would allow me to meet the challenge" "I could use the user interface of the game spontaneously and automatically without having to think" "The challenge that the game provided and my skills were at an equally high level" "The use of the user interface was easy to acquire"</p>
<p>Kiili et al., 2021 "The game provided just the right amount of challenge"</p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996) "This learning software is not easy, but it is not too hard either" "It is a challenging task to accomplish each mission in time"</p>
<p>Liu, 2017 (derived from multiple sources) "Playing online games challenges me" "Playing online games challenges me to do the best of my ability" "Playing online games provides a good test of my ability" "Playing online games stretches my capabilities to the limit" "I am skilled at playing online games" "I have better skills than others in playing online games" "I know useful tips and techniques to play online games" "I easily learn the skills needed to play online games" "I feel that playing online games involves a high degree of uncertainty" (Perceived Uncertainty Construct) "I feel that the uncertainty associated with playing online games is high" (Perceived Uncertainty Construct) "I feel a high degree of uncertainty when playing online games" (Perceived Uncertainty Construct) "I feel a high degree of uncertainty about the winning or losing outcome when playing online games" (Perceived Uncertainty Construct)</p>
<p>Liu, 2020 "I feel the difficulty levels of the blockades are mid-range" (Game Based Learning Activities Construct)</p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey "Using the Web challenges me" "Using the Web challenges me to perform to the best of my ability" "Using the Web provides a good test of my skills" "I find that using the Web stretches my capabilities to my limits" "How much does the Web challenge you, compared to other things you do on the computer?" "How much does the Web challenge you, compared to the sport or game you are best at?"</p>

<p>"I am extremely skilled at using the Web"</p> <p>"I consider myself knowledgeable about good search techniques on the Web"</p> <p>"I know somewhat less than most users about using the Web." (Reverse coded)</p> <p>"I know how to find what I am looking for on the Web"</p> <p>"How would you rate your skill at using the Web, compared to other things you do on the computer?"</p> <p>"How would you rate your skill at using the Web, compared to the sport or game you are best at?"</p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience)</p> <p>"I felt skillful" (Competence Construct)</p> <p>"I felt strong" (Competence Construct)</p> <p>"I was good at it" (Competence Construct)</p> <p>"I felt successful" (Competence Construct)</p> <p>"I was fast at reaching the game's targets" (Competence Construct)</p> <p>"I felt competent" (Competence Construct)</p> <p>"I felt that I was learning" (Challenge Construct)</p> <p>"I thought it was hard" (Challenge Construct)</p> <p>"I felt stimulated" (Challenge Construct)</p> <p>"I felt challenged" (Challenge Construct)</p> <p>"I had to put a lot of effort into it" (Tension Construct)</p> <p>"I felt time pressure" (Tension Construct)</p> <p>"I felt tense" (Tension Construct)</p>
<p>Pearce et al., 2005</p> <p>"I was frustrated by what I was doing" (Control Construct)</p> <p>"The activities bored me" (Control Construct)</p>
<p>Rachmatullah et al., 2021</p> <p>"I felt frustrated while using <the game>" (Feelings of Frustration Construct)</p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS)</p> <p>"I feel just the right amount of challenge" (Absorption by Activity Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM)</p> <p>"I have sufficient Internet skills needed for this course" (Skill Construct)</p> <p>"I have sufficient intellectual skills to understand this course" (Skill Construct)</p> <p>"I would be able to take a more advanced course than this" (Skill Construct)</p> <p>"This course is too demanding for me" (Challenge Construct)</p> <p>"It is difficult for me to understand the subject matter" (Challenge Construct)</p> <p>"It is difficult for me to keep up with this course" (Challenge Construct)</p> <p>"It is hard for me to complete the task required in this course" (Challenge Construct)</p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions)</p> <p>"Games should be sufficiently challenging and match the player's skill level"</p> <p>"Games must support player skill development and mastery"</p>
<p>Wang et al., 2017</p> <p>"Learning to operate the serious game was easy for me" (Perceived Ease of Use Construct)</p> <p>"I found the serious game flexible in tasks and activities" (Perceived Ease of Use Construct)</p> <p>"I found it easy to get the serious game to do what I wanted" (Perceived Ease of Use Construct)</p> <p>"It was easy for me to become skillful at using the serious game" (Perceived Ease of Use Construct)</p> <p>"I found the serious game easy to use" (Perceived Ease of Use Construct)</p> <p>"My interaction with the serious game at work was clear and understandable" (Perceived Ease of Use Construct)</p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008)</p> <p>"The game tasks were challenging, but I had the skills to meet the challenge" (Challenge / Skills Balance Construct / Flow Antecedent Construct)</p> <p>"The difficulty level of the game equaled to my skill level" (Challenge / Skills Balance Construct / Flow</p>

Antecedent Construct)

“As I played the game, my skills got improved and so I was able to complete more difficult tasks”
(Challenge / Skills Balance Construct / Flow Antecedent Construct)

“The game did not get any more difficult as I played” (Gamefulness Construct / Flow Antecedent Construct)

Clear Goals

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine learners' perceptions of the goals of the DGBL as clearly defined, understandable, and achievable. The suggestion that the provision of clear and easily understandable goals to the DGBL player for the purpose of facilitating player success was also identified.

Table D2

Summary Guide, Clear Goals

Flow Dimension: Clear Goals	
Description: The DGBL player should perceive the goals of the game as clearly defined, understandable, and achievable. The DGBL's design should ensure that the game's rules, goals, and objectives are provided in a manner such that player success is facilitated.	
Keywords / Key Phrases: Goals are clearly defined; Players know what to do	
Synonyms, Assessments:	
Clarity Clear Goals	Goals Goal Clarity
Parallel Synonyms, Conceptualizations:	
Clarity of goals Clarity of objectives Clear and known goals Clear establishment of goals Clear Goals Clear Set of Goals Coherence of the activity Fluency Focused on goals	Goal Clarity Goals Goals and Rules Open and Clear Goals Perceived Goals Rules and Concrete Goals Rules and Constraints Rules and Set Goals
Assessment Statements / Questions Used Across Studies, Organized by Theorist:	
Bressler & Bodzin, 2013 "I had a strong sense of what I wanted to do"	
Buil et al., 2017 "At the beginning of the business simulation game the goals were clearly defined" "At the beginning of the business simulation game I knew what I had to do" "At the beginning of the business simulation game I knew what I had to achieve"	
Fu et al., 2009; EGameFlow Scale "Overall game goals were presented in the beginning of the game" "Overall game goals were presented clearly"	

<p>“Intermediate goals were presented in the beginning of each scene” “Intermediate goals were presented clearly”</p>
<p>Hamari et al., 2016 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Heutte et al., 2016; EduFlow Model “At each step, I know exactly what I have to do” (Cognitive Control construct)</p>
<p>Hong et al., 2019 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hung et al., 2015 “The goals of the game were clearly defined” “I knew clearly what I wanted to do and achieve” “I understood the idea of the game” “The frame story of the game created a clear context to the game events”</p>
<p>Huang et al., 2018 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) “I had a strong sense of what I wanted to do” (note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) “I knew clearly what I wanted to do” “I had a strong sense of what I wanted to do” “I knew what I wanted to achieve” “My goals were clearly defined” (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Kiili, 2006; Flow Scale for Games “I knew clearly what I wanted to do and achieve” “The goals of the game were clearly defined”</p>
<p>Kiili et al., 2012 “I knew clearly what I wanted to do and achieve” “The goals of the game were clearly defined”</p>
<p>Kiili et al., 2021 “I knew what I had to do in the game”</p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996) “I know the goal of each learning unit” “Before the start of each section, a graphic description helped me understand the learning objectives”</p>
<p>Liu, 2017 (derived from multiple sources) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2020 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey <none identified; this survey was not specifically developed to examine DGBLs></p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) <none identified; this model did not examine player perceptions of this flow dimension></p>

<p>Pearce et al., 2005 "I knew the right thing to do" (Control Construct)</p>
<p>Rachmatullah et al., 2021 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) "I know what I have to do each step of the way" (Fluency of Performance Construct) "I am worried about failing" (Perceived Outcome Importance Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) <none identified; this survey was not specifically developed to examine DGBLs></p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions) "Games should provide the player with clear goals at appropriate times"</p>
<p>Wang et al., 2017 "I knew clearly what I wanted to do during game time " "I had a strong sense of what I wanted to do during game time" "I knew what I wanted to achieve during game time" "My goals were clearly defined during game time"</p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008) "I knew clearly what I needed to do in the game" (Clear Goals Construct / Flow Antecedent Construct) "The goal of the game was very clear to me" (Clear Goals Construct / Flow Antecedent Construct) "I understood the goal of the game from the very beginning" (Clear Goals Construct / Flow Antecedent Construct) "I understood the game on the screen quickly and knew what to do without having to think" (Clear Goals Construct / Flow Antecedent Construct) "I learned how to lay the game very easily" (Clear Goals Construct / Flow Antecedent Construct) "It was easy for me to understand how to play the game" (Clear Goals Construct / Flow Antecedent Construct)</p>

Swift, Unambiguous Feedback

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine learners' perceptions of the feedback received during DGBL gameplay as arriving in a timely manner, it being of actionable quality, and it being meaningful. The suggestion that the provision of immediate, useful, and actionable feedback during DGBL gameplay would enable the player to monitor performance and progress was also identified.

Table D3

Summary Guide, Swift, Unambiguous Feedback

Flow Dimension: Swift, Unambiguous Feedback	
Description: The DGBL player should receive feedback during gameplay they perceive as being received as timely, actionable, and useful. The DGBL's design should ensure that the game's feedback timing and information facilitates player understanding of progress and performance and should allow the player to remain focused on their activities.	
Keywords / Key Phrases: Players know what to do <u>next</u> ; Players know progress	
Synonyms, Assessments:	
Feedback Human-to-Machine Interactivity Immediate and Unambiguous Feedback	Immediate Feedback Swift, Unambiguous Feedback Unambiguous Feedback
Parallel Synonyms, Conceptualizations:	
Cognitive and Immediate Feedback Continuous and Immediate Feedback Feedback Frequent and Targeted Feedback	Immediate and Appropriate Feedback Immediate Feedback Unambiguous Feedback
Assessment Statements / Questions Used Across Studies, Organized by Theorist:	
Bressler & Bodzin, 2013 "I felt I was on track towards my goals"	
Buil et al., 2017 "While I am playing the business simulation game, I receive feedback on my progress in the game" "While I am playing the business simulation game, I am notified of the results of decision-making" "While I am playing the business simulation game, I receive information on my score within the business simulation game"	
Fu et al., 2009; EGameFlow Scale "I receive feedback on my progress in the game" (Feedback Construct)	

<p>"I receive immediate feedback on my actions" (Feedback Construct)</p> <p>"I am notified of new tasks immediately" (Feedback Construct)</p> <p>I am notified of new events immediately" (Feedback Construct)</p> <p>"I receive information on my success (or failure) of intermediate goals immediately" (Feedback Construct)</p> <p>"The game provides "hints" in text that help me overcome the challenges" (Challenge Construct)</p> <p>"The game provides "online support" that helps me overcome the challenges" (Challenge Construct)</p> <p>"The game provides video or audio auxiliaries that help me overcome the challenges" (Challenge Construct)</p>
<p>Hamari et al., 2016</p> <p><none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Heutte et al., 2016; EduFlow Model</p> <p><none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hong et al., 2019</p> <p>"When playing the game, I am not used to the mode of how a wrong order of stroke is displayed" (Intrinsic Cognitive Load Construct)</p> <p>"I was annoyed when it showed that I had made an error in the order of strokes" (Intrinsic Cognitive Load)</p> <p>"When I play the correct order of strokes game, I am aware of the strokes I missed" (Flow Construct)</p>
<p>Huang et al., 2018</p> <p><none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hung et al., 2015</p> <p>"I was aware of how I was performing in the game"</p> <p>"The feedback the game provided was useful"</p> <p>"The user interface of the game was easy to use"</p> <p>"The game provided enough feedback for my actions"</p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS)</p> <p>"I had a good idea about how well I was doing while I was involved in the task/activity"</p> <p>(note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS)</p> <p><none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2)</p> <p>"It was really clear to me how I was going"</p> <p>"I was aware of how well I was doing"</p> <p>"I had a good idea about how well I was doing while I was involved in the task/activity"</p> <p>"I could tell by the way things were progressing how well I was doing"</p> <p>(note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Kiili, 2006; Flow Scale for Games</p> <p>"I was aware how I was performing in the game"</p> <p>"I could tell by the way I was performing how well I was doing"</p>
<p>Kiili et al., 2012</p> <p>"I was aware how I was performing in the game"</p> <p>"I could tell by the way I was performing how well I was doing"</p>
<p>Kiili et al., 2021</p> <p><none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996)</p> <p>"I received immediate feedback whenever I acted during the course"</p> <p>"I am able to know my current learning status, such as score earned"</p>

<p>Liu, 2017 (derived from multiple sources) “Online games themselves advise me what to do” (Human to Machine Interactivity Construct) “Online games themselves advise me of necessary information” (Human to Machine Interactivity Construct) “Online games themselves advise me properly in each situation (Human to Machine Interactivity Construct)”</p>
<p>Liu, 2020 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey <none identified; this survey was not specifically developed to examine DGBLs></p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Pearce et al., 2005 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rachmatullah et al., 2021 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) “I must not make any mistakes here” (Perceived Outcome Importance Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) <none identified; this survey was not specifically developed to examine DGBLs></p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions) “Players must receive appropriate feedback at appropriate times”</p>
<p>Wang et al., 2017 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008) “The feedback given by the game helped me know how well I was doing in the game” (Feedback Construct / Flow Antecedent Construct) “The game provided quick feedback of how well I was playing” (Feedback Construct / Flow Antecedent Construct) “The feedback that the game provided was very helpful” (Feedback Construct / Flow Antecedent Construct)</p>

Merging of Action and Awareness

General themes of this dimension. The analysis of this dimension across the studies in the data set of the findings revealed the desire on the part of the researchers to examine (1) the learners' perceptions of their merging with or being immersed in the DGBL game environment; (2) the learners' perceptions of their thought processes as progressing smoothly and fluidly; and (3) their perception that any concerns external to the game environment (time, disturbances, other obligations) were immaterial. The suggestion that the DGBL's environment should be designed such that the player would become increasingly involved was also identified.

Table D4

Summary Guide, Merging of Action and Awareness

Flow Dimension: Merging of Action and Awareness	
Description: The DGBL player should perceive their immersion into or merging of their awareness into the DGBL game environment as occurring during gameplay. The DGBL's design should ensure that the game's environment allows the player to enjoy immersion in the environment, allowing smooth and fluid thought processes, and the ability to ignore extraneous distractions.	
Keywords / Key Phrases: Actions occur naturally; No distractions; Immersion in environment; Actions are smooth/fluid; Telepresence	
Synonyms, Assessments:	
Action / Awareness Merging Emotional Investment Immersion Merging of Action and Awareness	Playability Sensory and Imaginative Immersion Telepresence
Parallel Synonyms, Conceptualizations:	
Action / Awareness Merging Activity becomes Spontaneous and Almost Automatic Complete Immersion Immersion	Merging of Action and Awareness Playability Sensory and Imaginative Immersion Telepresence
Assessment Statements / Questions Used Across Studies, Organized by Theorist:	
Bressler & Bodzin, 2013 "I did things naturally without thinking too much"	

<p>Buil et al., 2017 “When I am playing the business simulation game, I get carried away by the game” (Absorption Construct / Flow Experience Construct) “When I am playing the business simulation game, I forget everything else around me” (Absorption Construct / Flow Experience Construct) “When I am playing the business simulation game, I am totally immersed in the game” (Absorption Construct / Flow Experience Construct)</p>
<p>Fu et al., 2009; EGameFlow Scale “No distraction from the task is highlighted” (Concentration Construct) “I am not distracted from tasks that the player should concentrate on” (Concentration Construct) “I become unaware of my surroundings while playing the game” (Immersion Construct) “I temporarily forget worries about everyday life while playing the game” (Immersion Construct) “I can become involved in the game” (Immersion Construct) “I feel emotionally involved in the game” (Immersion Construct) “I feel viscerally involved in the game” (Immersion Construct)</p>
<p>Hamari et al., 2016 “How immersed were you in the game?” (Immersion Construct)</p>
<p>Heutte et al., 2016; EduFlow Model <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hong et al., 2019 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Huang et al., 2018 “I feel carried off by the 3D virtual environment” (Emotional Involvement Construct) “I feel as if I am part of the 3D virtual environment” (Emotional Involvement Construct) “I feel deeply about the 3D virtual environment” (Emotional Involvement Construct)</p>
<p>Hung et al., 2015 “I was totally immersed with playing the game”</p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) “I had a good idea about how well I was doing while I was involved in the task/activity” (note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) “I did things correctly without thinking about trying to do so” “Things just seemed to be happening automatically” “I did things automatically, without thinking too much” “I did things spontaneously and automatically without having to think” (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Kiili, 2006; Flow Scale for Games “I could use the user interface of the game spontaneously and automatically without having to think” “It was no effort to keep my mind on game events” “I was totally immersed in playing the game”</p>
<p>Kiili et al., 2012 “I was not concerned with what others may have been thinking about my playing performance” “I was not worried about my performance during playing”</p>
<p>Kiili et al., 2021 “My thoughts/activities ran fluidly and smoothly” “The right thoughts/movements occurred of their own accord” “I was completely lost in thought”</p>

<p>Liu, 2014 (derived from Jackson & Marsh, 1996) “During the learning, I did not notice what was happening around me” “Time flies fast when I use learning software for learning”</p>
<p>Liu, 2017 (derived from multiple sources) “I forget about my immediate surroundings when I play the online game” (Telepresence Construct) “Playing the online game often makes me forget where I am” (Telepresence Construct) “After playing the online game, I feel like I come back to the “real world” after a journey” (Telepresence Construct) “Playing the online game creates a new world for me, and this world suddenly disappears when I stop playing” (Telepresence Construct) “When I am playing the online game, I feel I am in a world created by the online game” (Telepresence Construct) “When I am playing the online game, my body is in the room, but my mind is inside the world created by the online game” (Telepresence Construct) “When I am playing the online game, the world generated by the online game is more real for me than the “real world” (Telepresence Construct)</p>
<p>Liu, 2020 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey Irrelevant/Relevant (Reverse coded) Means a lot to me/Means nothing to me Matters to me/Doesn't matter Of no concern/Of concern to me (Reverse coded) “I forget about my immediate surroundings when I use the Web” (Reverse coded) “Using the Web often makes me forget where I am” “After using the Web, I feel like I come back to the “real world” after a journey” “Using the Web creates a new world for me, and this world suddenly disappears when I stop browsing” “When I use the Web, I feel I am in a world created by the websites I visit” “When I use the Web, my body is in the room, but my mind is inside the world created by the websites I visit” “When I use the Web, the world generated by the sites I visit is more real for me than the ‘real world’.”</p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) “I forgot everything around me” (Flow Construct) “I lost connection with the outside world” (Flow Construct) “I felt imaginative” (Sensory and Imaginative Immersion Construct) “I felt that I could explore things” (Sensory and Imaginative Immersion Construct) “It felt like a rich experience” (Competence Construct)</p>
<p>Pearce et al., 2005 “I was aware of distractions” (Interest Construct)</p>
<p>Rachmatullah et al., 2021 “I felt involved in this experience” (Game Satisfaction Construct)</p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) “My thoughts/activities run fluidly and smoothly” (Fluency of Performance Construct) “The right thoughts/movements occur of their own accord” (Fluency of Performance Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) “While watching VOD, I adjust the volume or the screen size” (Telepresence Construct) “I remember vividly the way in which the contents were presented on screen” (Telepresence Construct) “I screen the contents and go directly to the part I need within the table of contents of the lecture” (Telepresence Construct) “I go over every piece of information put on the screen” (Telepresence Construct)</p>

"I have a clear memory of the instructor's voice even after the class is over" (Telepresence Construct)
 "When intruded by someone while watching the lecture, I am annoyed" (Focused Attention Construct)
 "When watching the lecture, I am unaware of what is going on around me" (Focused Attention Construct)
 "Being occupied with the lecture, I would forget other engagements" (Time Distortion Construct)

Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions)

"Players should experience deep but effortless involvement in the game"

Wang et al., 2017

"I was deeply engrossed in the serious game activity" (Concentration Construct)

Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008)

<none identified; this model did not examine player perceptions of this flow dimension>

Concentration on the Task at Hand

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine the learners' perceptions of their ability to focus and/or center their attention on the task(s) presented in the game, and learners' perceptions that the DGBL activities enhanced their ability to concentrate during gameplay. Concentration was further identified as a state of intense and focused attention that left the learner with no cognitive resources remaining for extraneous or irrelevant information during gameplay. The suggestion that the DGBL should be designed such that the player could focus their concentration on the activities during gameplay was also identified.

Table D5

Summary Guide, Concentration on the Task at Hand

Flow Dimension: Concentration on the Task at Hand	
Description: The DGBL player should perceive that they enjoy the ability to fully focus their attention and concentration during gameplay; they should also perceive the game's activities as enhancing that ability. The DGBL's design should allow for and enhance player ability to concentrate on game activities during gameplay.	
Keywords / Key Phrases: Players can concentrate; Focus; Attention	
Synonyms, Assessments:	
Concentration Concentration on the Task at Hand Engagement Focus on Task Focused Attention	Focusing on Task Heed Perceived Concentration Total Concentration on the Task at Hand
Parallel Synonyms, Conceptualizations:	
Attention Paid to a Particular Task Concentration Concentration on Event at Hand Concentration on Task Concentration on Task at Hand Deep Concentration Fluency of Performance Focused Attention Heed	High Concentration High Degree of Concentration Highly Focused Concentration on the Activity Increased Focus of Attention Intense and Focused Concentration Intense Concentration Perceived Concentration State of Full Concentration Total Concentration

Assessment Statements / Questions Used Across Studies, Organized by Theorist:
Bressler & Bodzin, 2013 "I was totally focused on what I was doing"
Buil et al., 2017 <none identified; this model did not examine player perceptions of this flow dimension>
Fu et al., 2009; EGameFlow Scale "Generally speaking, I can remain concentrated in the game" (Concentration Construct)
Hamari et al., 2016 "How hard were you concentrating?" (Concentration Construct) / (Engagement Construct) "It provided content that focused my attention" (Concentration Construct) / (Engagement Construct)
Heutte et al., 2016; EduFlow Model "I am deeply focused on what I am doing" (Immersion and Time Transformation construct)
Hong et al., 2019 "When I play the correct order of strokes game, I am totally focused on what I am doing" (Flow Construct)
Huang et al., 2018 "My attention is totally focused" (Flow Construct)
Hung et al., 2015 "My attention was focused entirely on playing the game"
Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) "I was completely focused on the task at hand" (note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)
Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) <none identified; this model did not examine player perceptions of this flow dimension>
Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) "My attention was focused entirely on what I was doing" "It was no effort to keep my mind on what was happening" "I had total concentration" "I was completely focused on the task at hand" (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)
Kiili, 2006; Flow Scale for Games "My attention was focused entirely on playing the game" "I had total concentration while playing the game"
Kiili et al., 2012 "My attention was focused entirely on playing the game" "It was no effort to keep my mind on game events" "I had total concentration while playing the game"
Kiili et al., 2021 "I could concentrate on playing"
Liu, 2014 (derived from Jackson & Marsh, 1996) "The multimedia drew my attention to learning" "I was able to concentrate on the learning software during the course"
Liu, 2017 (derived from multiple sources) "While playing online games, I concentrate fully" (Focused Attention Construct)
Liu, 2020 <none identified; this model did not examine player perceptions of this flow dimension>

<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey “Not deeply engrossed/Deeply engrossed” “Absorbed intently/Not absorbed intently” (Reverse coded) “My attention is not focused/My attention is focused” “I concentrate fully/I do not concentrate fully” (Reverse coded)</p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) “I was deeply concentrating on the game” (Flow Construct)</p>
<p>Pearce et al., 2005 “It required a lot of effort for me to concentrate on the activities” (Interest Construct)</p>
<p>Rachmatullah et al., 2021 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) “I have no difficulty concentrating” (Fluency of Performance Construct) “I am completely lost in thought” (Absorption by Activity Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) “When watching the lecture, I am not distracted” (Focused Attention Construct) “When watching the lecture, I don’t surf the Internet or things like that” (Focused Attention Construct) “When watching the lecture, I have a feeling of concentration” (Focused Attention Construct)</p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions) “Games should require concentration and the player should be able to concentrate on the game”</p>
<p>Wang et al., 2017 “My attention was focused in the serious game activity” (Concentration Construct) “I concentrated fully in the serious game activity” (Concentration Construct)</p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008) “The <game name> game really grabbed my attention” (Concentration Construct / Flow Experience Construct) “It was easy for me to pay all my attention to the game” (Concentration Construct / Flow Experience Construct) “I was completely concentrated in playing the game” (Concentration Construct / Flow Experience Construct)</p>

Sense of Control

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine the learners' perceptions of autonomy or their ability to control their actions and consequences during gameplay, including their learning. The suggestion that the DGBL should be designed such that the player could experience choice, freedom, and opportunities to participate in self-selected activities was also identified.

Table D6

Summary Guide, Sense of Control

Flow Dimension: Sense of Control	
Description: The DGBL player should perceive that they have autonomy within the game, and that they have control of their actions and consequences during gameplay. The DGBL's design should allow for player choice, opportunity to participate in self-selected activities, and control of actions and consequences.	
Keywords / Key Phrases: Control; Autonomy	
Synonyms, Assessments:	
Autonomy Control Domination Gamefulness	Judgment Perceived Autonomy Sense of Control
Parallel Synonyms, Conceptualizations:	
Autonomy Control Deep Sense of Control Domination Judgment	Opportunity to Control Situation Perceived Autonomy Potential Control Sense of Control
Assessment Statements / Questions Used Across Studies, Organized by Theorist:	
Bressler & Bodzin, 2013 "I felt I was in control of what I was doing"	
Buil et al., 2017 <none identified; this model did not examine player perceptions of this flow dimension>	
Fu et al., 2009; EGameFlow Scale "I feel a sense of control and impact over the game" (Autonomy Construct) "I know next step in the game" (Autonomy Construct) "I feel a sense of control over the game" (Autonomy Construct)	
Hamari et al., 2016 <none identified; this model did not examine player perceptions of this flow dimension>	

<p>Heutte et al., 2016; EduFlow Model "I feel completely in control of my actions" (Cognitive Control Construct)</p>
<p>Hong et al., 2019 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Huang et al., 2018 "I did things because they interested me" (Autonomy Construct) "I did not feel controlled and pressured to be a certain way" (Autonomy Construct) "Feel in control" (Flow Construct)</p>
<p>Hung et al., 2015 "The game enabled the use of different playing strategies" "I could exploit the rewards gained from successful actions later in the game" "I felt in total control of my playing actions"</p>
<p>Kiili, 2006; Flow Scale for Games "I felt in total control of my playing actions" "I had a feeling of control of my actions"</p>
<p>Kiili et al., 2012 "I felt in total control of my playing actions" "I had a feeling of control of my actions"</p>
<p>Kiili et al., 2021 "I felt that I had everything under control"</p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) "I had a feeling of total control over what I was doing" (note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) "I had a sense of control over what I was doing" "I felt like I could control what I was doing" "I had a feeling of total control over what I was doing" "I felt in total control of my actions" (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996) "I always know what to do next to complete the learning unit" "I can control my progress in each unit"</p>
<p>Liu, 2017 (derived from multiple sources) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2020 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey "Controlling/Controlled" "Influenced/Influential" (Reverse coded) "Dominant/Submissive" "Guided/Autonomous" (Reverse coded)</p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) <none identified; this model did not examine player perceptions of this flow dimension></p>

<p>Pearce et al., 2005 "I felt in control of what I was doing" (Control Construct)</p>
<p>Rachmatullah et al., 2021 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) "I feel that I have everything under control" (Fluency of Performance Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions) "Players should feel a sense of control over their actions in the game"</p>
<p>Wang et al., 2017 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008) "It was easy for me to control my playing actions in the game" (Control Construct / Flow Experience Construct) "I was able to decide on my own playing actions and made progress in the game" (Control Construct / Flow Experience Construct) "I was in good control of my playing action" (Control Construct / Flow Experience Construct) "I was able to play in many different ways" (Gamefulness Construct / Flow Antecedent Construct) "I could use the rewards (i.e., sand dollars) I gained later when I did other tasks" (Gamefulness Construct / Flow Antecedent Construct)</p>

Distorted Sense of Time

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine the learners' perceptions of their loss of awareness of time passage during DGBL gameplay. The suggestion that the DGBL environment and experience should be designed such that the player may lose track of time in terms of the real world surrounding them was also identified.

Table D7

Summary Guide, Distorted Sense of Time

Flow Dimension: Distorted Sense of Time	
Description: The DGBL player may experience an altered sense of time passage, resulting in a perception of time moving more quickly, more slowly, or in an unexpected manner. The DGBL's design should create an environment or experience that allows the player the luxury of ignoring time in the real world.	
Keywords / Key Phrases: Time distortion; Time slippage; Time loss	
Synonyms, Assessments:	
Altered Sense of Time Distorted Sense of Time Loss of Time	Time Distortion Transformation of Time
Parallel Synonyms, Conceptualizations:	
Altered Sense of Time Distorted temporal experience Loss of time Time Time Distortion	Time Passing Rapidly Time Transformation Transformation of Time Unaware of Time Spent / Flow of Time Spent
Assessment Statements / Questions Used Across Studies, Organized by Theorist:	
Bressler & Bodzin, 2013 "I lost my normal sense of time"	
Buil et al., 2017 <none identified; this model did not examine player perceptions of this flow dimension>	
Fu et al., 2009; EGameFlow Scale "I forget about time passing while playing the game" (Immersion Construct) "I experience an altered sense of time" (Immersion Construct)	
Hamari et al., 2016 "I lost track of time while playing it" (Immersion Construct)	
Hong et al., 2019 "After I finished playing the correct order of strokes game, I felt time passed quickly" (Flow Construct)	

<p>Huang et al., 2018 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hung et al., 2015 “During playing, time seemed to alter (either speeded up or slowed down)”</p>
<p>Heutte et al., 2016; EduFlow Model “I am losing track of time” (Immersion and Time transformation construct)</p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) “The way time passed seemed to be different from normal” (note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) “Time seemed to alter (either slowed down or speeded up)” “The way time passed seemed to be different from normal” “It felt like time went by quickly” “I lost my normal awareness of time” (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Kiili, 2006; Flow Scale for Games “My sense of time altered (either speeded up or slowed down)” “The way time passed seemed to be different from normal”</p>
<p>Kiili et al., 2012 “My sense of time altered (either speeded up or slowed down)” “The way time passed seemed to be different from normal”</p>
<p>Kiili et al., 2021 “I didn't notice time passing”</p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2017 (derived from multiple sources) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2020 “When participating in GBL activities, I feel time passes by very fast” (Perceived Concentration Construct)</p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey “Time seems to go by very quickly when I use the Web” “When I use the Web, I tend to lose track of time”</p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) “I lost track of time” (Flow Construct)</p>
<p>Pearce et al., 2005 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rachmatullah et al., 2021 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) “I do not notice time passing” (Absorption by Activity Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) “I am unconscious of the passage of time while watching the lecture” (Time Distortion Construct)</p>

<p>"It feels like time flies while I am watching the lecture" (Time Distortion Construct) "The login time becomes longer than I usually plan for this course" (Time Distortion Construct)</p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Wang et al., 2017 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008) "While I was playing the <game name> game, I felt time seemed to go in an unusual way" (either much faster or slower than usual) (Transformation of Time Construct / Flow Experience Construct) "During gameplay, I forgot about time because I really got into the game" (Transformation of Time Construct / Flow Experience Construct) "During gameplay, the time seemed to pass very fast. Suddenly, the playing session was almost over" (Transformation of Time Construct / Flow Experience Construct)</p>

Loss of Ego / Loss of Self-Consciousness

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine the learners' perceptions of enjoying freedom from the perceptions of others or worry about performance during gameplay; the perception that nothing else mattered during gameplay was also examined. Note that the flow dimension *loss of ego* does not refer to losing the sense of one's self; instead, it refers to the player's self-esteem being immune to injury during DGBL gameplay. The suggestion that the DGBL should be designed such that the player could ignore the perceptions or opinions of others during gameplay was also identified.

Table D8

Summary Guide, Loss of Ego / Loss of Self-Consciousness

Flow Dimension: Loss of Ego / Loss of Self-Consciousness	
Description: The DGBL player experience of freedom from the opinions, expectations, or perceptions of others during gameplay. They may also experience freedom from other concerns during this time. The DGBL's design should create an environment or experience that allows the player the luxury of ignoring the demands or expectations of the real world during gameplay.	
Keywords / Key Phrases: Absorption; Nothing else matters; Opinions of others meaningless; Effortless focus maintenance	
Synonyms, Assessments:	
Absorption Absorption by Activity Engagement Interaction	Loss of Ego Loss of Self-Consciousness Perceived Attractiveness Personal Involvement
Parallel Synonyms, Conceptualizations:	
Absorption Active Engagement Emotional Engagement Engagement Engagement (equated as state of full concentration) Engagement and Competition Interaction	Loss of Ego / Self-Consciousness Loss of Oneself Loss of Self-Consciousness Peer Interaction Perceived Relatedness Socialization as Connected to Engagement

Assessment Statements / Questions Used Across Studies, Organized by Theorist:
<p>Bressler & Bodzin, 2013 “It felt like nothing else mattered”</p>
<p>Buil et al., 2017 “When I am playing the business simulation game I think about nothing else” (Absorption Construct / Flow Experience Construct)</p>
<p>Fu et al., 2009; EGameFlow Scale “I am not burdened with tasks that seem unrelated” (Concentration Construct)</p>
<p>Hamari et al., 2016 “I became very involved in the game forgetting about other things” (Immersion Construct)</p>
<p>Heutte et al., 2016; EduFlow Model “I am wholly absorbed in what I am doing” (Immersion and Time Transformation construct) “I don’t care about what others may think of me” (Loss of Self-Consciousness Construct) “I am not concerned about the judgement of others” (Loss of Self-Consciousness Construct) “I am not worried about what others might think of me” (Loss of Self-Consciousness Construct)</p>
<p>Hong et al., 2019 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Huang et al., 2018 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hung et al., 2015 “I was not concerned with what others may have been thinking of my playing performance” “I was not worried about my performance during playing”</p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) “I was not worried about what others may have been thinking of me” (note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) “I was not concerned with what others may have been thinking of me” “I was not concerned with how others may have been evaluating me” “I was not concerned with how I was presenting myself” “I was not worried about what others may have been thinking of me” (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Kiili, 2006; Flow Scale for Games “I was not concerned with what others may have been thinking about my playing performance” “I was not worried about my performance during playing”</p>
<p>Kiili et al., 2012 “I was totally immersed in playing the game” “I found the experience extremely rewarding”</p>
<p>Kiili et al., 2021 “My mind was completely clear” “I was totally absorbed in playing”</p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2017 (derived from multiple sources) “Perception of online games: important/unimportant” (Personal Involvement Construct)</p>

<p>"Perception of online games: irrelevant/relevant" (Personal Involvement Construct)</p> <p>"Perception of online games: means a lot to me/means nothing to me" (Personal Involvement Construct)</p> <p>"Perception of online games: matters to me/does not matter to me" (Personal Involvement Construct)</p> <p>"Perception of online games: of no concern to me/ of concern to me" (Personal Involvement Construct)</p> <p>"While playing online games, I am deeply engrossed" (Focused Attention Construct)</p> <p>"While playing online games, I am absorbed intently" (Focused Attention Construct)</p>
<p>Liu, 2020 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) "I felt completely absorbed" (Flow Construct) "I was fully occupied with the game" (Sensory and Imaginative Immersion Construct)</p>
<p>Pearce et al., 2005 "I was absorbed intensely by the activity" (Interest Construct) "I thought about other things" (Interest Construct)</p>
<p>Rachmatullah et al., 2021 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) "My mind is completely clear" (Fluency of Performance Construct) "I am totally absorbed in what I am doing" (Absorption by Activity Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Wang et al., 2017 "I was absorbed intensely in the serious game activity" (Concentration Construct)</p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008) "When I was playing, I did not care about what others thought about how well I was playing" (Loss of Self-Consciousness Construct / Flow Experience Construct) "I just kept playing and was not worried about how well I was doing" (Loss of Self-Consciousness Construct / Flow Experience Construct) "While I was playing the <game name> game, I forgot about unhappy things" (Loss of Self-Consciousness Construct / Flow Experience Construct)</p>

Autotelic Experience

General themes of this dimension. The analysis of this dimension revealed the desire on the part of the researchers to examine the learners' perceptions of the experience of being in the zone during DGBL gameplay, and a desire to recapture the rewarding gameplay experience. As a reminder, Csikszentmihalyi (1990) offered that enjoyment may not be experienced during DGBL gameplay, although, upon reflection, the player may remember the experience as enjoyable. The suggestion that the DGBL should be designed such that the player would choose to engage with the game simply because it is worth doing, producing its own rewards, was also identified.

Table D9

Summary Guide, Autotelic Experience

Flow Dimension: Autotelic Experience	
Description: The Autotelic Experience is defined as one that is engaged in for its own sake. The DGBL player autotelic experience often takes the form of the experience of being in the zone, or as a wish to recapture a rewarding gameplay experience. The DGBL's design should create an environment or experience that encourages the player to wish to re-engage with the game.	
Keywords / Key Phrases: Worth doing for own sake; Replay intention; Worth doing for enjoyment; Worth doing for outcome	
Synonyms, Assessments:	
Autotelic Autotelic Experience Curiosity Emotion Enjoyment Experience Consequence Frame Story Gameplay Interest Interest Intrinsically Rewarding Activity Intrinsically Rewarding Experience Motivation, Extrinsic Motivation, Intrinsic Motivation, Utilitarian	Motivation Negative Affect Peer Interaction Perceived Enjoyment Perceived Usefulness Playfulness Positive Affect Positive Emotions Positive Value Replay Intention Rewarding Experience Satisfaction Self-Actualization Tension
Parallel Synonyms, Conceptualizations:	
A feeling that the activity is innately rewarding Achievement	Motivation Negative Affect

Autotelic Experience Autotelic state Curiosity Emotion Enjoyment Enjoyment (Sensation seeking) Experience Consequence Extrinsic Motivation Flow Consequence Frame Story Fun Interest Intrinsic Motivation Intrinsically rewarding experience Learning Motivate to higher performance levels	Perceived Enjoyment Perceived Learning Playfulness Positive Affect Positive Emotions Positive Enjoyment Positive Value Replay intention Rewarding Experience Satisfaction Self-Actualization Sense of Discovery Situational Interest Skills development as outcomes Tension User enjoyment
Assessment Statements / Questions Used Across Studies, Organized by Theorist:	
Bressler & Bodzin, 2013 "It felt like nothing else mattered"	
Buil et al., 2017 "Playing the business simulation game gives me a good feeling" (Enjoyment Construct / Flow Experience Construct) "I get a lot of enjoyment from playing the business simulation game" (Enjoyment Construct / Flow Experience Construct) "I feel happy whilst playing the business simulation game" (Enjoyment Construct / Flow Experience Construct) "I feel cheerful when I play the business simulation game" (Enjoyment Construct / Flow Experience Construct)	
Fu et al., 2009; EGameFlow Scale <none identified; this model did not examine player perceptions of this flow dimension>	
Hamari et al., 2016 "How much did you enjoy what you were doing?" (Enjoyment Construct) / (Engagement Construct) "Interacting with it was entertaining" (Enjoyment Construct) / (Engagement Construct) "Interacting with it was fun" (Enjoyment Construct) / (Engagement Construct) "How interesting was the game?" (Interest Construct) / (Engagement Construct) "Did you feel bored with playing the game?" (reverse coded) (Enjoyment Construct) / (Engagement Construct)	
Heutte et al., 2016; EduFlow Model "I have the feeling I am living a very exciting experience" (Autotelic Experience Construct) "This activity brings me a sense of well-being" (Autotelic Experience Construct) "When I talk about this activity, I feel such a deep emotion that I want to share it" (Autotelic Experience Construct)	
Hong et al., 2019 "The game inspires me to keep playing" (Flow Construct) "I like to play the game to learn the correct order of strokes" (Gameplay Interest Construct) "I feel very excited when I play the game" (Gameplay Interest Construct) "I feel very happy when I play the game" (Gameplay Interest) "I enjoy playing the game" (Gameplay Interest Construct) "I hope to play the game many more times" (Gameplay Interest)	
Huang et al., 2018 "I enjoyed experiencing the virtual world very much" (Intrinsic Motivation Construct)	

<p>"I thought experiencing in 3D virtual world was quite enjoyable" (Intrinsic Motivation Construct)</p> <p>"I would describe the experience as very interesting" (Intrinsic Motivation Construct)</p> <p>Positive Emotions Construct -- Amusement, Interest, Contentment, Joy, Pride, Cheerfulness, Delight (solicited player perceptions of the emotions)</p> <p>"Excites my curiosity" (Flow Construct)</p> <p>"Intrinsically interesting" (Flow Construct)</p> <p>"Willing to recommend" (Behavioral Intentions Construct)</p> <p>"Wanted to find out more information about the destination" (Behavioral Intentions Construct)</p> <p>"Gained an interest in visiting" (Behavioral Intentions Construct)</p> <p>"Wanted try to visit in the future" (Behavioral Intentions Construct)</p>
<p>Hung et al., 2015</p> <p>"I really enjoyed the playing experience"</p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS)</p> <p>"I found the experience extremely rewarding"</p> <p>(note: this may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS)</p> <p><none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2)</p> <p>"I really enjoyed the experience of what I was doing"</p> <p>"I loved the feeling of what I was doing, and want to capture this feeling again"</p> <p>"The experience left me feeling great"</p> <p>"I found the experience extremely rewarding"</p> <p>(note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Kiili, 2006; Flow Scale for Games</p> <p>"I really enjoyed the playing experience"</p> <p>"I loved the feeling of playing and want to capture it again"</p> <p>"The playing experience left me feeling great"</p> <p>"I found the experience extremely rewarding"</p>
<p>Kiili et al., 2012</p> <p>"I really enjoyed the playing experience"</p> <p>"I loved the feeling of playing and want to capture it again"</p> <p>"The playing experience left me feeling great"</p>
<p>Kiili et al., 2021</p> <p><none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996)</p> <p>"I wanted to proceed to the next unit after completing each learning unit" (Self-Actualization Construct)</p> <p>"I felt great self-actualization when I achieved the goal of each learning unit" (Self-Actualization Construct)</p> <p>"I was happy during the learning activities" (Playfulness Construct)</p> <p>"I felt enjoyment when I played the learning software" (Playfulness Construct)</p>
<p>Liu, 2017 (derived from multiple sources)</p> <p>"I plan to play online games in the future" (Replay Intention Construct)</p> <p>"I intend to continue playing online games in the future" (Replay Intention Construct)</p> <p>"I expect my online game playing to continue in the future" (Replay Intention Construct)</p>
<p>Liu, 2020</p> <p>"I feel the game activities are interesting" (Game Based Learning Activities Construct)</p> <p>"I feel the story details of the game are related to the learning subject" (Game Based Learning Activities Construct)</p> <p>"In general, I am satisfied with the learning process of the game" (Game Based Learning Activities Construct)</p>

<p>"I feel GBL activities are fun" (Perceived Enjoyment Construct)</p> <p>"I feel GBL activities are enjoyable" (Perceived Enjoyment Construct)</p> <p>"I feel GBL activities keep me happy" (Perceived Enjoyment Construct)</p> <p>"Overall, the whole process of GBL activities is pleasurable" (Perceived Enjoyment Construct)</p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey</p> <p>"I feel unimaginative when I use the Web" (Reverse coded)</p> <p>"I feel flexible when I use the Web"</p> <p>"I feel unoriginal when I use the Web" (Reverse coded)</p> <p>"I feel uninventive when I use the Web" (Reverse coded)</p> <p>"I feel creative when I use the Web" (Reverse coded)</p> <p>"I feel playful when I use the Web"</p> <p>"I feel spontaneous when I use the Web"</p> <p>"Happy/Unhappy" (Reverse coded)</p> <p>"Annoyed/Pleased"</p> <p>"Satisfied/Unsatisfied" (Reverse coded)</p> <p>"Melancholic/Contented"</p>
<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience)</p> <p>"I was interested in the game's story" (Sensory and Imaginative Immersion Construct)</p> <p>"It was aesthetically pleasing (Sensory and Imaginative Immersion Construct)</p> <p>"I found it impressive" (Sensory and Imaginative Immersion Construct)</p> <p>"I felt restless" (Positive Affect Construct)</p> <p>"I felt annoyed" (Positive Affect Construct)</p> <p>"I felt irritable" (Positive Affect Construct)</p> <p>"I felt frustrated" (Positive Affect Construct)</p> <p>"I felt pressured" (Positive Affect Construct)</p> <p>"I felt content" (Positive Affect Construct)</p> <p>"I could laugh about it" (Positive Affect Construct)</p> <p>"I felt happy" (Positive Affect Construct)</p> <p>"I felt good" (Positive Affect Construct)</p> <p>"I enjoyed it" (Positive Affect Construct)</p> <p>"I thought it was fun" (Positive Affect Construct)</p> <p>"I thought about other things" (Negative Affect Construct)</p> <p>"I found it tiresome" (Negative Affect Construct)</p> <p>"I felt bored" (Negative Affect Construct)</p> <p>"I was distracted" (Negative Affect Construct)</p> <p>"I was bored by the story" (Negative Affect Construct)</p> <p>"It gave me a bad mood" (Negative Affect Construct)</p>
<p>Pearce et al., 2005</p> <p>"I found the activities enjoyable" (Enjoyment Construct)</p> <p>"I found the activities interesting" (Interest Construct)</p> <p>"The activities excited my curiosity" (Interest Construct)</p>
<p>Rachmatullah et al., 2021</p> <p>"I consider my experience a success" (Game Satisfaction Construct)</p> <p>"Using <game name> was worthwhile" (Game Satisfaction Construct)</p> <p>"My experience was rewarding" (Game Satisfaction Construct)</p> <p>"This experience was fun" (Game Satisfaction Construct)</p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS)</p> <p>"Something important to me is at stake here" (Perceived Outcome Importance Construct)</p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM)</p> <p>"I enjoy the learning experience this course offers me" (Enjoyment Construct)</p> <p>"I enjoy watching the lecture delivered in a virtual space" (Enjoyment Construct)</p>

"I am attracted to the subject of this course" (Enjoyment Construct)
 "Taking this course is a visually pleasing experience" (Enjoyment Construct)
 "The lecture content of this course is not boring" (Enjoyment Construct)

Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions)

<none identified; this model did not examine player perceptions of this flow dimension>

Wang et al., 2017

"Using the serious game was useful for learning" (Perceived Usefulness Construct)
 "Using the serious game increased my learning productivity" (Perceived Usefulness Construct)
 "Using the serious game increase my learning effectiveness" (Perceived Usefulness Construct)
 "Using the serious game made it easier to do my work" (Perceived Usefulness Construct)
 "The serious game has been enjoyable" (User Enjoyment Construct)
 "The serious game was one of my favorite learning modules" (User Enjoyment Construct)
 "I had fun interacting with the serious game" (User Enjoyment Construct)

Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008)

"I really enjoyed playing the <game name> game" (Autotelic Experience Construct / Flow Experience Construct)
 "I liked the feeling of playing and want to play it again" (Autotelic Experience Construct / Flow Experience Construct)
 "I enjoyed playing the <game name> game because it made me feel good" (Autotelic Experience Construct / Flow Experience Construct)

Flow Experience Construct

General themes of this dimension. The analysis of this dimension across the studies in the data set of the findings for each of the two research questions revealed the desire on the part of the researchers to examine the learners' perceptions of the experience of the flow state.

Generally speaking, this flow dimension is examined as a construct. The suggestion that the DGBL environment and experience should be designed such that the player experiences the flow state during gameplay was also identified.

Table D10

Summary Guide, Flow Experience Construct

Flow Construct: Flow Experience	
Description: Flow Experience is a construct of the combination of all of the flow dimensions, which allows the learner to experience the flow state experience during DGBL gameplay.	
Keywords / Key Phrases: In the zone; In the flow; Player experienced flow	
Synonyms, Assessments:	
Flow Flow Construct Flow Experience	Flow State Multimedia Flow Overall Experience of Being in Flow
Parallel Synonyms, Conceptualizations:	
Absorption of Activity Flow Flow Experience Flow Experience (construct)	Flow Level Flow State Fluency of Performance Multimedia Flow
Assessment Statements / Questions Used Across Studies, Organized by Theorist:	
Bressler & Bodzin, 2013 "I was in the zone"	
Buil et al., 2017 "I would still play the business simulation game, even if I was not rewarded for it" (Flow Experience Construct) "I find that I also want to play the business simulation game in my free time" (Flow Experience Construct) "I play the business simulation game because I enjoy it" (Flow Experience Construct) "I get my motivation from playing the business simulation game, and not from the reward of winning it" (Flow Experience Construct)	

<p>Fu et al., 2009; EGameFlow Scale <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hamari et al., 2016 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Heutte et al., 2016; EduFlow Model <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hong et al., 2019 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Huang et al., 2018 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Hung et al., 2015 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson & Marsh, 1996; Short Dispositional Flow Scale (S FSS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Jackson, Eklund & Martin, 2010; Core Flow State Scale (C FSS) "I was 'totally involved' " "It felt like 'everything clicked'" I was 'in the zone' " I felt 'in control' " I was 'switched on' " It felt like I was 'in the flow' of things" I was 'in the groove' " I was 'totally focused' on what I was doing" (note: these may not be reproduced without permission from the publisher, Mind Garden, Inc.)</p>
<p>Jackson, Eklund & Martin, 2010; Long Dispositional Flow Scales (DFS-2) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Kiili, 2006; Flow Scale for Games "I experienced a clear flow experience during playing"</p>
<p>Kiili et al., 2012 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Kiili et al., 2021 "I didn't notice time passing"</p>
<p>Liu, 2014 (derived from Jackson & Marsh, 1996) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Liu, 2017 (derived from multiple sources) "Do you think you have ever experienced flow when playing an online game?" "In general, how frequently would you say you experience 'flow' when playing an online game?" "Most of the time I play an online game I feel that I am in flow"</p>
<p>Liu, 2020 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Novak, Hoffman & Yung, 2000; Customer Experience Online Flow Survey "Do you think you have ever experienced flow on the Web?" "In general, how frequently would you say you have experienced 'flow' when you use the Web?" "Most of the time I use the Web I feel that I am in flow."</p>

<p>Okansen, 2013 (derived from Poels et al., 2008); Game Experience Questionnaire (GEQ Core Experience) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Pearce et al., 2005 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Rachmatullah et al., 2021 “The time I spent using [The Game] just slipped away” (Flow Experience Construct)</p>
<p>Rheinberg, Vollmeyer & Engeser (2003); Flow Short Scale (FKS) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Shin, 2006; Virtual-Course Flow Measure (VFM) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Sweetser & Wyeth, 2005; Gameflow Model (used to develop questions) <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Wang et al., 2017 <none identified; this model did not examine player perceptions of this flow dimension></p>
<p>Zheng & Spires, 2014 (derived from Kiili & Lainema, 2008) <none identified; this model did not examine player perceptions of this flow dimension></p>

APPENDIX E

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3 messages

Sharon Stidham <sharon62@vt.edu>

Wed, Dec 8, 2021 at 6:15 PM

To: magyiguo@umich.edu

Dear Dr. Guo,

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My dissertation study is focused on flow in the digitally-based games for learning environment, which I realize is not precisely what your paper discusses, but I found your Figure 1, A general model of flow and learning, a fabulous illustration of flow within the context of learning.

I am writing today to request permission to use this image in my dissertation, which will be submitted next semester. I hope that this is something to which you will be amenable.

I hope that this note finds you well, and that you have a great end for this semester.

Best regards,

Sharon.

--

Sharon Flynn Stidham, MBA
(pronouns: she/her)

PhD Candidate, Instructional Design and Technology
Graduate Assistant, School of Education Communications
Virginia Polytechnic Institute and State University

Yi Guo <magyiguo@umich.edu>

Wed, Dec 8, 2021 at 7:45 PM

To: Sharon Stidham <sharon62@vt.edu>

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Best,

Maggie

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--

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Permission for Figure 6



Sharon Stidham <sharon62@vt.edu>

Permission request re your The Art of Game Design book

4 messages

Sharon Stidham <sharon62@vt.edu>
 To: jschell@schellgames.com

Wed, Dec 8, 2021 at 6:31 PM

Dear Mr. Schell,

Good evening! My name is Sharon Stidham, and I am a Ph.D. Candidate at Virginia Tech. I truly enjoyed your book "The Art of Game Design" which, honestly, I stumbled upon in the giveaway pile when we had to move our offices (pre-pandemic). It truly inspired me, especially given my areas of study and interest.

I'm writing because my dissertation study is focused on flow in the digitally-based games for learning environment, and your image of your version of the flow model on p. 121 is far more realistic than many I've come across.

I am writing today to request permission to use this image in my dissertation, which will be submitted next semester. I hope that this is something to which you will be amenable.

I hope that this note finds you well, and that you have a great rest of the year.

Best regards,

Sharon.

--

Sharon Flynn Stidham, MBA
 (pronouns: she/her)

PhD Candidate, Instructional Design and Technology
 Graduate Assistant, School of Education Communications
 Virginia Polytechnic Institute and State University

Jesse Schell <jesse@schellgames.com>
 To: Sharon Stidham <sharon62@vt.edu>

Wed, Dec 8, 2021 at 6:39 PM

I am glad to grant permission. Good luck!

[Quoted text hidden]

--

Jesse Schell (he/him/his)
 CEO, Schell Games - <http://schellgames.com>
 Distinguished Professor of Entertainment Technology, Carnegie Mellon - <http://etc.cmu.edu>
 Phone: (412) 303-0885

Sharon Stidham <sharon62@vt.edu>
 To: Jesse Schell <jesse@schellgames.com>

Wed, Dec 8, 2021 at 7:03 PM

Thank you so much!!

[Quoted text hidden]

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The FLOW Manual
The Manual for the Flow Scales
Manual, Sampler Set

Sue Jackson, PhD, Bob Eklund, PhD, & Andrew Martin, PhD

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