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Health science educators' awareness, understanding and experience of digital game-based learning and gamification: a mixed methods study

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2024

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Olivier, Amanda . (2024). Health science educators' awareness, understanding and experience of digital game-based learning and gamification: a mixed methods study [Master's dissertation PhD thesis, University of the Witwatersrand, Johannesburg]. wirEdsPACE. https://hdl.handle.net/10539/49099

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HEALTH SCIENCE EDUCATORS' AWARENESS, UNDERSTANDING AND EXPERIENCE OF DIGITAL GAME-BASED LEARNING AND GAMIFICATION: A MIXED METHODS STUDY

Amanda Olivier

A dissertation submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science in Medicine in the field of Health Sciences Education.

Johannesburg, 2024

DECLARATION

I, Amanda Olivier, declare that this dissertation is my own unaided work. It is being submitted for the Degree of Master of Science in Medicine in the field of Health Sciences Education at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

 (Signature of candidate)8th day

Of October 2024 in Johannesburg.

DEDICATION

Dedicated to my mother and father,

Gerna Croucamp Olivier

15/01/1951 to 24/10/2015

Matthew 10:29-31

Hendrik Willem Olivier

08/02/1954 to 29/09/2004

2 Corinthians 4:7-13

ABSTRACT

The educational landscape needs new innovative methods to engage students and to ensure achievement of learning outcomes. Traditional methods often fail to capture students' attention in an increasingly digital and interactive world, highlighting the need for more dynamic and engaging strategies. Better engagement can foster deeper understanding, retention, and application of knowledge, enhancing the achievement of learning outcomes. In this study, health science educators' awareness, understanding, and experience of digital game-based learning (DGBL) and gamification in health science education were examined, with the aim of bridging the gap in the literature on this topic. By examining these elements, the study aims to address gaps in the existing literature and provide insights into the potential of these methods to transform teaching and learning practices.

The research used a mixed-method approach, including surveys, interviews, and a scoping review. The study targeted health science educators in South Africa to determine their awareness, understanding, and practical experiences with DGBL and gamification. Developing and implementing a new survey instrument was essential because of the lack of tools measuring these aspects in health science education.

Findings show great interest among health science educators in adopting DGBL and gamification methodologies, recognising their potential to enhance student learning outcomes. However, significant challenges, such as limited resources, insufficient training and lack of institutional support, were identified as barriers to widespread adoption. The study recommends targeted professional development, increased institutional commitment, and strategic integration of these methodologies into the curriculum. The integration of qualitative and quantitative data provided a comprehensive understanding of educators' perspectives, highlighting the need for support systems and further research to establish best practices for implementing DGBL in health science education.

ACKNOWLEDGEMENTS

To God, all the glory! I am incredibly grateful for God's presence throughout this journey. Thank you for this opportunity, for sending Your Son to save us, and for the Holy Spirit's comfort.

I want to express my sincere gratitude to my supervisors, Dr Paula Barnard-Ashton and Professor Judith Bruce, for their patience, guidance, and invaluable support throughout this dissertation process.

Thank you to my colleagues for their support and understanding as I dedicated time to complete this dissertation.

I want to honour my mother and grandmother, who are no longer with us, whose unwavering faith in my teaching potential has shaped my path, even during times of self-doubt.

I am also immensely thankful for the unwavering support of Auntie Betsie, Karin, Sonja and Zelda. Your encouragement kept me going when I considered giving up. I love and appreciate you.

Marchárl, thank you for being there. Thank you for teaching me about patience and how to hurry up and wait. I love you!

Last but not least, thank you to my furry companions, Nastia and Fasie, for their loyal presence during countless writing sessions.

Funding:

This research was self-funded.

CONFERENCE AND ACADEMIC PRESENTATIONS

Conference Paper Presentations

1. Olivier, A. (2020, October 30). *Game-based learning in Health Science Education*. Paper presented at the North American Gaming Association National Conference, Online.

Congress Workshops

1. Olivier, A. (2020, 26 August). *The Pedagogy of Online and Offline Games-based Learning: Strategies & Applications*. Panellist in webinar organized by LEARN Tech Asia, Online.
2. Olivier, A. (2020, 30 October). *Game-based learning in Health Science Education*. Workshop presented at the North American Simulation and Gaming Association Annual Conference, Online.
3. Olivier, A., Barnard-Ashton, P., & Crous, L. (June 2021). *Game-based learning in Health Science Education*. Workshop presented at the SAAHE National Conference, Online.

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NOMENCLATURE AND DEFINITIONS

21CLD	21st Century learning design
Assessment and evaluation	Processes used to measure and analyse student learning, the effectiveness of teaching methods, and the overall educational experience.
CHE	Council on Higher Education
Critical thinking	The ability to analyse, evaluate, and synthesise information to make reasoned judgments and solve problems.
Curriculum integration	Incorporating specific teaching methods, tools, or content (such as DGBL) into the existing educational curriculum.
DGBL	Digital game-based learning. This refers to utilizing digital games as an educational tool, integrating gameplay with learning objectives.
Educator training	Professional development programs designed to provide educators with the skills and knowledge necessary to successfully implement new teaching methods.
Engagement	The degree of interest, enthusiasm, and engagement that students demonstrate in learning activities.
Feedback mechanisms	Systems or processes by which students and educators can provide and receive feedback on teaching methods, learning activities, and outcomes.
Gamification	Incorporating game design elements (like points, badges, and leaderboards) into non-game settings to boost motivation and engagement.
Interactive gameplay	A game design feature allowing players to actively participate and make decisions that affect the outcome, enhancing engagement and learning.
Knowledge retention	The ability of students to retain and recall information over time is a crucial goal of effective teaching methods.
Learning outcomes	The measurable knowledge, skills, attitudes, and values that students are expected to gain from a learning experience.
Problem-solving skills	The ability to identify problems, develop possible solutions, and choose the best course of action.
Student-centred learning	An instructional approach focusing on the needs, abilities, interests, and learning styles of students and encouraging active learning.
Technological infrastructure	The hardware, software, and network resources required to support digital learning tools and platforms.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

In our dynamic and ever-changing world, the educational landscape necessitates a paradigm shift towards continuous adaptation to ensure its relevance (Redecker et al., 2011; Videnovik et al., 2023). There is a gap between traditional teaching and the skills needed in the modern workplace (Amory and Seagram, 2003). There is, thus, a need to explore innovative and real-world approaches to teaching. Integrating digital game-based learning (DGBL) and gamification into health science education has the potential to strengthen the learning opportunities that health science students receive, ensuring an education that remains relevant in the present era and into the future (Çiftci, 2018; Pereira et al., 2014; Zohari et al., 2023). Nursing is the only profession that requires a board certification in education before a nurse may apply to become a nurse educator at a nursing college or university. Within the University of the Witwatersrand, postgraduate programmes aim to up-skill health science educators in education competencies.

The terms DGBL and gamification are sometimes used interchangeably (Al Fatta et al., 2018; Ghai & Tandon, 2023). Collaboration, engagement, competition, and immediate reward are elements in DGBL and gamification (Amory et al., 1999; Auman, 2011; Lucas et al., 2020; Martinengo et al., 2019). Although there are certain parallels between the two terms, distinctions regarding their scope, implementation approaches, and role in a lesson become clear. Given the novelty of this field, various terms are being coined and used; for example, terms such as ‘serious games’ also exist to define similar concepts.

DGBL changes the teaching approach to being student-centred through active learning by playing the game (Aoun, 2017; Chang et al., 2017; Gee, 2003). A game (online/physical) is specifically designed for the students to learn a skill or content of the curriculum and facilitate achieving learning outcomes (Cheng and Su, 2012). It may include competition and immediate reward elements, but learning occurs through gameplay. It allows students to work alone or collaborate with other students towards a learning outcome (Cheng et al., 2017). Parallels can be drawn between DGBL and problem-based learning as the students learn by solving challenges or problems posed by the game (Cicchino, 2015). The gameplay is the lesson, and if it is removed, the objective of the lesson will be lost.

On the other hand, gamification is seen as the development of a reward system and competitive element to learning that sparks engagement and taps student motivation to learn (Cheng and Su, 2012; Hamari et al., 2014; Videnovik et al., 2023; Wolfe and Crookall, 1998)

Gamification can be implemented offline, for example, a star chart in a classroom and online by giving badges when a task is completed as a reward. The term ‘gamification’ has, however, also loosely been used to refer to the process of converting lesson content into a game, as seen in Barnard-Ashton et al. (2018), who referred to the development of a WebQuest to create a self-paced game as gamification. Thus, referring to ‘gamifying’ learning could refer to both game-based learning and gamification. Clarification of how these terms are used in health sciences education is needed to advance and integrate game-based learning and gamification.

In this dissertation, the author suggests that DGBL serves as a broader concept that can include gamification as one of its elements. However, gamification alone cannot encompass the entirety of DGBL.

1.2 HISTORICAL PERSPECTIVE OF GAME BASED LEARNING

Gaming in various forms has been used in health sciences education since the 1950s. Before the widespread use of digital technology, gaming in health sciences education involved tabletop simulations, role-playing and basic educational games (Wilkinson, 2016).

With the advancement of digital technology, the potential for using gaming as an educational tool in health sciences has become more apparent. Since 2010, augmented reality and virtual reality (VR) technologies have started being incorporated into gaming applications, allowing for more realistic simulations and training environments (Videnovik et al., 2023). During this period, there was a growing body of research supporting the effectiveness of gaming in health sciences education. Organisations and institutions increasingly collaborated with game developers and educational technology companies to create tailored gaming solutions for health sciences education (Ghai and Tandon, 2023; Wilkinson, 2016).

As of the early 2020s, gaming in health sciences education continues to evolve and expand (Van Gaalen et al., 2020). Advances in technology, including artificial intelligence; machine learning, and immersive simulation, are driving further innovation in game-based learning. There is a growing emphasis on personalised learning experiences and adaptive feedback mechanisms that allow students to hone their skill precision, clinical reasoning and decision-making at their level. Additionally, the Covid-19 pandemic highlighted the importance of digital learning tools, accelerating the adoption of gaming and virtual simulations in remote education settings (Unger and Meiran, 2020).

Even though DGBL has been used in higher education and health science education for several years, only a few studies have been published in South Africa, mainly limited to exploring the student's perspective. One example is the case study by Shaikh et al. (2021) that

looked at a game developed for pharmacy students in Minecraft. The focus of this case study was the game design and the student perspective.

1.3 THEORETICAL UNDERPINNINGS

Social constructivism focuses on collaborative learning that enables learners to construct new mental models through their experiences and interactions with peers, the health science educator, the learning facilitator, and the real-world community (Dunaway, 2011; Schifter et al., 2013; Siemens, 2006). Social constructivism is a learning theory that highlights the role of social interaction and collaboration in the learning process. Siemens (2006) coined the term 'connectivism' as a learning theory that emerged in response to the digital age, acknowledging the profound impact of technology and access to networked information on learning. Social constructivism and connectivism are two learning theories that have gained prominence in the 21st century, aligning with the framework for 21st-century learning. DGBL aligns with social constructivism by encouraging collaboration and knowledge construction through interaction. Regarding connectivism, DGBL assists students in navigating information networks within the games.

The introduction of the 21st-century learning framework by Partnerships for 21st Century Learning represents a significant step in the field of connectivism, as highlighted in the works of Bishop (Bishop, 2015; Kivunja and Kuyini, 2017).This framework offers a practical approach to teaching that aims to equip students with essential 21st-century skills. Doing so positions both students and educators advantageously to adapt to the evolving learning landscape shaped by the progression of the knowledge economy.

In the 21st-century learning framework, Kereluik et al. (2013) described three knowledge domains, namely foundational knowledge (the focus on traditional learning methods), meta-knowledge (often referred to as 21st-century skills), and humanistic knowledge (which contextualises learning in the real world). The framework shifts the focus of learning away from foundational knowledge towards meta- and humanistic knowledge. In health science education, meta- and humanistic knowledge are of great importance as they play a vital role in fostering social and cultural competence, which is indispensable in healthcare.

The 21st-century learning framework provides guidelines for developing meta-knowledge and humanistic knowledge, and DGBL can be used as a teaching modality and gamification applied to encourage student engagement (Bauman, 2013). In a world where information is easily accessible, meta-knowledge skills like communication, collaboration, problem-solving, and critical thinking are essential. These skills help make sense of the vast amount of available information.

1.4 PROBLEM STATEMENT

DGBL and gamification have been successfully implemented in education, offering benefits such as enhancing critical thinking skills, self-regulation, motivation, and the ability to cater to large groups of students (Babichenko et al., 2019). DGBL can assist students in navigating through the vast amounts of information available in the knowledge economy (Van Laar et al., 2017). Scholars Bauman (2013) and Oermann (2015) advocate adopting DGBL and gamification in health science education to prepare graduates as knowledgeable workers and critical thinkers.

The implementation of DGBL in health science education works well because of the complexity and abstract nature of the material taught, which can cause challenges for students in understanding and retaining information. By providing an interactive and engaging learning experience, DGBL offers an effective approach for students to comprehend these complex concepts, resulting in a more enjoyable and memorable learning process.

While these methods have been applied in health science education, there is a dearth of research on their implementation in South African universities and, even more so, studies focusing on the health science educator's perspective. For effective implementation of DGBL and gamification in health science education, it is essential to establish the health science educator's awareness, understanding and experiences of DGBL and gamification. While many health science educators are highly trained in their professional fields and specialisations, few have any specific postgraduate training to be educators. A critical gap exists in the availability of tools to measure educators' awareness and experiences in implementing these innovative teaching strategies. A validated survey that could be used to understand health science educators' awareness and experiences of implementing DGBL or gamification in their teaching could not be found in the literature. This aligns with the research by Van Gaalen (2020), who conducted a literature review and found that only a limited number of studies have been identified in this area.

Van Gaalen's systematic review identified 5044 articles, of which only 38 met the inclusion criteria after full-text screening. After further discussion and consensus among the research team, three additional studies were included, bringing the total to 44 eligible studies. Most of these studies were conducted in the USA and Canada, primarily involving medical and nursing students.

This paucity of literature about the lecturer's perspectives indicates that DGBL and gamification are still emerging areas of interest and research within this discipline. Research in the field is predominantly student-focused, exploring how students experience and respond to DGBL and gamification (Bourgonjon et al., 2010; Desjardins et al., 2011; Khan et al., 2017). There is also

some emphasis on game design and its impact from the student's perspective. An example is a study by Bulut et al. (2022) that looked at the effect of the educational game design process on students' creativity.

The primary gap identified is the lack of empirical evidence from the lecturer's perspective. The current limited number of studies highlights the need for additional research to address this gap, which is critical for establishing best practices and documenting the associated benefits and challenge.

1.5 RESEARCH QUESTION

What is the extent to which health sciences educators are aware of and understand the use of DGBL and gamification, and how do they experience the integration of DGBL and gamification in their teaching practice?

1.6 PURPOSE OF THE STUDY

The purpose of the study is to gain an understanding of the potential of using DGBL and gamification as teaching tools within a 21st-century learning framework. It has the potential to support the maintenance and improvement of education standards in a health sciences education context that is challenged by massification, student diversity, and an ailing digital competence of health science educators. The integration with health science education programmes will be beneficial because of the complexity of the subject matter, and DGBL and gamification provide an engaging learning experience.

It is essential to establish the awareness, understanding and experience that health science educators have of DGBL and gamification, as understanding this can inform potential integration into health science programmes. This can guide decision-making in determining whether incorporating digital game-based learning can contribute positively to health science education in South Africa. This study seeks to deepen our understanding of the potential of DGBL and gamification in health sciences education. It aims to catalyse positive change by informing policy, curriculum and professional development initiatives that can ultimately enhance the quality of education in South Africa's health sciences sector.

1.7 AIM OF THE STUDY

To establish health science educators' awareness, understanding and experiences of digital game-based learning and gamification.

1.8 STUDY OBJECTIVES

Objective 1: To determine what is known about the use and measures of DGBL and gamification through a scoping review with a view to generate and validate educator survey items. This formed part of phase 1 of the study.

Objective 2: To investigate health science educators' awareness and understanding of DGBL and gamification using a validated educator survey. This formed part of phase 1 of the study.

Objective 3: To explore health science educators' experiences of DGBL and gamification in their teaching practices and their perspectives on the opportunities and barriers of integrating DGBL and gamification into their teaching. This formed part of phase 2 of the study.

1.9 Study variables

Independent Variables

1. Demographic Variables: The characteristics of the study participants that may influence their responses.
2. Institutional Variables: Characteristics related to the institutions where participants work.

Dependent Variables

The variables listed are dependent variables because they are influenced by other factors or interventions, for example as exposure to specific training, or information about DGBL and gamification.

1. Awareness of DGBL and gamification: the extent to which participants are familiar with the concepts and terminology of DGBL and gamification.
2. Understanding of DGBL and gamification: the depth of participants' knowledge regarding how DGBL and gamification work, their purposes, and their benefits.
3. Experiences with DGBL and gamification: practical experiences and interactions with DGBL and gamification.
4. Perceptions of DGBL and gamification: Participants' attitudes, beliefs, and opinions about DGBL and gamification.
5. Adoption and integration of DGBL and gamification: the extent to which participants have used DGBL and gamification in their professional practice or learning environments.

1.10 JUSTIFICATION

An instrument to survey the implementation of DGBL and gamification that would contribute to the implementation of DGBL in health sciences could not be found. This study developed an instrument to identify gaps and strengths in the current application. Thus, the future execution of DGBL and gamification can be better planned following the outcome of the findings. The findings can contribute to developing evidence-based guidelines and recommendations for incorporating these methodologies into health science education programmes in South Africa.

1.11 STRUCTURE OF THE DISSERTATION

The dissertation comprises seven chapters:

Chapter 1 introduces the study by providing a brief overview of the study's background, details of the problem, the purpose, aim, objectives, and justification for the research.

Chapter 2 describes the methods used for both study phases, including the research design, sampling strategy, data collection, data analysis methods, and ethical considerations.

Chapter 3 presents a scoping review of the existing literature for a comprehensive analysis of previous research studies on DGBL and gamification in health sciences education. Part of the process was to glean the literature for the question items.

Chapter 4 presents the results of the expert content validity study towards developing the survey instrument. The expert content validity study involved a panel of experts providing their opinions on using DGBL and gamification in health science education. The results of survey data collected from health science educators regarding their awareness, understanding, and experiences of DGBL and gamification are presented.

Chapter 5 presents the quantitative data collected through the educator survey of health science educators regarding their experiences of implementing DGBL and gamification in their teaching.

Chapter 6 presents the qualitative data collected from semi-structured interviews with health sciences educators regarding their experiences implementing DGBL and gamification in their teaching.

Finally, Chapter 7 provides a summary of the main findings, a discussion of the implications and results, and a set of conclusions drawn. Recommendations are proposed for education practice and future research in this area.

1.12 CONCLUSION

In the context of using DGBL and gamification for teaching health sciences, a key aspect is that educators should adapt their teaching to overcome challenges related to the changing world in which we live. This means using new technologies and digital games to help students learn skills they need for the 21st century, for example, finding and using information in diverse learning situations. Chapter 1 provided an overview of the research background, highlighting the growing recognition of the benefits of DGBL in health science education. The need for more research on implementing DGBL in health science education in South Africa, specifically from the perspective of health science educators, was highlighted.

CHAPTER 2:
RESEARCH METHODS

2.1 INTRODUCTION

This study investigated how health science educators perceive digital game-based learning (DGBL) and gamification, emphasizing the significance of using mixed methods research to gain a deeper understanding of these phenomena (Creswell, 2018; Johnson & Onwuegbuzie, 2004). The study consisted of two phases: In Phase 1, a scoping review was conducted to establish the state of DGBL and gamification in health science education and to generate items for educator survey development and validation. In Phase 2, sequential mixed methods (quantitative-qualitative) were implemented to survey the health sciences educator population and then use the survey results, sequentially, to conduct semi-structured interviews.

This chapter presents a detailed explanation of the research methods, including the research plan and procedures used to answer the research questions. The sampling strategies used to select the participants in the study are explained, including the criteria used to identify eligible participants and the methods used to recruit them.

2.2 STUDY DESIGN

A mixed methods study using an explanatory, sequential design (Bowen et al., 2017; Braun & Clarke, 2021) was conducted to investigate and explore perspectives of DGBL and gamification among health science educators in South Africa.

Mixed methods research involves using qualitative and quantitative methods to understand a topic or phenomenon better than any individual approach could offer on its own (Harper, 2019). An important benefit of this approach is that it can overcome the limitations of using only one research method, thus enhancing the credibility and validity of the research findings. Using multiple data sources and analysis methods, the researcher strengthened the credibility of the findings using data triangulation. Phase 1 involved the scoping review and the instrument validation while phase two focused on the educator survey and interviews. After phase 1 and as part of phase two all the data were integrated. The study phases are illustrated in Figure 2.1.

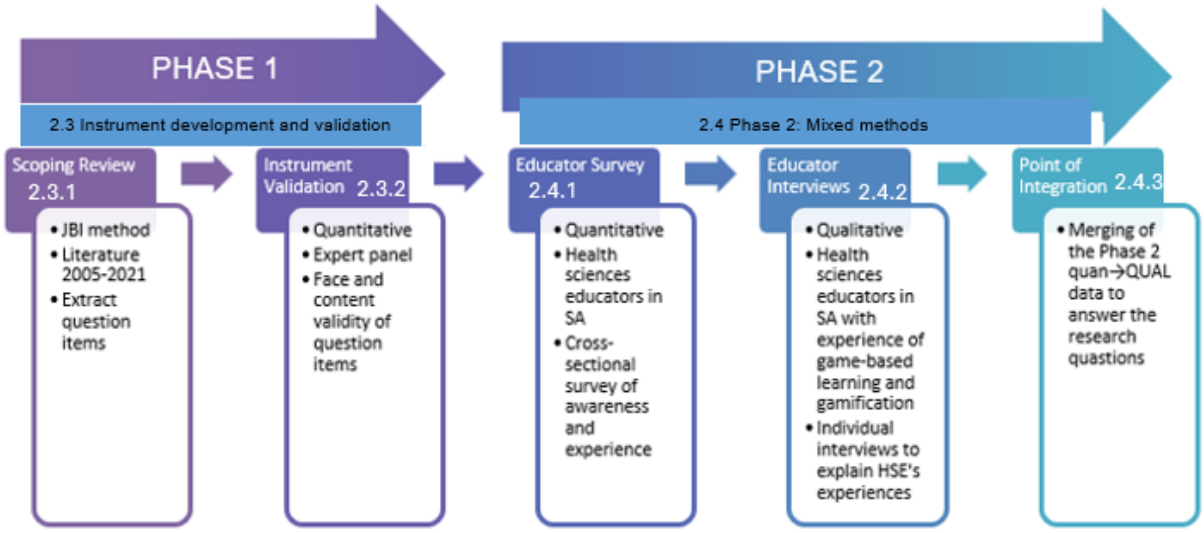

Figure 2.1: Phases of the study.

2.3 PHASE 1: INSTRUMENT DEVELOPMENT AND VALIDATION

Considering the absence of an instrument to investigate perspectives of DGBL and gamification, and in line with the first study objective, phase 1 involved a scoping review and the development and validation of a survey instrument using expert content validity survey.

2.3.1 Scoping review

A scoping review was conducted to generate and formulate items for the DGBL and gamification educator survey instrument. The review question was: “What is known about the implementation of DGBL and gamification in health science education?” The scoping review was conducted following a structured five-step framework developed by Arksey and O'Malley (2005) and refined by the Joanna Briggs Institute in 2015. Step 1: the research question is identified. Step 2: relevant studies are identified. Step 3: study selection. Step 4: charting and collating the data, summarising and reporting the results in Step 5. Line-by-line coding of primary studies was done. Descriptive themes were constructed, and the themes were analysed using thematic analysis. Themes and patterns were organised into descriptive themes. The detailed method is described in 3.2.

2.3.2 Expert content validation of instrument

Considering the absence of an instrument to investigate the awareness, understanding, and experience of health science educators regarding DGBL in health sciences education, an instrument was developed that contributed to objective 1 of the study. The expert content

validity survey was selected because it enables validation by a specific number of experts (Ghahramanian et al., 2015). The validation process aimed to ensure the quality and relevance of the educator survey instrument by gathering expert evaluation according to the following criteria: relevance, quality and clarity. Experts were asked to consider alignment of the questions with research objectives in their responses. Experts rated survey items on a visual analogue scale (VAS) from 0 to 100. The Median value (M) indicated the experts rating of the relevance, quality and clarity of the survey items. The Interquartile Range (IQR) indicates the degree of consensus with a low value indicating strong consensus while a high value indicates dispersion of the experts' opinion. The descriptive consideration of the number of experts (as a percentage) who rated the survey items at 60 or above on the VAS and comments from the experts were also instrumental in determining inclusion and exclusion of survey items.

Where survey items had a M ≥80, with an IQR ≤30 and where ≥75% of the experts rated the survey item at 60 or above on the VAS, the item was considered to have met the criteria for inclusion in the educator survey. Where survey items had an M of 70-79, an IQR of 31-45 and 60%-74% of the experts rated the survey item at 60 or above on the VAS the item was considered for revision. Where items had an M <70, an IQR >45 or less than 60% of the experts rated the item above 60 on the VAS the item were considered for exclusion.

2.3.3 Developing instrument items

The result of the scoping review yielded no surveys of educators' perspectives. Thus, instrument development started with a broader literature search for surveys on educators' experience and perspective of DGBL and gamification. Five articles were found, and the question items gleaned are presented in Chapter 3.

Key concepts and variables relevant to the objectives of the tool were identified from the literature search. Each question was crafted to address a specific aspect of the construct being measured, ensuring clarity and relevance. Additionally, language and tone were set to ensure the questions were understandable and suitable for the target audience.

The initial question bank was sourced by a literature search. Databases such as, but not limited to, Science Direct, EBSCO host, LearnTechLib, and Google Scholar were used to find full-text articles that included surveys related to DGBL. The search terms used included DGBL, gamification, Higher Education, health sciences education and survey. The studies were conducted from January 2005 to March 2020. All articles that contained information relevant to the topic in the results or body of the article were included. Survey questions collected formed the basis of categorisation into the following broad themes:

- Health science educator use of technology in teaching.
- Health science educator awareness of DGBL and gamification.

- Health science educator understanding of DGBL and gamification.
- Health science educator implementation of DGBL and gamification.

2.3.4 Expert content validity panel for the instrument items

The proposed list of instrument items was presented to five health sciences educators (four from the researcher's home institution and one from another local health sciences faculty) to establish face validity. They were asked to consider each item and evaluate its quality in terms of clarity, use of understandable language and relevance. They were further asked to comment on the overall structure and flow of the items and thus enhance the survey's validity by identifying and correcting any issues with the survey design (Ghahramanian et al., 2015)

2.3.5 Expert panel selection

Potential panellists were invited to participate in the expert content validity survey study. The survey study was intended to establish the quality of the questions and the data that would be collected. Purposeful sampling was first used to send direct invitations to potential panellists through personal contacts, LinkedIn, The Playful Learning Alliance and the North American Simulation and Gaming Association. Afterwards, snowball sampling was used, and interested panellists were asked to recommend other potential panellists.

Inclusion Criteria:

- Experts in DGBL, someone holding a PhD in Education Technology or a Health Science educator currently lecturing in a health science education degree programme.

Exclusion Criteria:

- Refusal of consent to take part in the study.
- A possible conflict of interest.
- Someone unable to commit their time to the study.

2.3.6 Instrument distribution and data collection

An electronic expert content validity survey was used to gain expert consensus on the instrument items to be included as questions in the educator survey and to establish the content validity of the final instrument. The potential participants had to give electronic consent via a consent form (Appendix C). The categorised items were presented to the experts via an electronic survey using REDCap (Harris et al., 2009). REDCap is a secure web platform designed to build and manage online databases and surveys, particularly for research purposes.

The expert panel for the content validity survey was asked to consider each instrument item as follows:

a) Answer the question of the instrument item as if they were a participant in the final survey to experience the question as a survey participant.

b) Rate the instrument item on a visual analogue scale (do not agree – neither agree nor disagree – agree) that the question item should be included in the final instrument considering relevance, quality and clarity.

c) Comment on the instrument item.

The expert panel were also offered the opportunity to add questions to each section of instrument items to be considered. This took place from September 2020 to October 2020. Table 2.3 presents the data collection chronology.

Table 2.1: Data collection chronology

Action	Start date	End date
Survey issued	21 September 2020	23 October 2020
Data analysed	24 October 2020	2 November 2020

2.3.7 Expert content validity survey data analysis

The results were descriptively analysed to remove less relevant, poor-quality questions and to refine and improve the remaining questions.

Collected responses were inspected using results descriptive analysis. This inspection aimed to discern questions of lower quality or limited relevance to the research objectives, such as ambiguity or misalignment with the study's focus. Once the poor quality and less relevant questions were identified, the researcher started a process of refinement and improvement. This step involved revising the remaining questions to make them more effective.

The qualitative data from the visual analogue scales of the validity survey technique yielded ratings on a 0 to 100 scale where 0 was “do not agree” that the instrument item should be included in the final instrument and 100 was considered “agree”. The ratings for each instrument item were descriptively analysed for median (M), inter-quartile range (IQR) and the percentage of experts who rated the instrument item at or above a score of 60 (i.e. respond on the “agree” side of the visual analogue scale by ten or more from the midpoint of 50) to determine consensus.

The final version of the Educator Survey is in Appendix D.

2.4 PHASE 2: MIXED METHODS

This phase used a mixed method quantitative-qualitative (quan-QUAL) to address objectives 2 and 3 of the study. The method was chosen to enable a more comprehensive understanding of the research question by combining qualitative and quantitative data (Creswell, 2018). Quantitative data gives statistical insights, while qualitative data provides rich descriptions. When more than one method is used, triangulation strengthens the overall validity and reliability of the study (Johnson & Onwuegbuzie, 2004). When quantitative and qualitative data are integrated, they overcome the limits of each method when used individually.

2.4.1 Educator survey

The educator survey was conducted among health science educators. The method is explained below.

Population and sample

The target population consisted of health sciences educators in South Africa, approximately 500 people. The sample was selected based on the following:

Inclusion Criteria:

- Participants who indicated they were registered for a health science education course/degree or working as a health science educator in South Africa.

Exclusion Criteria:

- A refusal of consent to take part in the study.
- A possible conflict of interest.
- A potential participant unable to commit time to the study.

Sampling technique

The electronic survey was sent to 120 Health Science educators (non-probability, voluntary response sampling).

Initially, invitations were sent to health science educators based at higher education institutions and colleges in South Africa and known to the researcher. As part of the request to complete the survey, the researcher also requested that a link be sent to other health science educators meeting the survey criteria. The snowball sampling technique was thus used to select participants who met the inclusion criteria. Snowball sampling asks initial participants to refer additional participants who meet the inclusion criteria (Naderifar et al., 2017).

Informed consent

An electronic form (Appendix E) was used to obtain consent from all participants before they gained access to the survey. The form detailed the purpose of the study, their rights as participants, the voluntary nature of participation, and the confidentiality of their responses.

Data management and analysis

Anonymised data were collected and stored via REDCap (Harris et al., 2009).

Descriptive survey data were inspected to find incomplete sets. The questionnaire was not included if a survey response missed more than 10% of the information. The data were anonymised in preparation for analysis. Excel was used to analyse the quantitative data using descriptive statistics such as frequencies, means, modes and standard deviations to interpret trends and patterns. Descriptive statistics are used to summarise and understand the basic characteristics of a dataset, helping researchers identify trends and patterns within their data.

In concluding the quantitative strand, the researcher drafted the interview guide by first identifying key themes that emerged from the descriptive statistics and required further exploration.

2.4.2 Educator interviews

An interview schedule was developed for the semi-structured interviews from the outcome of the educator survey. The aim was to compile a series of relevant, open-ended questions relating to the key topics, including perspectives of DGBL, gamification effectiveness, implementation strategies and challenges and integration of game-based learning into the curriculum. The interview schedule included probing questions and aligned with the study objectives.

Population and sample

The population consisted of health science educators who participated in the educator survey and indicated experience with DGBL and gamification. Purposive sampling was used to select participants. Ten participants were selected based on their willingness to participate and experience with DGBL and gamification. Nine participants agreed to take part in the interview thus the interview sample included nine health science educators (n=9).

Inclusion Criteria

- Health science educators with experience in DGBL and gamification.
- A willingness to participate in the study.

Exclusion Criteria

- Educators who, at the time of the study, had not actively taught health science education in the past six months or more.

Informed Consent

Informed consent was obtained electronically from all participants (Appendix F). They were informed about the nature of the study, their voluntary participation, confidentiality of their responses, and their right to withdraw at any time.

Data collection and data management

Semi-structured one-on-one interviews were conducted to investigate experiences with DGBL and gamification, aligning with objective three of the study. The interviews were held online via Microsoft Teams, ensuring participant privacy and confidentiality as participants could conduct the interviews in a space where they felt comfortable. The interviewer and interviewee agreed on the interview time and date. Before the interviews, participants were assured of the confidentiality of their responses and encouraged to express their views openly. The interviews followed an interview guide, lasted for a maximum of one hour, and were digitally recorded and transcribed for analysis. The interviews were transcribed *verbatim* by an external transcriber who signed a confidentiality agreement. The researcher verified the transcriptions by listening to the recording while reading the transcription and made the necessary corrections. Transcriptions were securely stored in separate locations to maintain confidentiality and data integrity.

Data Analysis

The transcriptions were imported into the MAXQDA (VERBI, 2019) software package for analysis. MAXQDA uses validity encoding features, including intercoder agreement analysis and visual analysis tools, to interpret the qualitative findings.

Thematic data analysis was employed, following the approach outlined by Braun and Clarke (2021) and Vaismoradi et al. (2013). Significant statements from transcripts were coded. The codes were clustered into themes that reflect the experiences of the health science educators with DGBL. The themes were interpreted for meaning, integrating qualitative findings with quantitative results from previous study phases.

Below is a detailed overview of the qualitative analysis.:

1. Interviews were transcribed and imported into MAXQDA.

2. The researcher read through the transcriptions several times to become familiar with the data. Initial notes about general impressions and insights from the data were made.

3. The researcher conducted an open coding process, meaning they identified significant statements or chunks of text that reflected meaningful experiences or perspectives of the health science educators with DGBL. These statements were assigned preliminary codes.

4. After the initial coding the codes were reviewed and grouped together. After this the codes were put into categories.

5. After this the themes were developed but clustering categories together into themes.

6. The themes are read in relation to the research question, focusing on understanding the meaning behind the educators' experiences. The results are integrated with the quantitative results for better understanding. To ensure validity intercoder agreement was assessed.

7. Once all the themes were refined, the final analysis was written up.

2.4.3 Integration of Quantitative and Qualitative data

Quantitative and qualitative data was integrated to form a better understanding of the research findings by combining numerical insights with context. Quantitative data was first collected through questionnaires and statistical analysis to identify trends and patterns. Then interviews were conducted with open-ended responses to contextualize these findings to better explain the numbers. By triangulating both data types both statistical significance and human perspectives were captured.

2.5 DELIMITATIONS OF THE STUDY

The scope of this study is delimited to the experiences of health science educators in the Republic of South Africa. It does not cover the implementation of DGBL and gamification beyond the realm of health science education.

2.6 ETHICAL CONSIDERATIONS

Ethical clearance was received from the University of the Witwatersrand Human Research Ethics Committee (Medical). The clearance number is M191152 (Appendix A).

Informed consent: Participants were given information about the study via the introduction email, which requested participation. Participants consented to participate via an electronic

form and were free to withdraw at any time without consequence. There was no risk of harm to the participant as the interview topic was not emotionally charged or sensitive.

Confidentiality was maintained by removing personal identifiers from all documents and replacing them with a participant code. The participant-to-code list was kept separately from the research documentation.

Data management: All personal identifiers were removed and replaced with participant codes to ensure anonymity. The participant list linking the participants to their codes was kept apart. Data were stored securely on OneDrive, and access was password restricted. The data will be stored for three years.

2.7 CONCLUSION

Chapter 2 provided an overview of the research methods used in this study. The mixed methods approach allowed a comprehensive understanding of the methods employed in this study, which used quantitative and qualitative methods. The significance of a mixed methods design in achieving a holistic understanding of the research topic was highlighted, emphasising its potential to overcome the limitations of using a single research method and enhance the credibility and validity of findings through data triangulation. The expert content validity survey, employed in developing the survey instrument contributed to its content validity by involving expert participation, ensuring the questions were both relevant and clear. The chapter also outlined the data analysis procedures for both quantitative and qualitative phases,

After the expert content validity survey, the following data collection and analysis phases progressed from quantitative surveys to qualitative interviews. Integrating findings from both strands allowed for a good exploration of educators' perspectives, enriching the understanding of DGBL and gamification in health science education.

Emerging themes were identified and synthesised with quantitative results using a thematic analysis of interview data, offering a holistic perspective on the phenomenon under investigation. This integrative approach illuminated not only the prevalence and awareness of game-based learning but also the underlying perspectives and experiences of educators in the South African context.

Chapter 3 explores the existing literature through a scoping review of DGBL and gamification. The specific focus will be on their use in health science education and instrument development.

CHAPTER 3:
SCOPING REVIEW

3.1 BACKGROUND

This scoping review is an important first step in the research, especially because a lack of consensus and established knowledge characterises this research field. The scoping review focused on digital game-based learning (DGBL) and gamification within health science education in this study. A scoping review requires an exploration of the existing literature to find out what is available in the realm of DGBL and gamification within health science education. This foundation allows the researchers to identify prevalent themes, emerging trends, and areas where consensus remains elusive, laying the groundwork for the forthcoming expert content validity survey.

DGBL and gamification are powerful tools for facilitating student engagement in learning (Arruzza and Chau, 2021). DGBL involves the application of educational games purposefully designed to transform the pedagogical approach in a classroom, with student participation and engagement central to the learning process. It constitutes an essential and integrated component of the curriculum because, through the integration of DGBL, educational experiences become more interactive, enjoyable, and effective, fostering deeper understanding and long-lasting knowledge acquisition (Gee, 2003; Hassan et al., 2019; Lenz et al., 2018). According to Babichenko et al. (2019), Boskic et al. (2015), Felszeghy et al. (2019), and Hamari et al. (2015), gamification is a technique that involves the development of a reward system and the incorporation of competitive elements into the learning process, which motivates students to learn. Unlike DGBL, which integrates games into the learning process, gamification is an add-on to the learning process (Al-Azawi et al., 2016). DGBL and gamification involve collaboration, engagement, competition, and immediate reward as essential elements (Auman, 2011; Boskic and Hu, 2015).

Even though DGBL and gamification have been used in higher education and health science education for several years, only a few studies have been published, mostly limited to offline games and simulations. Therefore, a scoping review was conducted in alignment with objective 1 of this study. Mapping evidence was the primary aim of the scoping review, and secondarily the aim was to identify an existing instrument and to find specific questions that could aid in the development of such an instrument if needed.

3.2 SCOPING REVIEW METHOD

This scoping review was conducted following a structured five-step framework developed by Arksey and O'Malley in 2005 and refined by the Joanna Briggs Institute in 2015 (Peters et al., 2015).

These steps involve the following:

- Step 1: identifying the research question,
- Step 2: identifying relevant studies,
- Step 3: study selection,
- Step 4: charting and collating the data,
- Step 5: summarising and reporting the results

Scoping reviews aim to provide a comprehensive overview of the literature, distinguishing them from systematic reviews, which focus on in-depth analysis of individual studies. The choice of framework, such as the Arksey and O'Malley method, is essential for its established credibility, systematic approach, clarity, consistency, and efficiency, enhancing research quality, transparency, and communication within the scientific community. The Joanna Briggs Institute (JBI) checklists were used, and the PRISMA checklist was incorporated for reporting.

3.2.1 Step 1: Identifying the research question

As a health science educator interested in DGBL and gamification, the question arose about how DGBL and gamification are implemented in health science education globally and in South Africa.

The overarching question guiding this review was: “What is known about the implementation of DGBL and gamification in health science education globally?” The specific sub-questions included:

I. How are DGBL and gamification perceived in health science education?

II. How are DGBL and gamification implemented in different areas of Health Science Education?

III. What questions should be asked of health sciences educators to gauge their awareness, understanding and experience of DGBL and gamification? Are there surveys that can be used to explore health science educators' experiences of DGBL and gamification?

The search aimed to identify both global and local literature on the implementation of DGBL and gamification in health science education.

3.2.2 Step 2: Identifying relevant studies

The researcher and a health sciences librarian developed a search strategy with keywords. Systematic searches were conducted in databases to locate published studies. As part of the search strategy, all study designs were considered, including qualitative, quantitative, and mixed methods. A systematic search was conducted with the support of two professional librarians according to keywords and delimiter Boolean structures (Tricco et al., 2016). The keywords used included 'game-based learning and gamification', 'DGBL and gamification' and 'health science education'. See Table 3.1 for an explanation of the keywords and inclusion criteria. Databases searched included Scopus, PubMed, Web of Science, and Eric. Articles with the keywords in the title or abstract were included. Articles that did not focus on DGBL and gamification were excluded. Several articles that focused on simulation but included DGBL were found but excluded.

The searches were limited to full-text articles and conference proceedings published between 2005 and 2021. This limitation was to ensure that only the latest articles were sourced to consider technological advancement. In addition to being obtained through the various databases, articles were selected based on manual searches of references in critical articles.

Table 3.1: Keywords used in the search.

Settings for Database	Boolean search words	Period	Inclusion criteria
Advanced search	DGBL in Health Science Education	2005- August 2022	Full-text articles English language Focus on Health Science Education
	Gamification learning in Health Science Education		
Title and abstract	Game-based learning and gamification		

3.2.3 Step 3: Study selection

Specific criteria were used to determine which articles should be included. The criteria ensured relevance to the research focus and maintained a level of quality and specificity in the selected studies.

The inclusion criteria were that the relevant keywords must be in the title or abstract. Specific keywords, such as DGBL and gamification, game-based learning and gamification, and health science education, had to be in the title or abstract. This criterion helped to ensure that the selected studies were directly related to the topics of interest. The articles also had to focus primarily on DGBL and gamification. Only full-text articles were included to ensure that the

researcher had access to the complete content of the study. Studies not published in English were excluded for practical reasons.

Articles that did not primarily focus on DGBL or gamification were excluded. Articles focused on simulation were also excluded to indicate a clear distinction between DGBL and gamification and simulation.

The articles found were uploaded to Mendeley, and all duplicates were removed. The review focused on empirical research in DGBL and gamification and excluded editorials and letters selecting original research over opinion-based content. All the article titles and abstracts were screened to select the articles relevant to the study according to the inclusion criteria. This ensured consistency with the review's objectives and showed interest in securing evidence-based findings. Irrelevant articles were excluded, thus streamlining the selection process. Full texts of the selected articles were obtained after the initial screening. If a full-text article was not available, the article was excluded. The full-text articles were reviewed to ensure the context aligned with the research objectives. During this phase, manual searches of references were done to identify relevant studies. This process is known as snowballing and helps ensure an overall literature review. A systematic record of articles included and excluded in each phase of the screening process was kept. This documentation enables reproducibility. The final number of reviewed articles was determined by those that successfully met all the established criteria during the systematic screening process.

3.2.4 Step 4: Charting and collating the data

A data extraction form was developed to summarise the articles systematically (JBI, 2015) based on the research questions. The form was used to analyse and extract critical information from all the literature found and to ensure consistency and standardisation in data collection. This method helps capture relevant details such as the authors, year of publication, research methods, key findings, and other pertinent information, facilitating a coherent presentation and interpretation of the results in the subsequent stages of the scoping review. Additionally, it focused on extracting critical details about the study's research methods (e.g., qualitative, quantitative, mixed methods), sample size, population characteristics, and settings.

This method not only provided a structured way to handle a large volume of literature but also facilitated comparison between studies. By ensuring that the same types of information were extracted from each article, the data extraction form contributed to a more coherent synthesis and interpretation of the findings during the scoping review process. This approach ultimately aided in identifying research gaps, trends, and patterns across the body of literature, thus enhancing the quality and transparency of the review.

3.2.5 Step 5: Summarising and reporting

Line-by-line coding of primary studies was done to break down the raw data into manageable units for analysis. Each line of text from the studies was closely examined, and codes were applied to capture specific ideas, concepts, or patterns that emerged. Codes served as labels that represented core elements of the text, highlighting key aspects such as participant perspectives and methodologies. Descriptive themes were constructed, and the themes were analysed using thematic analysis. Themes and patterns were organised into descriptive themes. Descriptive themes act as overarching categories that summarize and synthesize the data in a way that reflects its broader meaning. Qualitative content analysis involves reading the data to immerse yourself and then capturing critical thoughts and concepts to create codes. The data and concepts are then grouped into categories. Categories are broader groupings that organize similar codes, often reflecting the relationships between different concepts.

3.3 SCOPING REVIEW FINDINGS

The researcher extracted the data and included specific details about the articles, concept, context, study methods, and critical findings relevant to the review question. The data extraction form can be found in Appendix G.

The identified full-text publications were collated and uploaded to MAXQDA (VERBI, 2019). The descriptive themes were analysed, looking for patterns and relationships. Table 3.2 summarises the characteristics of the studies included.

The search yielded 123 potentially relevant articles and records; 82 remained after removing duplicates. The abstracts and titles of the remaining 82 articles were screened (Razavi et al., 2018), and 65 were excluded because they did not contain information about DGBL and gamification in health science education. Nine articles were eliminated because they were not full text, and six were added from the bibliography of the screened articles. A total of 13 articles were analysed using MAXQDA (VERBI, 2019). Titles and abstracts were then screened; articles not in English or those for which the full text was unavailable were excluded. The full text of selected citations was assessed in detail against the inclusion criteria. The scoping review recorded and reported reasons for excluding sources of evidence in full-text articles that do not meet the inclusion criteria. The reasons included were not focused on health science education, DGBL and gamification and not published in English.

Table 3.2: Summaries of main findings per article.

Author and year of publication	Country	Nature of study/ study design	Field	Study population and sample size	Main findings
Abdulmajed et al., 2015.	South Korea and USA	Systematic review	Health Professions	Five papers were included for systematic review (Abdulmajed et al., 2015)	There is an increasing trend of health science educators using games in health professions education, positively impacting the teaching and learning process. Specifically designed educational games are more effective than adaptations from commercial games. Games can offer a setting for formative assessment. There is a need for assessment tools that fully capture learning in games. More research in the field of game-based learning and gamification in health professions education is needed.
Arruzza and Chau, 2021.	Australia	Scoping review	Health Sciences	Undergraduate students Eleven randomised controlled trials were included in this study. (Arruzza and Chau, 2021)	**Gamification** can potentially enhance learning outcomes and increase student motivation, especially in health science education. In this article, games are recognised as effective tools for education. Educators are asked to supplement traditional teaching methods with gamified learning, not replace them entirely. Additional research is recommended to explore further the benefits and implications of gamified learning in education.
Barnard-Ashton et al., 2018.	South Africa	Case study (Empirical study)	Occupational Therapy and Physiotherapy	250 undergraduate (first-year) students (Barnard-Ashton et al., 2018)	WebQuests effectively facilitate the exploration and learning of online resources and virtual learning environments. The use of WebQuests can contribute to students becoming more self-directed and independent learners. Further research is needed to determine the best ways of implementing WebQuests in higher education.
Bayram and Caliskan, 2019	Turkey	Randomised trial	Nursing	118 randomised trials (Bayram and Caliskan, 2019a)	The game-based VR phone application positively influenced nursing students' knowledge and skills in tracheostomy care. The study found that the game is effective in the short term, with notable improvements in scores related to suctioning a tracheostomy tube and peristomal skin care. Integrating similar applications into psychomotor skill training in nursing education is recommended.

Foss et al., 2014	Norway	Randomised Controlled Trials	Nursing	First-year nursing students at a university college in Norway; Sample size: 113 students. (Foss et al., 2014)	The findings were that the online computer game, named the medication game, did not significantly improve students' marks, but it did enhance collaboration among students. The game aimed to provide simple mathematical and medical calculation drills. Improvement in calculation skills was observed. It is suggested that DGBL can be effective in improving nursing education.
Gentry et al., 2019a	United Kingdom	Systematic Review	Health Professions Education	The review included all articles on serious gaming and gamification in health professions education. It covered 27 randomized controlled trials (RCTs) and three cluster RCTs.(Gentry et al., 2019b)	Serious gaming and gamification are as effective as, and sometimes even outperform, traditional methods in improving skills, knowledge, and satisfaction. However, the evidence is not robust, indicating the need for further research.
Shaikh et al., 2021	South Africa	Case Study	Pharmacy	First-year pharmacy students (Shaikh et al., 2021)	Minecraft Education Edition was incorporated into the pharmacy curriculum. Specific content was explained by using the game. Students found the activity enjoyable, and the feedback was positive about game-based learning. This serves as a reason for further engagement with game-based learning.
Tan et al., 2017	Singapore	Randomised Controlled Trials	Nursing	Undergraduate students (103) (Tan et al., 2017)	A game was used to teach blood transfusion practice. Gaming technologies can potentially engage student learning and increase knowledge and confidence. The group that played the serious game exhibited significantly higher post-test scores than the control group. The authors suggest serious games are a valuable tool for enhancing nursing education in this area.
Titus and Ng'ambi, 2014	South Africa	Conference proceeding	Sports Science	Second-year students (88) studying for a sports science degree	This was a mixed methods study with a design-based enquiry focusing on a case study of sports curricula. Incorporating a game promoted collaborative knowledge-building, and the students provided feedback on the influence of introducing the game on the co-construction of knowledge.
Titus and Ng'ambi, 2019a	South Africa	Case study/ conceptual paper	Sport psychology	Not specified	Group dynamics, time, and academic challenges should be considered when developing games for use in health sciences. As the game level increases, student competency increases. Game-based learning creates adaptability in group dynamics in the educational setting.

Van Gaalen et al., 2021	Netherlands	Qualitative study and focus groups	Medicine	Undergraduate medical students (58)	It was found that medical students perceive play as an important component of their learning process. Serious games have the potential to enhance medical students' learning experiences. Technical difficulties were identified as a potential barrier to implementing serious games in medical education. An additional barrier originated from insufficient time and resources, presenting hurdles to seamlessly incorporating serious games. Clearly defined learning objectives and assessment criteria are essential for successfully integrating games into medical education.
Van Gaalen et al., 2020	Netherlands	Systematic Review	Health professions education	Forty four articles	This systematic review focused on the evidence for the effectiveness of gamification approaches. Forty-four articles out of 5044 initially identified were analysed, mainly from the USA and Canada and centred on medical students. Positive outcomes were consistently noted without negative effects, but the review identifies a lack of well-defined control groups and theoretical frameworks in existing research. Theoretical implications stress theory-driven gamification, while practical implications advise cautious experimentation and highlight the potential of gamification for improving learning outcomes. The findings suggest that it is possible to improve learning outcomes in health professions education through gamification. The review recommends further research in the field.
Volejnikova-Wenger et al., 2021	Australia	Interpretative phenomenology	Nursing	Eight undergraduate nursing students	Gamification was found to affect learning outcomes in health professions education positively. More research is needed to determine the overall effectiveness of gamification strategies in this field. Well-defined learning objectives are essential for successful gamification. Integration with the curriculum enhances the effectiveness of gamification.

The Prisma flow diagram illustrates the study selection process (Figure 3.1).

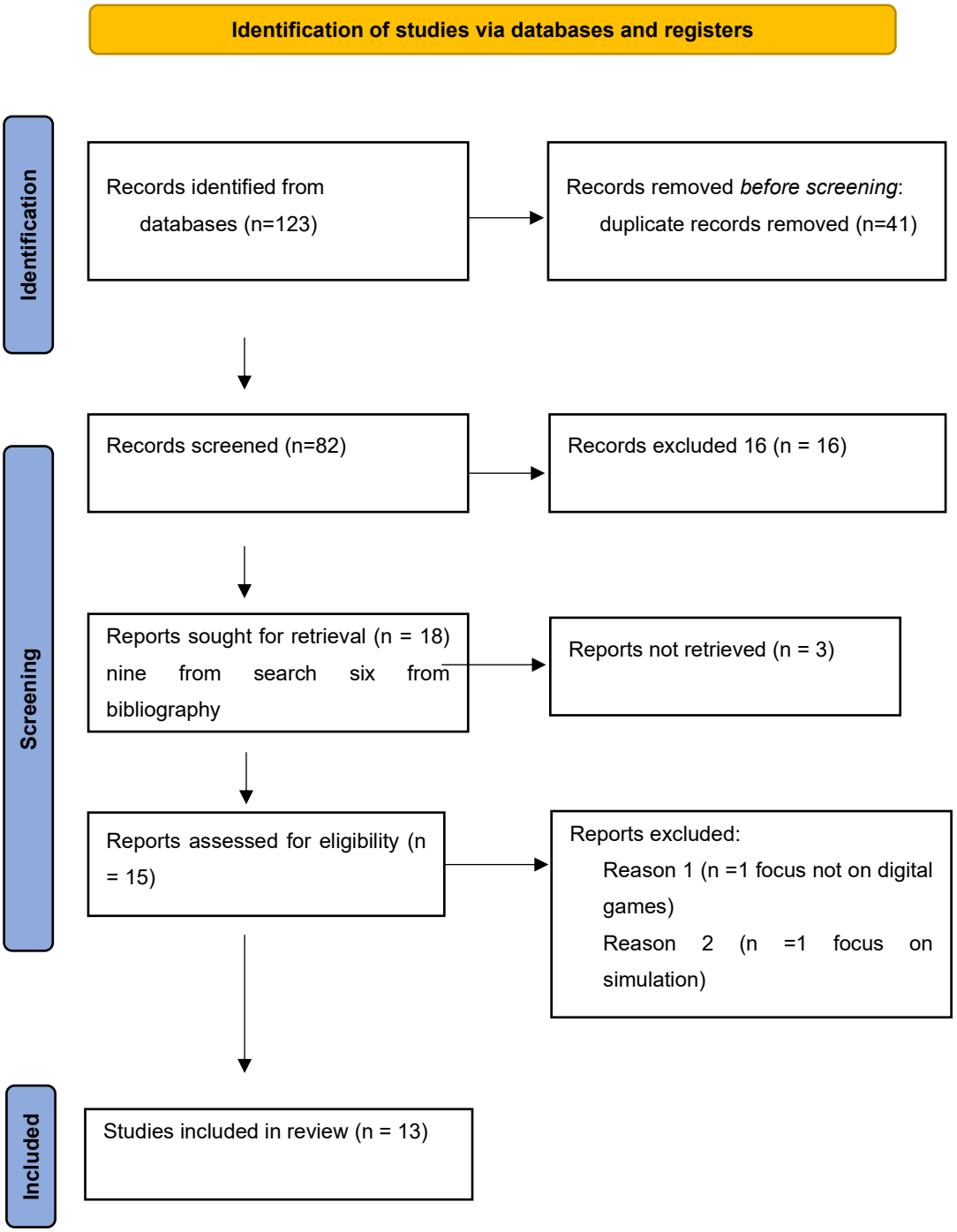

Figure 3.1: Prisma diagram to show identification of databases (Adapted from Rethlefsen et al., 2019.

Based on the analysis of publication year and country, it was found that no articles were published before 2014, as depicted in Figure 3.2. Most of the articles included in the analysis were published in South Africa, followed by Australia and the Netherlands.

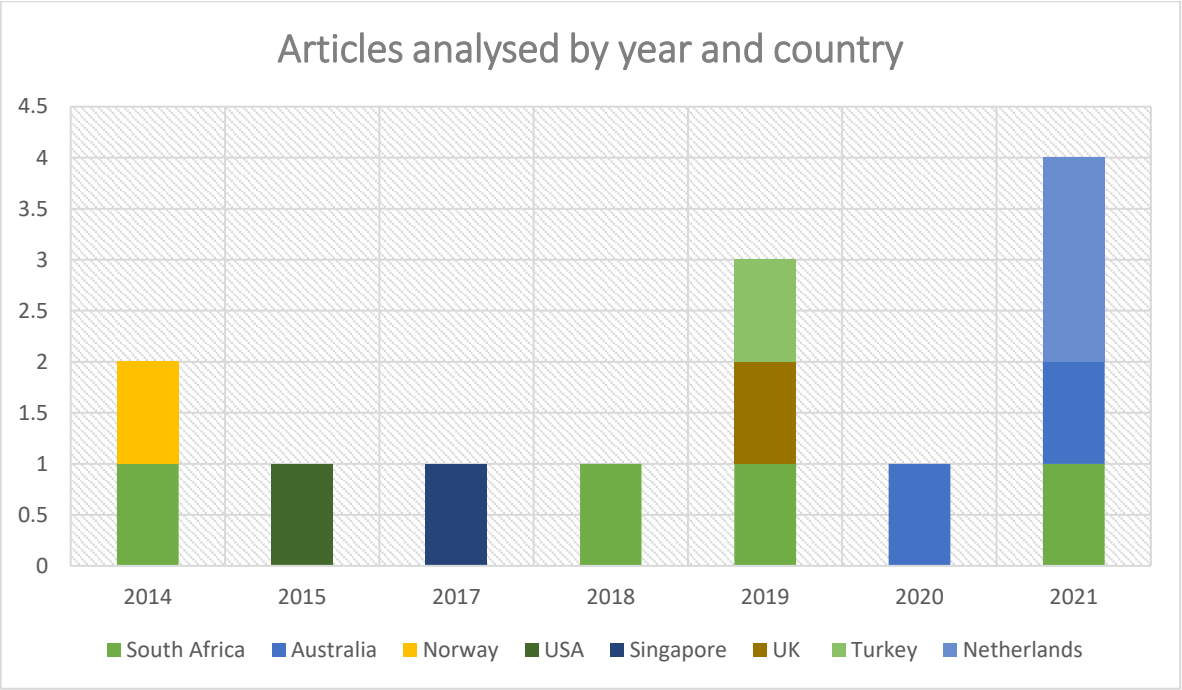

Figure 3.2: Articles analysed by year and country (n=13).

Of the 13 articles examined, four studies focused on nursing students as their population. One article was part of conference proceedings; three were randomised control studies. There were three systematic reviews, one scoping review, three case studies, one focus group, and one interpretive phenomenological study. All the studies were conducted at universities. The review findings are presented in four themes. The first theme revolved around the descriptions of DGBL and gamification, and the second focused on the value of DGBL and gamification. It was followed by exploring the implementation strategies that underlay these immersive pedagogical approaches, captured as Theme 3. Lastly, the focus was on examining students' experiences within these innovative teaching modalities, labelled Theme 4.

3.3.1 Theme 1: Descriptions of DGBL and gamification

All the articles described game-based learning; the most common interpretation of DGBL is that the lesson/learning material is changed completely to incorporate DGBL. The most common interpretation of gamification is that it introduces a reward system. Throughout the literature, the terminology is interchangeable.

3.3.2. Theme 2: Value of DGBL and gamification

Five articles elaborated on game design in health science education (Abdulmajed et al., 2015; Arruzza and Chau, 2021; Foss et al., 2014; Gentry et al., 2019b; van Gaalen et al., 2020). These articles suggest that DGBL and gamification positively impact teaching and learning and

can be used for formative assessment. Games that were specifically designed for educational purposes are more effective than games adapted from commercial games. There was value in DGBL and gamification, but it was noted that educators should supplement didactic teaching strategies with gamified learning rather than replace it. DGBL and gamification were shown to be effective, and learning outcomes improved. When compared to traditional education, increased knowledge and satisfaction levels were reported. Further research is needed to understand better the benefits and limitations of game-based learning and gamification.

Most of the studies highlight the positive impact of games on learning outcomes and motivation; others highlight the need for further research and caution in implementation. Arruzza et al. (2021) and Gentry et al. (2019) state that there is potential in game-based learning and gamification but also mention the importance of additional research and integrating DGBL into traditional teaching methods. On the other hand, Abdulmajed et al. (2015) found that incorporating games (gamification) into health professions education was both positive and effective.

The studies vary on the effectiveness of DGBL on skills development. Bayram et al. (2019) and Foss et al. (2014) found significant improvement in skills development but not student grades.

DGBL and gamification bring value to learning, but clear objectives are needed for overall success. Games should not be introduced for the sake of it - there should be a purpose.

3.3.3 Theme 3: Implementation of DGBL and gamification

Six articles explained how DGBL and gamification have been implemented in health science education (Barnard-Ashton et al., 2018; Bayram and Caliskan, 2019b; Foss et al., 2014; Shaikh et al., 2021; Titus and Ng'ambi, 2019a; Volejnikova-Wenger et al., 2021). These articles address the implementation of DGBL and gamification in undergraduate curricula of pharmacy, sports science, occupational therapy, physiotherapy, dentistry, and nursing students. Once again, the terms DGBL and gamification were used interchangeably and thus, DGBL and gamification are addressed as a unit in this section. GBL and gamification in education are often positively showcased, but actual long-term effectiveness is questionable and may depend on the students' motivations and system design (Hamari et al., 2014).

According to a study by Tan et al. (2017), gaming technologies have been identified as a promising tool to engage students in their learning and development. They can be a valuable alternative to traditional didactic approaches. A unique approach was introduced to teach blood transfusion practice to nursing students to move away from conventional methods. Tan et al. (2017) encouraged the researchers to develop the game further. Another example of using

gaming technologies in education can be seen in a case study presented by Shaik et al. (2021), where a game was incorporated into the third-year pharmacy curriculum. The game aimed to replicate an inspection carried out by a pharmacy inspector, requiring students to identify the mistakes made by the pharmacy. The students reported that the game was enjoyable. This study highlighted the effectiveness of gamification and, later, DGBL and the need for additional investigation in this educational approach.

DGBL and gamification encourage active participation and provide instant feedback (Foss et al., 2014). Bayram and Caliskan (2029) introduced a game-based VR game to nursing students. An increase in the final score of students in the control and the experimental groups was observed, and it was found that using the game-based VR phone application developed the knowledge and skills of these students. However, it cannot be stated that it improved student results.

DGBL and gamification were found to improve collaboration and enhance student construction of knowledge (Titus and Ng'ambi, 2014). Productivity in game-based learning is enhanced by randomising the assignment of students to groups to avoid cliques and to optimise group interaction (Titus and Ng'ambi, 2019). In another study, Barnard-Ashton et al. (2018) reported on introducing a WebQuest with gamification elements that allow undergraduate students to work at their own pace as part of an orientation session to the university's online environment. Implementation of game-based learning increased when there was a collaboration among students, controlled interaction patterns and various gaming technologies.

The studies reviewed provide insights into implementing DGBL and gamification across various disciplines within health science education. The versatility of these approaches in engaging students and offering alternatives to traditional didactic methods is illustrated. The examples of implementation, such as teaching blood transfusion practices to nursing students or simulating pharmacy inspection scenarios for pharmacy students, highlight the innovative potential of these methods. DGBL and gamification are recognised for promoting active learning and providing immediate feedback, potentially improving knowledge and skills. It is essential to note that additional research is needed to establish the definitive impact of these methods on student outcomes.

3.3.4 Theme 4: Student experiences

Only four studies (Barnard-Ashton et al., 2018; Tan et al., 2017; Van Gaalen et al., 2021; Volejnikova-Wenger et al., 2021) reported findings that pertain to the student's perspective. According to these studies, students enjoy the implementation of DGBL and gamification but could not confirm whether this way of learning assists them in achieving better results. In a local study that involved WebQuest, students were undecided about the enjoyment of the

activity because of technical difficulties and its time-consuming nature (Barnard-Ashton et al., 2018). Another factor seems to be a decline in the entertainment value of the learning exercise. In a study conducted by Van Gaalen et al. (2021), it was found that students' eagerness for play declined when the emphasis shifted from leisure activities to academic learning, along with the motivation linked to game-based learning, including both intrinsic and extrinsic factors. After playing the game and being assessed on the content, students demonstrated increased confidence in performing specific procedures such as blood transfusion (Tan et al., 2017). Volejnikova-Wenger et al. (2021) mentioned that students' prior knowledge plays a role in influencing their learning outcomes when using game-based learning. Knowledge is just one of several factors that influence learning outcomes; engaging in play also has the potential to enhance self-improvement, competence, and sociability.

3.4 DISCUSSION OF MAIN FINDINGS

Interest in game-based learning and gamification is increasing (Abdulmajed et al., 2015). This study focused on finding evidence of what is known in the existing body of knowledge about implementing game-based learning and gamification in health science education. It also determined gaps in the literature on this topic.

The value and the possibilities around game-based learning and gamification were discussed in all the articles analysed, but the effectiveness of its implementation was only explained in six articles (Barnard-Ashton et al., 2018; Bayram and Caliskan, 2019; Foss et al., 2014; Shaikh et al., 2021; Titus and Ng'ambi, 2019a; Volejnikova-Wenger et al., 2021). Most articles that formed part of the research identify the capacity of game-based learning and gamification to promote increased levels of collaboration among students, as well as their potential to enhance learning outcomes that suggest game-based learning can enhance engagement, motivation and achievement and improve problem-solving skills, critical thinking and creativity.

While literature suggests the potential benefits of game-based learning and gamification in education, further research is needed to determine their effectiveness in practice. In particular, more studies are needed to examine the impact of game-based learning and gamification, specifically DGBL and gamification, on health science students, as well as the perspective of health science educators on using these approaches.

This scoping review suggests the effectiveness of game-based learning and gamification in health science education. It supports the understanding that these methods offer meaningful benefits for teaching and learning, affirming the utility in engaging students and enhancing the educational experience. The metric of this study was the implementation of game-based learning and gamification, and the studies show that collaboration among students is increased

and thus implementation increases. It upholds the belief that game-based strategies foster enhanced collaboration among students, in keeping with the consensus that interactive and gamified educational activities encourage teamwork and engagement in academic contexts. The idea that game-based learning and gamification can improve learning outcomes is suggested, as demonstrated by heightened levels of knowledge acquisition and student satisfaction. This substantiates the commonly held view that these approaches can augment student achievement and motivation.

On the other hand, this study introduces distinctions that challenge the current understanding in this field. It stresses the vital need for further research to explain the benefits and limitations of game-based learning and gamification, thereby indicating that the existing comprehension of the implementation of game-based learning and gamification may have some limitations. It highlights a notable gap in the literature, particularly the scarcity of studies presenting the health science educators' perspective. By focusing predominantly on student experiences, the existing body of knowledge may inadequately address the multifaceted role of educators and the challenges they encounter when implementing these pedagogical methods. Additionally, the study reveals the variability in student experiences with game-based learning and gamification. While some students enjoy and engage with these methods, others encounter difficulties. This variability in student responses implies that the extant understanding may oversimplify the impact of these approaches on student engagement and satisfaction.

3.5 CONCLUSION

The scoping review points to a growing consensus that DGBL and gamification increase student engagement with learning content and that these are useful tools to supplement traditional ways of teaching. Games designed for educational purposes are effective, and gamification can enhance learning outcomes and student motivation. Gamification and game-based learning can be as effective, or even more effective, than traditional teaching methods.

As mentioned previously, authors and health science educators use the terms DGBL and gamification interchangeably, creating confusion as to what exactly it means. It is suggested that, as more research is done in the field, standardisation and formalisation will occur, clarifying the distinctions between these terms and establishing clearer definitions.

This research introduces challenges to the current understanding of game-based learning and gamification in health science education. While it confirms the positive impact, collaborative potential, and educational value, it simultaneously underscores the need for further comprehensive investigation. It highlights gaps in the current literature from the educator's perspective and the nuanced nature of student experiences.

Student experiences of game-based learning and gamification are better understood because of research in the field, but the same can be said for teacher experiences or perspectives. There appears to be a gap in the research about how health science educators perceive game-based learning and gamification in the classroom. Research exploring health science educators' perspectives is recommended to find out where educators are in their thought processes, perspectives and plans of implementation around DGBL and gamification and to determine if they see a need for implementing DGBL and gamification in health science education. This scoping review has played an important role in identifying the needs of game-based learning in health science education.

A valid instrument to determine how health science educators experience DGBL and gamification in their education practices could not be found in the literature searched for this scoping review. The search for this scoping review was limited to health sciences education and expanded to include literature from a wider field, as is explained in Chapter 4. questions for a survey were gleaned from this second search.

Chapter 4 outlines the survey development and validation.

CHAPTER 4:
SURVEY DEVELOPMENT AND VALIDATION

4.1 INTRODUCTION

Chapter 4 presents the survey development and validity (face and content) results and addresses the second part of Objective 1 of the study. The process to develop a validated survey instrument was discussed in Chapter 2. Establishing content validity involved carefully selecting experts who participated in one round of questions, evaluating them and providing written feedback.

4.2 GENERATING SURVEY ITEMS

The scoping review yielded no suitable content for developing survey questions or items. Another literature search was conducted with a broader search area to generate questions for the survey instrument. A set of questions was compiled from the literature review, which aimed to answer the research objectives. The literature provided the basis or content for generating the questions. Five articles were located, and the question items are presented in Table 4.1. The first instrument can be found in Appendix F.

Table 4.1: Question items gleaned for developing the educator survey instrument.

Lecturer awareness of digital game-based learning and gamification.		
Question found in literature	**Reference**	**Adapted question**
Do you play games in your free time?	Yasin et al., 2018	Do you play games in your free time?
How often do you play games per day?	Bakar et al., 2019	How often do you play games in your free time?
I have experience with gamification in a library instruction setting.	Capdarest-Arest et al., 2019; Xi and Hamari, 2019	Do you have experience with digital game-based learning in a health science education setting?
I feel confident using gamification in a library instruction setting.	Capdarest-Arest et al., 2019)	Do you think digital game-based learning is an effective teaching tool?
Reward is important	Bakar et al., 2019	Do you think rewarding students encourages learning?
Lecturer understanding of digital game-based learning and gamification		
Question found in literature	**Reference**	**Adapted question**
This game-based learning trains us to work in teams.	Yasin et al., 2018	Does DGBL enhance collaboration – not the same as teamwork, so which is the key concept?
How can the best practices/methods for designing and incorporating games and simulations in student learning be recognised?	Vlachopoulos and Makri, 2017	How should the best practices be identified: should they focus on explaining "how" to design and incorporate games and simulations into student learning, or on determining the most effective methods for doing so?

4.3 Face Validity

Following item identification from the literature, the survey questions were prepared for face validity; the purpose was to solicit expert opinion on whether the questions appear, on face value, to investigate the intended aspects regarding DGBL and gamification. Five experts (n=5) with a background in research or game-based learning were invited to participate in the validation section to establish the quality of the questions and the quality of the data collected through the questions. Table 4.2 shows the characteristics of the experts who assisted in establishing face validity. Experts were recruited from the University of the Witwatersrand (Wits) and the North West University (NWU). The choice of the two universities was based on their alignment with the research goals. These two universities were also selected for their capacity to provide access to a diverse panel of experts. All the expert participants (n=5) were

female, while the institutional breakdown shows a majority from Wits (80%) and a smaller representation from NWU (20%). The experts commented, in writing, on the spelling, grammar and clarity of the questions. Although they met the criteria for inclusion in the study, the experts did not participate in the subsequent phases. The data were analysed using Microsoft Excel to determine the score for each question. Frequency analysis was used to analyse the data collected in descriptive statistics.

Table 4.2: Characteristics of experts (n=5).

Characteristic	Category	Value n (% of N)
Gender	Male	0 (0%)
	Female	5 (100%)
Institution	WITS	4 (80%)
	NWU	1 (20%)

The experts recommended the following:

- The order of specific questions should be changed.
- Questions should be simplified. Some questions ask for too much information at once.
- Consistently use the terms DGBL and gamification throughout the survey.
- Reevaluate the necessity of questions about free time play when focusing on gamification in classroom settings.
- Avoid using yes-no dichotomies in questions.
- Rephrase questions starting with “How” to begin with “What”.
- Check the grammar and spelling in a few questions.
- Simplify the list of games, as it is currently too long.

The researcher reviewed the survey, keeping the experts’ recommendations in mind and adjusted it before sending it to the expert panel for the content validity survey.

4.4 EXPERT CONTENT VALIDITY

The instrument was sent to the experts with specific instructions, asking them to respond as if they were participants in the final survey These experts were identified using the snow ball sampling technique and invited to take part. Ratings were given on a 1-10 scale, evaluating the relevance, clarity, and structure of the questions. Experts were also asked to assess the question flow and report any typing or technical errors encountered during the process.

The survey link was sent to 136 experts in DGBL and gamification, of which 36 responded within the deadline (four weeks after the link was first sent out). Of the 36 responses received, eight were incomplete, and 11 participants indicated they did not meet the criteria at the beginning of the survey; the panel thus comprised 16 experts who completed the content validity survey of the question items (n=16).

Of the participants who completed the survey, Table 4.3 shows that 65% were female and 35% were male. It is interesting to note that the highest percentage of participants according to age was between the ages of 36 and 40 and 51-55 years. Most participants were from South Africa (31.25%; n=5), and only 37.5% (n=6) indicated that they had experience in DGBL.

Sixteen participants met the inclusion criteria set out at the beginning of the survey on content validity. They were given four weeks to respond to the survey conducted through RedCap (Conde et al., 2009). Expert participants were encouraged to freely contribute elements for the tool using an open survey format, alongside ranking and multiple-choice questions, to extract the most significant aspects.

Expert participants evaluated the quality of the questions and responded to them as participants to assess the quality of the collected data. Criteria used to evaluate the question quality included relevance and whether the questions addressed vital concepts relevant to the research objectives. It was also considered whether the question was clear and understandable and whether or not it measured what it should.

Table 4.3: Characteristics of the participants for expert content validity (n = 16).

Characteristic	Category	Value n (% of N)
Gender	Male	6 (35%)
	Female	10 (65%)
Age	26-30 years old	1 (6.25%)
	31-35 years old	1 (6.25%)
	36-40 years old	3 (18.75%)
	41-45 years old	2 (12.5%)
	46-50 years old	2 (12.5%)
	51-55 years old	3 (18.75%)
	56-60 years old	3 (18.75%)
	61-65 years old	0 (0%)
	66+ years old	1 (6.25%)
Country	South Africa	5 (31.25%)
	America	4 (25%)
	France	2 (12.5%)
	Morocco	1 (6.25%)
	Netherlands	1 (6.25%)
	Sri Lanka	1 (6.25%)
	China	1 (6.25%)
	Malaysia	1 (6.25%)
Experience of DGBL in Health Sciences	Yes	6 (37.5%)
	No	10 (62.5%)

4.5 THE SURVEY

Following item generation and validation procedures, the validation outcomes are presented according to four survey components. The median reporting was chosen because it offers a clearer, more reliable measure of central tendency, particularly when dealing with skewed distributions. The presence of outliers in the data could distort the mean, but the median is less affected by these outliers and skewness. This is why the median was preferred over the mean. The outliers are illustrated in Figures 4.1, 4.2, and 4.3.

4.5.1 Section 1: Health science educator's use of technology in teaching

The focus of the first section of the survey was to find out how health science educators use technology in teaching. Figure 4.1 illustrates the responses from the participants about this

section of the survey. The interquartile ranges for Questions 1.1 and 1.2 had a narrow spread, which indicate consensus regarding the validity of the questions. There are outliers in both questions. Quotes from participants can be seen in Table 4.4, and both questions were retained in their first format as over 75% of the participants rated these questions above 60 on the VAS. The interquartile range for Question 1.3 had a wider dispersion; thus, the question was modified after incorporating the comments from the participants (Table 4.4).

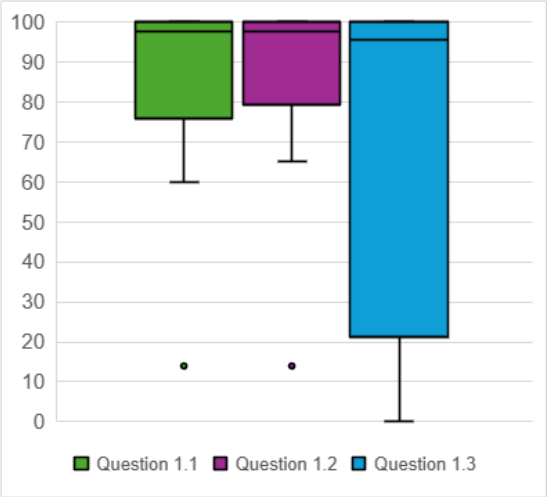

Figure 4.1: Health science educator use of technology in teaching.

4.5.2 Section 2: Health science educator awareness of DGBL and gamification

The second section focused on health science educators' awareness of DGBL. As seen in Figure 4.2 and Table 4.4, none of the questions in this section were retained, but definitions were added to the beginning of the survey. This decision is because participants commented that there are different ways of defining DGBL and gamification. Thus, a definition should be included that renders the questions in Section 2 null and void. Expert 6 commented: “Not sure - what you want to gain from this question? Defining the concept does not really speak to awareness. Maybe add; give an example to illustrate the meaning of DGBL?”

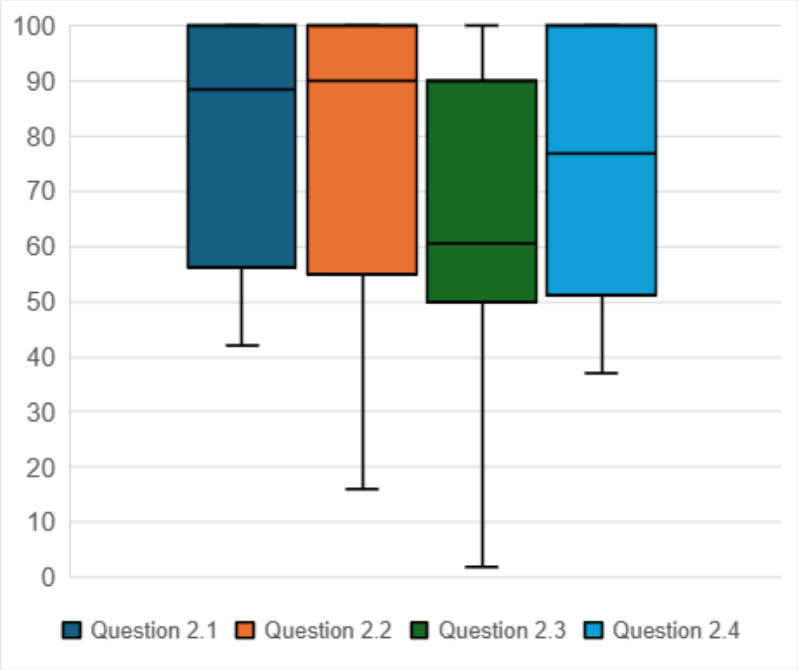

Figure 4.2: Health science educator awareness of DGBL.

4.5.3 Section 3: Health science educator understanding of DGBL and gamification

The third section of the survey focuses on health science educators' understanding of DGBL and gamification. There were five questions in this section; four were modified, and one was excluded after the feedback from the experts (Figure 4.3 and Table 4.4). The strong consensus (IQR=28) for Question 3.5 resulted in a low median value on the VAS (m=74), because the experts felt that the questions were not neutral and had presuppositions. After reviewing the comments, the question was modified to be more specific.

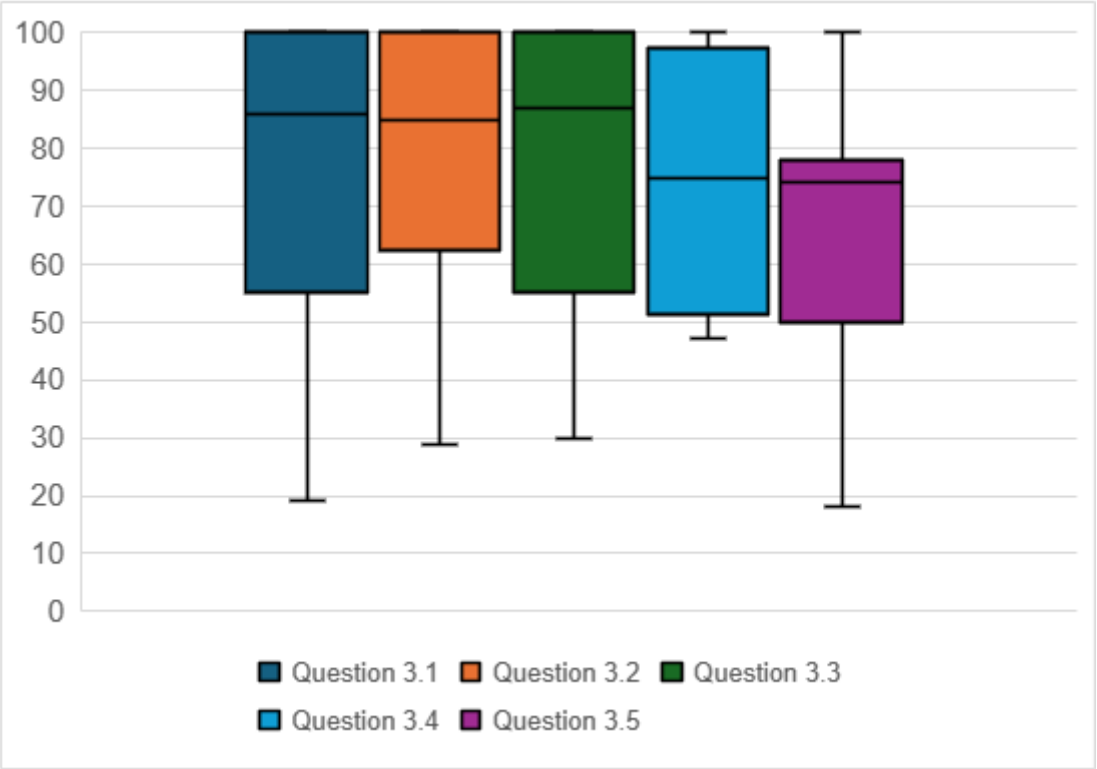

Figure 4.3: Health science educators' understanding of DGBL.

4.5.4 Section 4 Health science educators' implementation of DGBL and gamification

Section 4 was included in the survey to understand how health science educators implement DGBL and gamification. Six questions were excluded, three were modified, and one was retained as is (Figure 4.4 and Table 4.4). For Question 4, fewer participants rated it above 60, and the question had an outlier. When reviewing the comments from the expert participants, it becomes clear that they experienced the question as vague; for this reason, it was modified to be clearer and more focused.

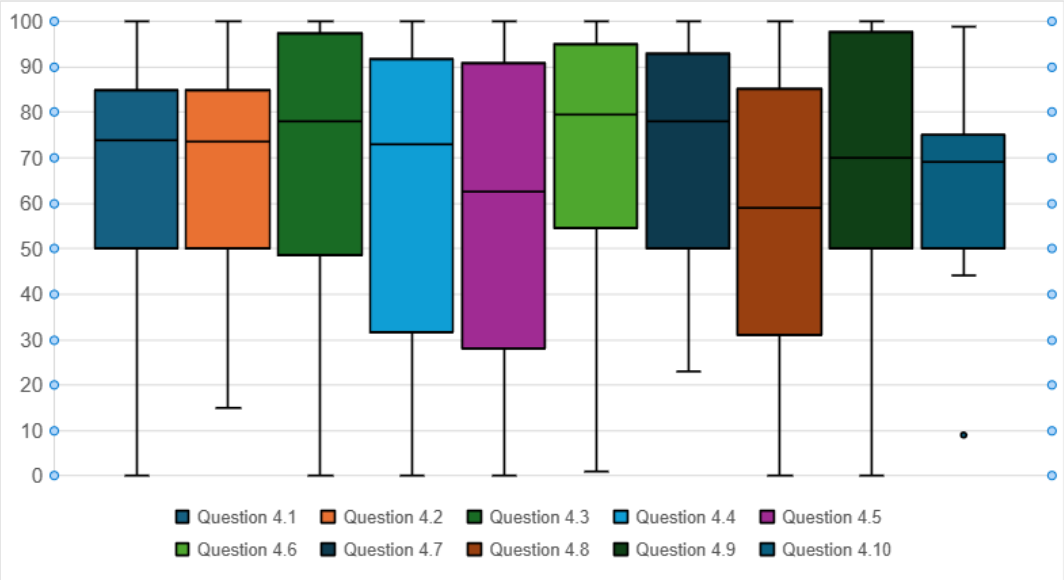

Figure 4.4: Health science educators' implementation of DGBL.

Table 4.4 Expert Content Validity: Analysis Item Tracking

Median: M≥80 | M70-79 | M<70
Inter-Quartile Range*: IQR≤30 | IQR 31-45 | IQR>45
Number of experts on the panel who rated the question ≥ 60 as a percentage of total panel: ≥75% | 60%-74% | <60%
Result of how question item progressed to the educator survey: Retained | Modified | Excluded
**IQR is Exclusive of median (even number of values), weighted averages*

Question items presented to expert panel (n= 16)	**Outcome** Median (M), Inter-Quartile Range (IQR)*, % experts rated ≥ 60 (%), Result	**Expert comment supporting changes**	**Question in educator survey**
Section 1: Lecturer usage of technology in teaching			
1. Did you lecture/teach using technology before the COVID-19 pandemic? (e.g. online teaching, using a learning management system or another platform) Yes / No If yes, how did you use technology in your teaching before the COVID-19 pandemic?	M=97.5, IQR=24.25, ≥60=94%, Retained	*Might be useful to ask: If yes, describe how you used technology in your teaching before the COVID-19 pandemic. The way the question is phrased currently - it does not require detailed information. i.e. I only wrote in assignments - but did not describe how I used the technology. Having a tablet on the table does not mean that I have incorporated technology in teaching and learning. Have a look and be consistent in how you write Covid-19 / Covid19.* **Expert 6**	Did you lecture/teach using technology (tablets, computers, data projector) before the COVID-19 pandemic (before March 2020)? Yes/No. If yes, describe how you used technology in your teaching before the COVID-19 pandemic.

2. Do you currently lecture/teach using technology? If yes, how do you currently use technology in your teaching?	M=97.5, IQR=20.75, ≥60=94%, Retained		Do you currently lecture/teach using technology? Yes/No. If yes, how do you currently use technology in your teaching?
3. How often do you use devices (tablet, laptop, cell phone in teaching? • Every day, • Every second day, • Once a week, • Every two weeks, • Once a month, • Once every 6 months, • Never.	M=95.5, IQR=78.75, ≥60=69%, Modified	*Don't think this adds value at all. I am not sure if it relates to me as the lecturer or wanting my students to use. With COVID-19, I don't know what devices the students have access to. Maybe it would be better to ask how do we design learning with what type of device in mind. What do we expect our students to have access to.* **Expert 6**	Do you design lessons with a type of device in mind (for example, laptop, tablet, cell phone)? Yes/No Indicate what device you design lessons for most often: o laptop o tablet o cell phone o other. If other, please elaborate.
Section 2: Lecturer awareness of DGBL.			
2.1 How would you define the concept DGBL?	M=88.5, IQR=43.75, ≥60=75%, Modified: Add definition in survey introduction.	*Perhaps useful for understanding your respondents, but seems superfluous.* **Expert 31** *May be difficult to measure and code.* **Expert 28** *Not sure - what you want to gain from this question? Defining the concept does not really speak to awareness. Maybe add/give an example to illustrate the meaning of DGBL?* **Expert 6**	*Definition stated in the survey for participants.*
2.2 How would you define the concept gamification?	M=90, IQR=45, ≥60=75%, Modified: Add definition in survey introduction.	*Personal definitions provide a baseline for understanding subsequent responses.* **Participant 4** *This term is often misused/misunderstood in my opinion.* **Expert 27**	*Definition stated in the survey for participants.*
2.3 Do you play games in your free time? Yes/No. If you play games in your free time. How often do you play games in your free time? • Every day • Every second day • Once a week • Every two weeks • Once a month • Once every 6 months • Never	M=60.5, IQR=40, ≥60=50%, Excluded	"*I'm not opposed to including this question, but I'm not sure how it relates to the research question. Also, there is such a wide variety of digital games (huge difference between Candy Crush and World of Warfare) that I wonder how relevant frequency of use may be. The frequency of use of different types of digital games may be vast (e.g. nearly daily for Candy Crush-genre games*	

		and every few months for the more in-depth games. How will you use this data? **Expert 4**	
2.4 For the classes that you teach, would you prefer to teach in a traditional lesson in which the instructor demonstrates and explains to the class or in a class where you play a game to learn more about the topic? • I prefer to teach in a traditional lesson in which the instructor demonstrates and explains to the class. • I prefer to teach in a class where students play a game to learn more about the topic.	M=77, IQR=48.75, ≥60=69% Excluded	*The relevance of this question is assumed, but the question itself is leading and not aligned with the rest of the section*. **Expert 11**	
Section 3: Lecturer understanding of DGBL and gamification			
3.1 Do you think there is a space in the curriculum for DGBL? If yes, why do you think there is space in the curriculum for DGBL? If no, Why do you not think there is space in the curriculum for DGBL?	M=86, IQR=45, ≥60 = 75%, Modified	*This series of questions may enhance your understanding of instructors' beliefs and opinions about game-based learning. Do they believe it's an 'extra' that takes more time, is difficult and adds little value, or do they see it as an efficient approach for more effective delivery of content or experiences that will stick with students over the long haul? (If it takes longer than the lecture, is the value greater than the cost of the extra time? I think it is, but many people with less experience using games may not think so*). **Expert 4** *There isn't a lot of space in terms of time, but one can always find some since games really help learning*. **Expert 25**	Do you think there is time in the Health Science curriculum for DGBL and gamification? Yes/No. If yes, why do you think there is time in the Health Science curriculum for DGBL and gamification? If no, Why do you not think there is time in the Health Science curriculum for DGBL and gamification?
3.2 Do you think that rewarding students encourages learning? This includes competitive and non-competitive rewards - on an individual or team basis.?	M=85, IQR 37.5, ≥60=75%, Modified	*Valuable question; however, what is meant by rewarding, and when is the reward issued? Being more specific might change how I would answer the question.* **Expert 6** *This is a good question because we have found that rewards cause learners to become myopic about the rewards instead of learning from their experience. We have also found that rewards may cause more*	Lecturers often use a reward system when implementing game-based learning and gamification in their classes. Do you think that rewarding students encourages learning? Yes/No If no, Why did you answer no?

		resilient learners to persevere and eventually gain the experience we hope they attain. **Expert 27** *Are you looking for opinion or experience? Are you sure that the faculty will understand the difference between award and grade points? This is very open-ended and open to a lot of suggestivity.* **Expert 28**	
3.3 Do you think that DGBL and gamification are effective teaching tools?	M=87, IQR=44.75, ≥60=75%, Modified	*For clarity, change from 'is an effective' to 'can be an effective'. Currently, this question is leading.* **Expert 11** *Good question because anything that challenges a student depends upon the learner's willingness to accept the credibility and need for what they are learning. Some respond well, some don't, and there's a lot in the middle.* **Expert 27** *I think this would work better as a Likert scale.* **Expert 28**	On a scale from 0 (disagree) to 100 (agree), do you think that DGBL and gamification can be an effective teaching tool? Please explain the reason for your choice.
3.4 What, in your view, is the difference between game-based learning and gamification?	M=75, IQR=46, ≥60=69%, Excluded	*Useful to determine how participants distinguish the two concepts. (Some may answer that they don't know.) This question seems a bit redundant with the definitions [questions] in the first section. You may not need both.* **Expert 4**	Definition stated in the survey for participants.
3.5 How can DGBL and gamification enhance education?	M=74, IQR=28, ≥60=69%, Modified	*This question is not neutral. It presupposes that participants believe that DGBL can enhance education. More neutral wording or an additional question framed from a negative perspective (e.g. in what ways may DGBL fail to enhance education) would be less leading. (Leading questions tend to bias results).* **Expert 4** *This is very general. Again, I would suggest and select all that align and list items like engagement, summative evaluation, formative evaluation, application, knowledge retention, etc. I think a Likert matrix would be the best measurement. You can get a clear spectrum of 'Absolutely needed' to 'Absolutely should not be used' with several points in between and then list the areas separately.* **Expert 28**	Scale matrix: Does not enhance this area of education – indifferent – enhances this area of education. • Indicate on the Likert scale if DGBL and gamification enhance student engagement. • Indicate on the Likert scale if DGBL and gamification enhance summative evaluation. • Indicate on the Likert scale if DGBL and gamification enhance formative evaluation. • Indicate on the Likert scale if DGBL and gamification

			enhance baseline assessment. • Indicate on the Likert scale if DGBL and gamification enhance knowledge retention.
Section 4: Lecturer implementation of DGBL			
4.1 What are some best practices/methods for designing and incorporating games and simulations in student learning?	M=74, IQR=34.75, ≥60=63%, Excluded	*If your audience is well-informed and experienced with DGBL, this is a great question. If not, you may get a lot of "I don't know" responses. This question is worded in a way that is biased toward benefits of using games in education. It's not entirely clear how this question informs the research question (determining awareness and understanding?).* **Expert 4** *I'm not sure that many of your respondents will be able to answer this question. It might be better to ask first if they use games and then ask this question of those who say that they do use games.* **Expert 10**	**Added:** Have you implemented DGBL and gamification in your classes? Yes/No.
4.2 On which theories or principles do you base DGBL?	M=73.5, IQR=34.75, ≥60=69%, Excluded	*Theory is a way to describe/label behaviours/phenomena. If the simulation does not incorporate them in some manner, it may be discredited. However, some theories disagree with one another whereas a game/simulation may not be able to accomplish that. Is it a problem for the game or the theory?* **Expert 27** *I don't believe faculty and many designers can choose specific theories.* **Expert 28**	
4.3 Have you implemented DGBL in any of your instruction sessions? Please elaborate.	M=78, IQR=48.75, ≥60=56%, Excluded	*This question has been answered in the beginning. This is replication.* **Expert 6** *This question needs some specific guidance around what you expect from elaborating.* **Expert 11** *This really is similar to the first round of questions and seems redundant and difficult for someone who has done a lot of this.* **Expert 28**	

4.4 In your opinion, how does DGBL increase students' interest in learning more about the subject that you teach?	M=73, IQR=60, ≥60=56%, Excluded	*While this question seems to relate to perceptions of instructors, it is not neutral. The wording assumes that participants agree that DGBL increases students' interest.* **Expert 4** *This is a leading question, assuming that there is an increase in interest*. **Expert 11**	
4.5 What experience do you have with DGBL in a health science education setting?	M=62.5, IQR=62.75, ≥60=50%, Excluded	*Not sure if this question adds value... Maybe if the question is asked differently to maybe focus on what health science education games are you aware of*. **Expert 6** *This question seems very similar to the question on whether the person has used game-based learning in an instruction session. It might be worthwhile only using one question, or perhaps put this question first and then ask whether they've used in their own lessons or seen others using games in their lessons.* **Expert 10**	
4.6 What would encourage a lecturer to use DGBL in the classroom?	M=79.5, IQR=40.5, ≥60=75%, Retained	*Will probably elicit opinions. Seems to relate to the perception aspect of the research question.* **Expert 4** *Think if you combine this and the next question with the training needs you might get a richer response.* **Expert 6**	What would encourage a lecturer to use DGBL and gamification in the classroom?
4.7 What would prevent a lecturer from using DGBL in the classroom?	M=78, IQR=43, ≥60=69%, Modified	*Opinions about barriers seems relevant to considering likelihood of "adoption in practice.* **Expert 4** *Ask about barriers and be specific.* **Expert 28**	What barriers are you aware of that would prevent a lecturer from using DGBL and gamification in the classroom?
4.8 List the computer-based games that you use in your classroom.	M=59, IQR=54.5, ≥60=50%, Excluded	*Redundant question as you have already asked for the respondent to let you know what they have done. Having this question implies that there are specific games or programmes that people do and are expected to use. This is misaligned with game-based learning as a theoretical approach.* **Expert 11**	
4.9 How do you assess students using DGBL?	M=70, IQR=47.75, ≥60=63%, Modified	*This question was not clear and is leading in assuming that respondents do assess using GBL*. **Expert 11**	Do you assess students using DGBL and gamification (either

		Good question, but needs clarification. Do you mean by grade? By quizzes in the materials? Completion of the game? In-game summative assessment? **Expert 28**	baseline or continuous assessment)? Yes/No If yes, how do you assess students using DGBL and gamification (either baseline or continuous assessment)?
4.10 What are the benefits and shortcomings of your preferred approach (using demonstration/explanation or games)?	M=69, IQR=23.5, ≥60=64%, Modified	*I'm afraid I'm not sure what the question is referring to. Demonstration/ explanation of what? Is the approach referring to DGBL or to general teaching approaches? I think the question could be relevant if you're trying to establish the benefits and shortcomings of the approach to DGBL that the lecturer uses, but to me, it's not clear that that is what the question is asking.* **Expert 10**	What are the benefits and shortcomings of incorporating games and simulations in student learning? Include the names of games that you use if appropriate.

Data analysis was performed using Microsoft Excel. Descriptive statistics, frequency analysis, and thematic analysis were used to organise panellists' responses, identify key descriptors, and establish themes, thereby understanding experts' opinions and facilitating the integration of expert viewpoints in the final survey.

The final format of the survey can be found in Appendix F. Three sections of the final survey focus on health science educators' use, understanding and implementation of DGBL and gamification.

4.6 Limitations

The method depends on participants' expertise, which may introduce bias if selected experts have limited experience in health science education or DGBL and gamification. Participants are expected to self-respond, and this might introduce a response bias. The instrument was validated, but unforeseen issues related to wording or interpretation may have impacted response quality.

4.7 Conclusion

The development, refinement and validation of a survey instrument were discussed in Chapter 4. Through instrument development, validation, and expert feedback, valuable insights were gained from a panel of carefully selected experts. From the expert feedback, questions were

mainly validated with minor modifications to improve clarity and focus on Section 1. All questions for Section 2 were discarded because it was decided to include definitions to improve understanding. In Section 3, questions were changed to remove biases; in Section 4, several questions were excluded to capture the intended information better. Despite challenges such as potential biases characteristic of participant expertise and self-response, the study provided meaningful data for creating the educator survey tool. Chapter 5 presents the results of the implementation of this survey.

CHAPTER 5:
EDUCATOR SURVEY RESULTS

5.1 INTRODUCTION

After completing phase one, which involved the instrument development and validation using the expert content validity method, the instrument was administered to health science educators to survey their awareness and understanding of digital game-based learning (DGBL) and gamification as teaching tools in 21st-century learning. The survey explored how they have experienced these teaching tools and whether or how these affect their perspectives and adoption in practice, which were also of interest as part of the research question.

The survey was administered digitally using REDCap (Harris et al., 2009). This gave participants the ability to stay anonymous and keep confidentiality. Only survey responses were analysed, and no extra participant information was gathered. The factors or conditions that might have impacted participants during the study remain undisclosed. How the instrument was developed and validated was discussed in Chapter 4.

5.2 RESPONSE RATE

The survey link was sent to 136 practising health science educators. The potential participants were acquired using the snowball sampling technique. Ninety-four completed surveys were returned, of which 74 (78.7%) were health sciences educators lecturing at South African higher education institutions who consented to participate in the study.

Of the participants, 60% (n=94) had less than one year of experience with DGBL and gamification, and none had ten years or more experience. Two of the participants had not used DGBL and gamification at all.

5.3. DEMOGRAPHICS

This was an anonymous survey; the participants were not asked possibly identifying demographic questions due to the relatively small population.

5.4 USE OF TECHNOLOGY IN HEALTH SCIENCES EDUCATION

The majority (73; 98.6%) of health sciences educators indicated they had experience using technology in their teaching, while one (1.4%) stated no prior experience. When comparing the

participants' experience in using technology in their teaching before the COVID-19 pandemic to current use, 70 (94.6%) reported pre-pandemic experience, with 71 (95.9%) indicating current use of technology. Of note was that five (6.8%) Health Science Educators who were not using technology pre-pandemic have since started. In comparison, four (5.4%) who were using technology pre-pandemic have since stopped using it (one of whom reported not actively teaching at the time of the survey).

Before the COVID-19 pandemic, health science educators used various technologies in their teaching. This included using data projectors, PowerPoint presentations, and learning management systems like Moodle and Blackboard to share learning materials and conduct assessments. They enabled engagement from students by using response applications like Kahoot for interactive quizzes and formative assessments.

At the time of the study, technology was used in health science educators' classrooms and online platforms such as MS Teams, Zoom, and Moodle to deliver lectures, host discussions, and have assessments. Interactive tools like Padlet, Flipgrid, and WhatsApp were also used to enhance communication and engagement. Teaching included prerecorded PowerPoint presentations, narrated slides, and live sessions. Health science educators also indicated using e-guides, videos, and digital simulations for practical exercises and learning management systems.

The use of technology before and after COVID-19 was mostly similar. Although there was an increase in technology use during the pandemic, many health science educators went back to their pre-pandemic practices afterwards.

5.5 TECHNOLOGY CONSIDERATIONS IN LESSON DESIGN

When asked if they considered the device the student would be using when designing their lessons, 39 respondents (52.7%) reported that they created for laptops, tablet computers or cell phones (Figure 5.1).

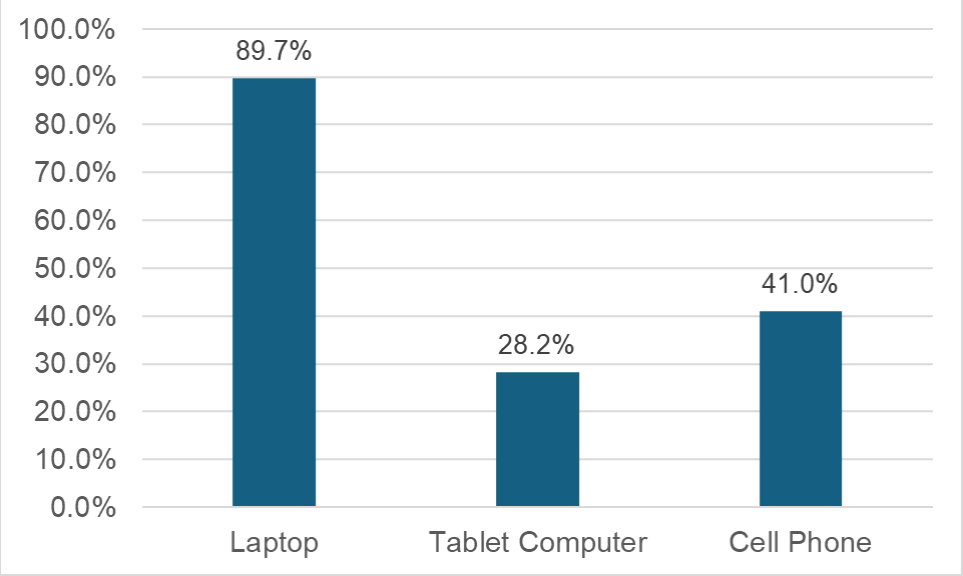

Figure 5.1: Percentage of lecturers who design lessons with a particular device in mind (n=39).

5.6 YEARS OF EXPERIENCE IN DIGITAL GAME-BASED LEARNING AND GAMIFICATION

Of the 74 health science educators, only 30 (40.5%) indicated they had experience with DGBL and gamification. However, as shown in Figure 5.2, 60.0% indicated having less than a year of experience with DGBL and gamification. Of those with experience, only 16 (53.3%) report having implemented DGBL and gamification in their own teaching at the time of the survey.

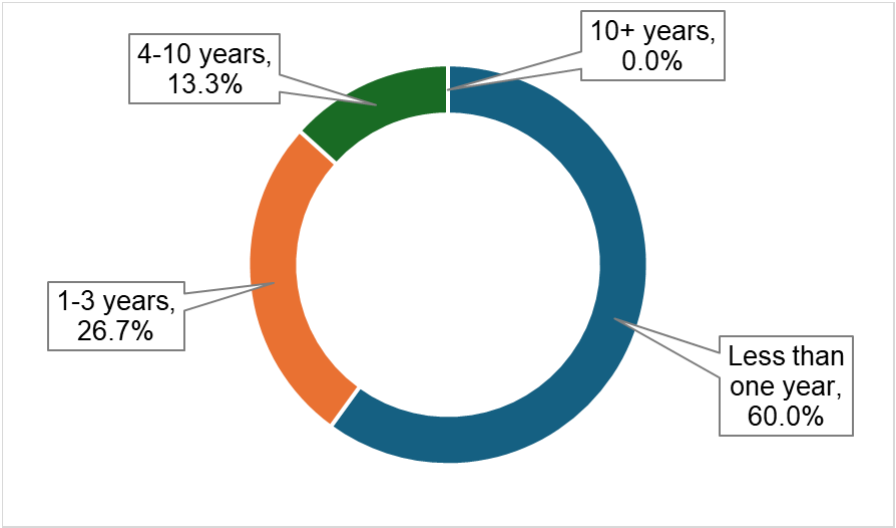

Figure 5.2: Health science educators' years of experience using digital-games-based learning and gamification (n=30).

As seen above, the experience of DGBL and gamification among health science educators varied. Some health science educators believe these methods waste time and prefer traditional approaches like case studies, roleplay, and real-life patient interaction. On the other hand, some see the value in implementing DGBL and gamification in the classroom. There is interest, with participants wanting to learn more about implementing DGBL and gamification in their classrooms.

5.7 PERSPECTIVES OF DIGITAL GAME-BASED LEARNING AND GAMIFICATION

5.7.1 Time

Twenty-nine (96.7%) participants agree there is time in the curriculum for DGBL and gamification. Comments by the health science educators showed that DGBL and gamification are engaging and enjoyable teaching methods that can be effectively integrated into the curriculum with planning. Activities should be aligned with learning outcomes, and it can be time-consuming, but there are long-term benefits like reusable materials and increased student understanding.

5.7.2 Perceived effectiveness

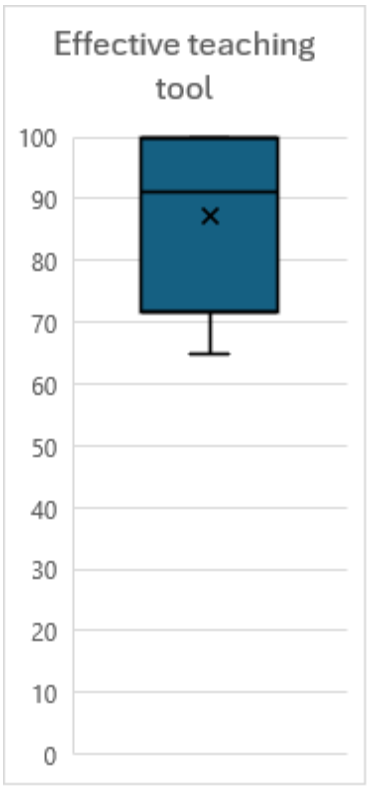

Figure 5.2: DGBL and gamification as an effective teaching tool.

Figure 5.3 shows a median score of 91, indicating a positive perspective by the participants. The narrow interquartile range (IQR) shows consensus among the health science educators who responded. This suggests a consistent agreement regarding the effectiveness of DGBL and gamification as an effective teaching tool.

> *We all learn differently. Sometimes, just sitting in class and listening to the health science educator speak is boring. Using game-based learning puts the learner at the centre of learning; they can take more in because they physically have to do it.* **Participant 15**

> *Taking the current expansion of online teaching and learning as well as the generation of students we are engaged with into account, as well as the sometimes-monotonous nature of online teaching and learning. Data cost and networking are two realities to consider.* **Participant 69**

5.7.3 Perspectives on the benefits and shortcomings of incorporating games and simulations in student learning

Health sciences educators' responses to this question showed that they believe that there are benefits and shortcomings to DGBL and gamification. On the positive side, these tools give opportunities for engagement and fun in the classroom. DGBL and gamification offer learning and integrating soft and 21st-century skills into the curriculum. It provides a platform for creating personalised learning paths, allowing students to work at their own pace and receive immediate feedback. On the negative side, challenges such as technical issues, time-intensive setup, and the necessity for alignment with curriculum objectives show the difficulty of integrating games into educational settings. Health science educators voiced concerns about accessibility to data and equipment and distraction in the form of GBL and gamification, which take away from the essence of the lesson.

5.7.4 Enhancing student engagement and knowledge retention

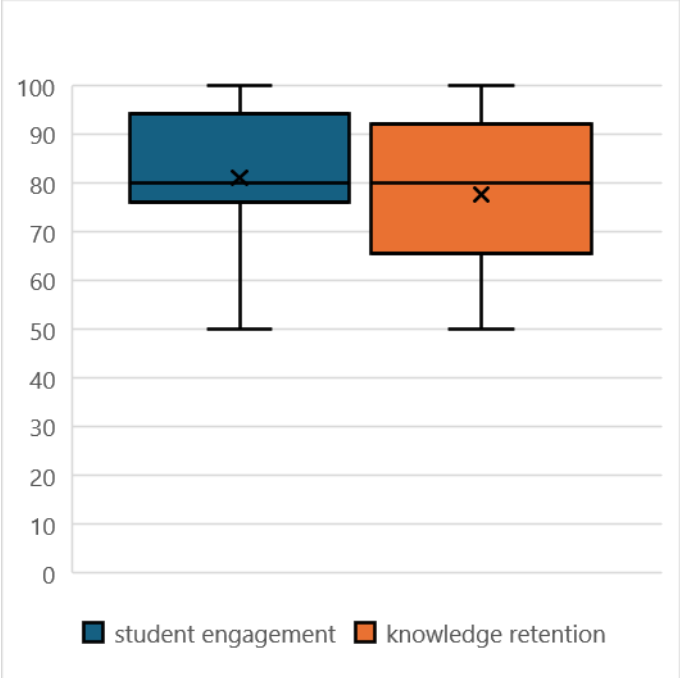

Figure 5.3: Enhancing student engagement and knowledge retention through DGBL and gamification.

Figure 5.4 shows a median score of 77, indicating a positive perspective by the participants. The narrow interquartile range (IQR) suggests a consensus among health science educators, reflecting consistent agreement on student engagement and knowledge retention, two of the benefits of DGBL and gamification. The feedback from participants shows the potential of these approaches to accommodate different learning preferences, encourage active participation, and establish a more interactive and enjoyable learning environment.

5.7.5 Enhancing student evaluation

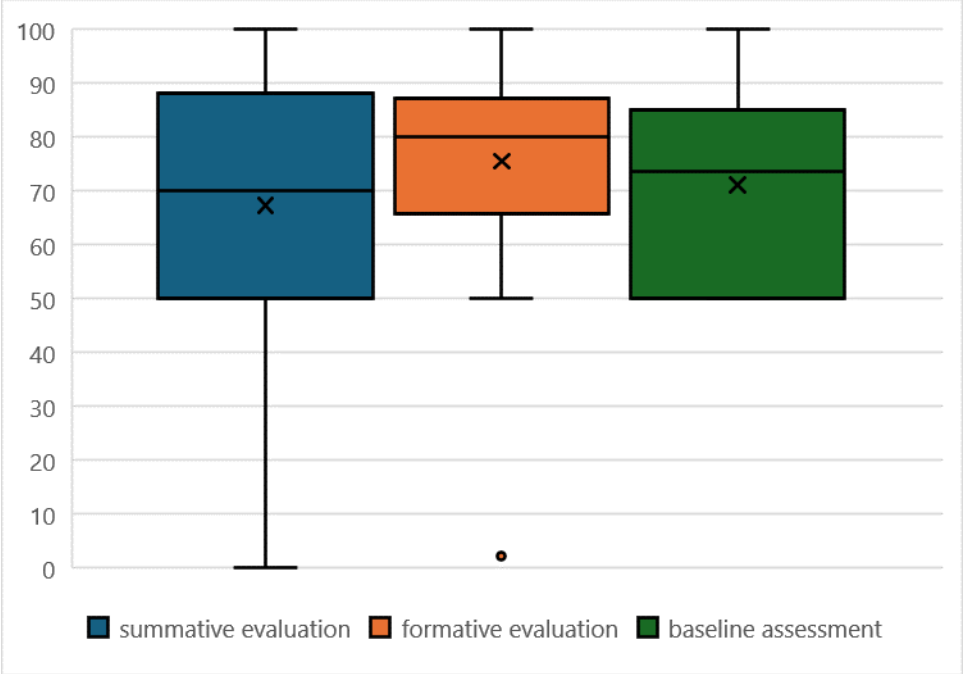

Figure 5.4: Evaluation and DGBL and gamification.

As can be seen in Figure 5.4, there is agreement that DGBL and gamification can be used for evaluation. However, there is less agreement on whether DGBL and gamification enhance baseline assessment. There is a lower median for summative and baseline assessments. Two of these participants had not yet tried these methods in their teaching but were willing to explore gamified assessment independently of their prior teaching experiences. This might suggest that, while rewards are commonly used in teaching, educators are more hesitant about using gamified assessment methods. Further research and discussion are needed to fully understand the dynamics and implications of incorporating DGBL and gamification into teaching and assessment practices.

In concluding the survey, participants were asked if they had any final comments, phrased as an open-ended question. Several themes emerged from the feedback received. While some participants expressed a lack of personal interest in gaming, they acknowledged exposure through their children. They expressed an interest in using gaming as a medium for teaching, aligning with their students' learning styles. There was consensus on the importance of supporting health science educators in converting learning activities into games, especially online. Participants were positive about DGBL and gamification.

Interestingly, time constraints and lack of personal knowledge were listed under health science educator-related barriers.

5.8 REVIEW OF THE FINDINGS

The findings in the survey show widespread adoption of technology among health sciences educators before and during the pandemic.

Health science educators had varying degrees of experience in digital game-based learning and gamification. It was clearly seen there is interest in learning more about and engaging with game-based learning and gamification among health science educators. Support and training, including technical and educational design assistance, were mentioned as important, along with access to relevant technology and proficiency in its use when considering implementing DGBL and gamification.

The potential to enhance student engagement, knowledge retention, and evaluation processes was acknowledged. Concerns included technical issues, time-intensive setup, and alignment with curriculum objectives.

5.9 CONCLUSION OF EDUCATOR SURVEY FINDINGS

The results of the educator survey provide empirical insights into South African health science educators' perspectives on DGBL in 21st-century learning; they shed light on the varying levels of awareness, engagement, and preferences among health science educators. Health science educators expressed positive perspectives on the effectiveness of DGBL and gamification, noting benefits such as enhanced memory retention and motivation for active participation. The results are a foundation for future exploration and potential interventions to enhance integrating these innovative teaching tools within the health science curriculum.

Participants used the terminology DGBL and gamification interchangeably. It was as if they did not want to use the term DGBL and then replaced it with gamification for ease of use. This is interesting to note as these health science educators have implemented DGBL in practice. The definitions for DGBL were also provided in the educator survey. Several participants mentioned simulation, but this terminology was not always used correctly. Some of the terminology was used incorrectly; for example, the Amazing Race was referred to as gamification, but, in this instance, it was a form of game-based learning. Another example is when a participant mentioned an example of audience interaction and called it gamification.

Chapter 6 presents the final phase of the mixed methods study - interviews with a subset of the survey participants.

CHAPTER 6:
RESULTS OF EDUCATOR INTERVIEWS

6.1 INTRODUCTION

A survey and semi-structured interviews were conducted to explore health science educators' experiences and perspectives on gamification and digital game-based learning. The survey provided quantitative data, and the interviews were necessary to gain deeper insights and understanding of the nuances of educators' experiences and perspectives.

In-depth interviews, guided by an interview guide (Appendix I), allowed detailed exploration of individual views. Probing questions were used where necessary to ensure comprehensive responses, capturing the rich, qualitative data that surveys alone cannot provide. This mixed-methods approach ensured a robust and well-rounded understanding of the topic.

Chapter 6 summarises the themes and subthemes of the educator interviews. The findings are then expanded in a narrative form according to themes and subthemes inferred from the interview data. An example of the coding process can be found in Appendix J.

6.2 DATA ANALYSIS

The reflexive thematic analysis approach was used to analyse the transcribed interviews (Braun & Clarke, 2021; 2019). This emphasized an inductive approach, allowing themes to emerge naturally from the data while considering the researcher's role and biases. Data were systematically coded and categorized into themes and subthemes, and these patterns were interpreted in relation to the research questions and broader educational contexts. The findings were contextualized within existing theories and literature, and the interpretation process was iterative, refining themes and ensuring that the analysis remained aligned with the study's objectives. After the interviews, the data were analysed and put into codes, then clustered into themes and subthemes.

6.3 RESULTS

The interviews were conducted with a sample of nine health science educators (n=9), comprising eight females and one male. Most participants were affiliated with the University of the Witwatersrand while one participant each represented Stellenbosch and Nelson Mandela Metropolitan University. Four main themes and 11 subthemes emerged from the interview data analysis. These themes are summarised in Table 6.1.

Table 6.1: Summary of themes and subthemes.

Themes	Subthemes	Code
User experiences	• Beyond own competency	• Training and knowledge • Resources • Expertise • Institutional support • Adoption into the curriculum
	• Feeling encouraged	• Prospects and opportunities • Engagement of students • Enhance student experience • promoting Interprofessional Education • teamwork
Learning to play	• Making the shift	• COVID-19 • Internal push factors
	• "Getting into it"	• Just do it • Planning • Start from own experience
	• (Learning to) play is a team effort	• Team effort • Collaboration between stakeholders
Playing to learn	• "Coming alive"	• Benefits • Participation • Safe environment
	• Student engagement	• Student engagement • self-directed learning
	• Engagement essentials	• Iinvolvement of all stakeholders • Suitability of the game • Play for purpose
Curriculum implications	• Educational pointers	• educational principles • Clinical skills
	• Formative learning	• Skills developed • Formative assessment
	• Students live in the curriculum	• Learning objectives • sky is the limit • identifying gaps in the curriculum

Each theme is presented in more detail below.

6.3.1 Theme 1: User experiences

Theme 1 focused on exploring the experiences of health science educators in the use of DGBL in their teaching practice (Table 6.1). For some interviewees, the journey with DGBL started with recognising their limitations and the fact that they had to acknowledge their perceived skills deficiency and rise above it ("Beyond own competency"). On the other hand, user experiences are shaped by aspects of DGBL that educators find uplifting ("Feeling encouraged").

- ***Subtheme: Beyond own competency***

Interviewees mentioned they had mixed feelings about the implementation of DGBL. Although the potential benefits of DGBL were somewhat obvious to them, some felt they did not have the necessary **training and knowledge**. Conceptualised as "beyond own competency", educators mentioned aspects that made them doubt their ability to use or integrate DGBL in their teaching practices; some of these related to **resources** (for example, computers to develop games and time) and people with the **expertise** to develop games:

> *"So, I might have an idea, but if there is not anybody available to translate it into the actual computer interface or whatever, then it's not going to materialise... So, ja."* ***(Participant 5)***

Besides personal limitations, educators also mentioned that **institutional support** for DGBL is variable. Users' experiences of competency seemed to be influenced by the institutional support available and the opportunities (for example, space in the curriculum approved by management) to use DGBL.

Participant 6 stated there are certain games and *"platforms such as Flipgrid and Mentimeter ....but the opportunity to play is not always there*.", indicating the need to have time to enhance their competency with these tools.

When DGBL has not been widely **adopted into the official curriculum** and teaching practices, interviewees appear to reach beyond their competence by integrating games in their courses. Some of those mentioned include postgraduate courses or a course in a specific year of study, for example, the final year. Experience of their competence and skill in navigating the game-based learning space is also influenced by the degree of difficulty of the game, which some find intimidating – this, in turn, interferes with their learning and that of the student. This

participant highlights that while adoption can be beyond your own competency, you need to start somewhere.

> *“One reason was because I wanted to prove my point [chuckles]. So I usually think it takes an innovator, or a champion to actually just start with it. Start where you are with what you have, with what you can do. That was the first thing.” (***Participant 9)**
>
> *~~The second thing was I needed to show so, so reversing it a little bit I really support the transformational learning theory of Mesirow and which I always summarize to my students to say yes you can teach old dogs new tricks but it's it's just a a learning theory that's based on a very deep personal reflection and I just decided that I'm going to going to jump in.~~*

Although interviewees’ experiences in using DGBL varied, there is a resounding need for training and development to use DGBL effectively and to experience students’ learning gains fully.

- ***Subtheme: Feeling encouraged***

Even though there were mixed feelings and doubts about their competence and institutional support, interviewees expressed feeling encouraged by **the prospects and opportunities that DGBL might bring**. Health science educators mentioned they felt encouraged by seeing the results of students **engaging** with one another in the classroom and that otherwise quiet students come ‘alive’ in the sessions that implement DGBL. The transformative potential of DGBL was mentioned to **enhance user experience** and enable integration between different parts of the curriculum and other learning areas. Educators view DGBL as effective in **promoting Interprofessional Education**. They found this encouraging through games that students from multiple disciplines can engage in; they share problem-solving, enhancing their communication skills and understanding of each other’s professional roles. Implementing DGBL also encourages **teamwork**, as students need each other to complete the levels of a game.

> *"I mainly use it for interprofessional education, where we have final-year students, and we developed some games to actually help them to understand the value of teamwork."* **Participant 3**
>
> *“There is a lot of space. Like, I have been trying to find a way to incorporate it into interprofessional education. It seems like game-based learning, it does take away that – like it brings out that competitive nature, but like that, you know, you’re in a team, you’ve got to work as a team. It’s like, you know, sink or swim, you know, swim or sink type situation, and*

then it kind of does like allow a kind of bonding and experience you have with someone." **Participant 2**

Overall, interviewees' experience as users of DGBL is positively influenced by the learning prospects and potential of DGBL, and their experience could be enhanced if the necessary skills and support were in place.

6.3.2 Theme 2: Learning to play

The theme of learning to play brings together health science educators' experiences when they were thinking about introducing or implementing DGBL ("Making the shift") and when they started implementing it ("Getting into it"). Learning to play also exposed a reliance on a team of playmakers, which ranged from high-level design expertise to peer support ("Play is a team effort"). In describing the subthemes, several push factors that tie in with the courage displayed by educators introducing DGBL as a fun way to teach and learn in collaboration with others were identified.

- ***Subtheme: Making the shift***

The shift to DGBL is predicated on the assumption that online learning is in place in one form or another, i.e. in learning to play digital games, a virtual playground is essential. Several push factors emerged, which appear to be either from external sources or internally driven when focusing on the health science educator's perspectives on learning to play. The **COVID-19** pandemic emerged as an overwhelming external driver for innovative teaching and learning strategies amid strict lockdown measures. Participants recounted their experiences of how the COVID-19 pandemic necessitated a shift to online teaching and how game-based learning and gamification became necessary to enhance interaction in the online classroom. COVID-19 accelerated the adoption of digital tools and necessitated creative approaches to teaching, including leveraging technology to maintain student engagement in online settings. Introducing a new curriculum and courses was also identified as an additional external push factor for using novel approaches to stimulate learning and engagement in the learning process.

"So, my use of game-based learning really started to spring out during our COVID pandemic, when we needed to kind of shift our teaching that was taking place onto an online platform, and I just needed to kind of incorporate different ways in which I could get interaction in the classroom." **Participant 1**

"So, I think when we, I think when we moved over to a new curriculum, and I think we were just stimulated to think of new ideas. And also, we

had a workshop run by our e-learning team on different applications and software that can be used." **Participant 3**

Internal push factors stemmed from participants' beliefs about teaching philosophy and teaching styles. For some, self-reflection was important for initiating change in how one teaches, and students learn. For others, it was their love or passion for making learning fun using games.

> *"...so, if I take my own teaching philosophy because I think your teaching should actually be driven by you - what you perceive as good learning, and I believe in creating deep and meaningful learning events, and that's for the user to create connection with what is being learnt in and in that way you inter you internalise what you are learning."* **Participant 8**

Participant 9 mentions 'to gamify' in the comment below, but the researcher felt this refers to DGBL. 'To gamify' as a verb is broader than gamification, as seen in the article by Bassanelli et al. (2022).

> *"Approaching this correctly, I am a firm believer that you can gamify the biggest part of a curriculum. But it must be mindfully done. Then, the student needs to understand why and where games fit into the outcomes of the module."* **Participant 9**

Making the shift and adopting DGBL requires both a change in the philosophy of teaching and learning, and educators' belief in and passion for it. While making the shift, terminology like DGBL and gamification is used interchangeably, and this can cause confusion. External factors such as the COVID-19 pandemic, the introduction of new curricula and courses, workshops and e-learning teams that provided educators with the necessary tools and knowledge contributed to the implementation of DGBL.

- ***Subtheme: "Getting into it"***

This subtheme collates health science educators' experiences of taking up DGBL - for some, it was the first time. Commenting on how to get into DGBL, health science educators were encouraged to step out of their comfort zone to start implementing DGBL and to discover it.

> *"So, my use of gamification and game-based learning really started to spring out during our COVID pandemic, when we needed to kind of shift our teaching that was taking place, onto an online platform, and I just needed to kind of incorporate different ways in which I could get interaction in the classroom"* **Participant 1**

"You know, I think one must just do it – you will have to leave your comfort zone" Participant **6**

Popularised by the multinational company Nike, "**Just do it**" is more than a catchphrase – it is a call to action where educators are implored to follow a specific course of action. In this case, it is about taking up DGBL in a way that benefits educators and students. In taking up or getting into DGBL, participants felt that **planning** is a vital requirement to implement DGBL effectively and that any negative preconceived notions should be curtailed. This statement was also evident in 5.7.1 on page 53 that mentioned the importance of planning when implementing dgbl.

> *"So, I think that, you know, we speak about all those PlayStation games, and often they get a lot of criticism for being violent or, you know, explicit, etc. But I mean, there is so much other opportunities that the process of gaming brings that I think it nullifies, nulls those kinds of negative comments about what games do bring."* **Participant 1**

Participants encouraged fellow health science educators to look at their own gameplay competence and to **start** from their **own** experience with games, however few those **experiences** are.

> *"Now it's I guess it sounds a little bit cowboy, but I go from the approach of if you're going to wait for the perfect moment for magnification, then it might never happen."* **Participant 9**

> *"So those are some of the challenges and tricks, and I think you really need to have the support from a technical team in order to get the educational principles right."* **Participant 3**

> *"So, it's about introducing the landscape of game-based learning and gamification and so forth and telling people what is possible and maybe starting a community of practice and so forth to get the conversations going and getting interest in it.*" **Participant 7**

Health science educators interested in game-based learning and gamification should prioritise personal interest in gaming rather than mastery of games. Leveraging others' expertise can support implementation, and they should "Just do it."

- ***Subtheme: (Learning to) play is a team effort***

Aligned with peer support, learning to play and playing was considered a **team effort** by the educators. It emerged that experiencing specific challenges, such as not having the knowledge and digital literacy to develop games, interferes with the learning aspects of the game. For this reason, they say, **collaboration** between IT support and game developers is needed. From a health science educator's perspective, such expertise is required to implement a game designed for a specific learning purpose successfully.

> *"And then I was like hmm, I wonder if this can be used as a tool in education somehow [laughs]. So, in 2027 I had a colleague colleague, Lee-Anne Johnson. I'm like listen, can we do something with The Amazing Race, like maybe a Raptor Revision thing? So she's like sure, let's make this happen, and that's how it came to be. So, it's just genuinely my love for Amazing Race [laughs]."* ***Participant 2***

> *"...we are a team of three academics that were involved in this specific module, and we honestly sat down and consciously sought for possible ideas of how to essentially make the class more interactive and especially to, if I may use a very academic word, to use things up a bit."* **Participant 6**

Collaboration and being part of a team that brings diverse and critical skills affirm a team approach needed for DGBL and learning how to play as educators.

6.3.3 Theme 3: Playing to learn

The theme "playing to learn" encapsulates student benefits, as experienced by the educators interviewed. Playing, enjoying and having fun were consistent descriptors of students' experience and exploration of DGBL. Educators described a rise in student enthusiasm and energy as if they were "Coming alive" in playing and learning. "Student engagement" is an important outcome for health science educators who also felt there were certain essentials to facilitate student engagement in the play environment ("engagement essentials"). These are elaborated below.

- ***Subtheme: "Coming Alive"***

The **benefits** of Game-based learning engender enjoyment and fun among students playing the game; it fosters creativity, provides innovative learning experiences, and elicits enthusiasm among students. DGBL seems to liven up the learning process for all students, particularly those who are usually shy and inhibited in large classrooms. Educators experience these students as coming out of their shells because of the competitiveness and incentives of the game. Using DGBL as an icebreaker encourages such students to **participate** actively,

revealing a different part of their personality. This is good for self-esteem as students' opinions are recognised.

> "*I think it makes the students come alive for student learning."* **Participant 3**:

By using and integrating DGBL in their teaching practices, educators can help create a **safe environment** where students have freedom of expression and a degree of anonymity and pseudonymity.

> *"Also, the fact that, in our gamification, we allow the students to create their own nicknames. So, the truth of the matter is we did not know who said what, and that also created some freedom for the students, I think."*
> **Participant 6**

> *"What I have seen, it works almost like an icebreaker. So, in the other activities that we present, the students are very shy, and they don't want to participate. But as soon as they see this is a game, they can just give their opinion. Their opinion actually gets recognised by the rest of the students, and that is really good for their self-esteem."* **Participant 4**

DGBL allows students to "come alive" by allowing them to express themselves and giving them freedom to explore.

- ***Subtheme: Student engagement***

DGBL and gamification enhance **student engagement** and learning by fostering creativity, providing innovative learning experiences, and eliciting enthusiasm among students, especially at the postgraduate level (Sailer et al., 2017; Zohari et al., 2023). Participants gave an overwhelming 'yes' to the idea that DGBL enhances student engagement. There is a novelty in introducing a game, and this has the effect of making students interested in the learning material. Outcomes observed for students included an increase in the ability to be self-directed in their learning in an environment conducive to learning. Incorporating **self-directed learning** into the curriculum represents a strategic approach to integrating the methodologies. Learning is fun, and the emotional outcomes are positive. Social interaction is enhanced by the introduction of these methodologies, as can be seen in the excerpt below:

> *"… the social interaction that gamification brings to the classroom means that you can kind of assess them in a really fun way, you know, where it is about playing. And I think that the experiential learning methodologies definitely*

speak to why that would be a good way of bringing that into the classroom." **Participant 1**

Participants had a very positive outlook on the role of game-based learning in teaching and learning and how it increases student engagement and feedback. Although some were doubtful whether DGBL encourages engagement, they felt strongly that engagement depended on the lesson structure. For example, if a student is asked to play a game during an asynchronous session, they might get stuck at a particular place in the game if they are not well prepared. Thus, learning cannot continue.

> *"When I saw the engagement between these students, and I saw their conversations and the empowerment that occurred with these students, that was more positive than the resistance of the staff."* **Participant 9**

> *"Well, I am a very strong believer in the input of students. So, I think it really helps if they form part of the development and that they actually understand what the outcomes are. So, if they are fully engaged in it, I think the results are better."* **Participant 4**

Integrating DGBL and gamification in education encourages student engagement, creativity, self-expression, and social interaction. Shy students benefit from providing a fun and innovative learning environment that enhances self-esteem and promotes active participation.

- ***Subtheme: Engagement essentials***

Student engagement depends on certain conditions referred to as essentials or non-negotiables for engaging in the game within a DGBL approach. Educators emphasised **involving** peers and students in the development and execution of gamified learning activities, which enriches the learning experience, shares the workload, and fosters creativity. The positive feedback they received from students regarding the game-based learning approach suggests a focus on student-centred teaching and a desire to enhance their learning experience.

> *"Well, I am a very strong believer in the input of students. So, I think it really helps if they form part of the development and that they actually understand what the outcomes are. So, if they are fully engaged in it, I think the results are better*." **Participant 4**

Students must know **where the game fits into the learning process** and be prepared to participate fully. Educators' experience points to the necessity for students to be prepared for

the outcomes to be achieved and the rules of the game. Preparedness is essential for continuity and progress in the game.

> *"Because, for the level at which I'm teaching, it's not necessarily only about playing the game, but there are often other additional outcomes that we can link it to, you know?"* ***Participant 5***

Engagement as positive outcome is mentioned in 5.7.4 with a median of 77% of participants agreeing that student engagement and knowledge retention is enhanced.

Using games in a DGBL context enhances student engagement by making learning more interactive, enjoyable, and immersive; it draws hesitant students into the learning process, enhancing their self-confidence and self-belief. The outcomes and rules of the game are also important - not to play the game for the sake of it, but to **play for a purpose**.

6.3.4 Theme 4: Curriculum implications

This theme described the integrated nature of game-based learning in a curriculum, which is explained as the curriculum implications of DGBL. Participants felt that, from the outset, specific learning outcomes present the opportunity to integrate DGBL into the curriculum. To maximise the opportunities presented, participants provided "educational pointers" they felt would enhance the pedagogical merit of DGBL in student learning and learning assessment. The role of DGBL in forming specific skills is often foundational to scaffolding student learning ("formative learning"). As 'students live in the curriculum', they also need to have a say in how content is delivered. This sub-theme was also evident in response to the educator survey in 5.7.1 (p53) where integration into the curriculum was noted.

- ***Subtheme: Educational pointers***

Participants strongly believed that **educational principles** must not be forfeited when incorporating game-based learning into one's teaching practice. Specific learning outcomes and clear objectives must be kept in mind and used for game design features when implementing DGBL. The game difficulty level must not influence the outcome of the learning process; hence, a game design must be founded on educational principles and design frameworks for DGBL.

> *"I mean, I've engaged at looking at some of the leaderboards as a way of tracking assessment for students, but that's a little bit out of my expertise and is needing a lot of kind of additional input from some of the staff who have more. What is it? Design competencies."* **Participant 5**

Clinical skills can be effectively practised. Topics such as anatomy, pharmacology and medical terminology often require repeated exposure and practice to achieve proficiency, making them well-suited for integration into game-based learning environments.

> *"So, from there, it was like really useful because we identified that the students battled with urine analysis in terms of clinical skills, which made sense because, when we have our screening programme with, the students get to practise taking blood pressure and glucose and cholesterol."* **Participant 1**

> *"So, you know, having quizzes like Kahoot, whether our teams or even with one another and then game-based is more related to simulation where they would have to complete tasks within either Minecraft or other apps that is available to us that's related to nursing skills."* **Participant 2**

When implementing DGBL and gamification into the curriculum, health science educators should ensure the activities are relevant and the planned activities fit into the teaching plan. The lesson outcomes, educational principles and design framework for DGBL and gamification should be considered. Students should be involved in the design and planning process. Lack of prior engagement and level of game difficulty should not compromise the outcomes.

- ***Subtheme: Formative learning***

When implementing DGBL, several **skills** could be **developed** – either as a deliberate component of the curriculum or serendipitously, as a byproduct of another learning encounter. Interacting with their peers encourages students to communicate and reflect on the dialogue and communication outcomes between them. Decision-making skills, creative thinking, reflective skills, remembering and recalling information, and making connections between components were mentioned as additional formative skills learnt.

> *"And I thought, suppose it just stimulates a bit of creative thinking and how to do something differently."* **Participant 3**

There was a sense among educators that these skills are less suitable for formal assessment in a DGBL context, and a suggestion of **formative assessment** with feedback to students on their growth in these skills was made. Different components of the curriculum were thought to be suitable for gamification and game-based learning. While some areas may naturally lend themselves to gaming, others may require more thoughtful adaptation.

- ***Subtheme: Students live in the curriculum***

Students are 'living in the curriculum' and should thus be an integral part of the planning of curriculum delivery. Participants mentioned that **learning objectives** are essential, and that game-based learning needs to be planned with a goal in mind. The education levels of students need to be considered, and scaffolding is a good approach. The **sky is the limi**t when designing games, and much of the potential lies in the designer's imagination. Positive outcomes from implementing DGBL in the curriculum include **identifying gaps in the curriculum** and remediating them before examinations. DGBL can also be used to identify at-risk students. Participants mentioned opportunities for future game ideas. Incorporating DGBL into assessment methods gives new approaches to evaluating student learning performance.

> *"And also, because we identified where the gaps are that will allow us to tackle the gaps which would enhance students. So, I think in a sense that it did force that learning because without getting a correct answer you cannot proceed in the game. So, in terms of that you are dead and in terms of identifying with their shortfalls...***" Participant 1**.

> *"So, for me, if I could like organise an interprofessional ream, to have like phusions, pharmacists, the GIM students, nurses, like all of them in a group, where they are forced to work together in like this fun environment, where they can develop like an appreciation for each other's skills and you know, get past the egos and like the unknowns, I think I am really keen for it to be an opportunity". **Participant 2***

DGBL and gamification can positively benefit the curriculum and assist with identifying gaps and at-risk students. Students must be partners in curriculum delivery because they live in the curriculum.

6.4 CONCLUSION

The themes and subthemes derived from the interviews with health science educators provide valuable insights into their experiences using and implementing DGBL. First, the findings highlight the interchangeable use of terminology, particularly the frequent substitution of DGBL with gamification, which stresses a need for clarity in the language surrounding these educational strategies. This clarity is needed to discuss and implement DGBL accurately and will ensure that all parties involved have a shared understanding. Secondly, user experiences contrast the challenges of limited resources and institutional support and the encouraging outcomes of DGBL, such as increased student engagement and interprofessional

collaboration. These benefits can have the effect that health science educators are willing to overcome the challenges to reap the benefits. Thirdly, learning to play highlights the initial difficulties and the necessity for training, time investment, and the positive influence of a supportive environment during the adoption of DGBL methodologies. Implementing DGBL is not without difficulties; however, it can be done with training and a supportive community. Teamwork and collaboration are also mentioned in this theme as important factors to think about when implementing DGBL and gamification. The fourth theme, playing to learn, embraces the fun elements of DGBL and the desirable outcomes of enhanced engagement. There is consensus on the effectiveness of DGBL approaches in promoting interactive and enjoyable learning experiences. The positive emotional and social outcomes observed, such as increased enthusiasm and improved self-esteem, highlight the transformative potential of DGBL.

The curriculum implications of DGBL direct us to its potential for deep integration into the curriculum. By aligning DGBL with clear outcomes and involving students in the design and implementation process, health science educators can create more effective and engaging learning experiences. The use of DGBL can also assist in identifying gaps in the curriculum and at-risk students, allowing for appropriate interventions.

The experiences and perspectives of health science educators show that, while adopting DGBL can be challenging, the benefits it offers are extensive. Clarity in terminology, training and support, and thoughtful integration into the curriculum are essential to consider when implementing DGBL.

Chapter 7 summarizes the study's key findings. It will also reflect on the study's limitations, offer recommendations for educators and institutions, and suggest areas for future research to further enhance DGBL integration into the curriculum.

CHAPTER 7:
DISCUSSION AND CONLUSION

7.1 INTRODUCTION

With the changes seen in our world and the educational landscape, there is a need to change how students are taught so they can adapt to the future world of work (Granziera et al., 2019; Redecker et al., 2011). DGBL has emerged as a potential solution to meet this need by effectively engaging students, especially in complex subjects like health sciences, by connecting interactive and immersive experiences (Sáiz-Manzanares et al., 2021). Despite global advances in this field, research in South Africa has been limited, especially in investigating the educators' perspectives. The study explored the potential of DGBL and gamification as teaching tools by applying the 21st-century learning framework, supported by a social constructivist lens, within health sciences education. It aimed to establish the awareness, understanding, and experiences of health sciences educators in South Africa regarding DGBL and gamification.

The mixed methods design sought to find an existing survey or to develop and validate a survey instrument to assess health sciences educators' awareness and understanding (quantitative), followed by participant interviews to gain insight into their experiences of DGBL and gamification (qualitative).

Integrating qualitative and quantitative findings provides a blended understanding of health science educators' perspectives on DGBL and gamification. Combining data sets, the researcher gleaned complementary insights, contextual examples, and contradictions, thus offering a holistic view of DGBL and gamification use in South African health sciences education. The study indicated that, while there is a general interest in implementing DGBL and gamification, barriers such as a lack of resources, training, and institutional support prevent widespread adoption.

This chapter presents an integrated discussion of the results by merging findings from the scoping review, survey development and educator survey and interviews.

7.2 DISCUSSION OF FINDINGS

This study explored health science educators' perspectives on Digital Game-Based Learning (DGBL) and gamification, with a particular focus on their awareness, understanding, and experiences in relation to the integration of these strategies into

teaching practices. The study was conducted in three phases, corresponding to the study's objectives.

Objective 1: To determine what is known about the use and measures of DGBL and gamification through a scoping review to generate and validate educator survey items.

The scoping and follow-up literature review revealed a notable lack of publications focusing on Digital game-based Learning (DGBL) and gamification in the Health Sciences. As mentioned in Chapter 1 Van Gaalen's (2020) systematic review identified a limited number of studies on DGBL and gamification, with only 44 eligible studies found, mostly focused on students' perspectives. The research gap from the lecturer's perspective highlights the need for further studies to establish best practices and document the associated challenges and benefits. The scoping review found that articles on DGBL and gamification in education indicate a generally positive impact on teaching and learning (Arruzza & Chau, 2021; Sailer et al., 2017), showing improved learning outcomes, increased knowledge, and higher satisfaction levels compared to traditional methods. DGBL has the potential to enhance learning opportunities for health science students by making the learning process more engaging and relevant (Abdulmajed et al., 2015; Zohari et al., 2023). It promotes active, student-centred learning and helps develop critical thinking and problem-solving skills. The value of DGBL lies in its ability to make complex and abstract concepts more accessible and memorable using interactive gameplay (Van Gaalen et al., 2020). This aligns with the principles of social constructivism, which emphasize the importance of active participation in the learning process.

The scoping review revealed no existing survey instruments that would aid in determining health science educators' awareness, understanding, and experience of DGBL and gamification. It was necessary to develop a validated survey instrument, and one was designed through a further literature search and tested via an expert panel to implement and gather relevant educator data.

This new instrument provides a valuable tool for future research and lays the groundwork for comparisons and determining trends in health sciences educators' perspectives across different contexts and over time. Developing, testing, and implementing a new instrument was vital because it provides a standardised tool that can be used in future research, which is essential for building a body of knowledge about DGBL (Ghahramanian et al., 2015). The instrument, while supported by the content validity of the expert panel

(Taherdoost, 2016), could benefit from internal and test-retest reliability analysis once a more significant number of health sciences educators have completed the survey. However, in South Africa, the educator survey indicated that few health sciences educators (40.5% as noted in Chapter 5 heading 5.3) have experience using DGBL or gamification in their teaching, thus an insufficient number for accurate reliability testing of the survey instrument. Without standardised tools, conducting effective research on the experiences and effectiveness of DGBL and gamification is challenging, delaying progress in this field.

Objective 2: To investigate health science educators' awareness and understanding of DGBL and gamification using a validated educator survey.

The review of literature and feedback from interviewees and survey participants indicated considerable confusion regarding the terminology related to DGBL and gamification. Social constructivism emphasises the construction of knowledge through social interaction and collaboration. The confusion around terminology in gamification and DGBL highlights the lack of a shared understanding within the community of educators, researchers, and practitioners. Throughout the study, terms related to digital game-based learning and gamification were often used inconsistently or incorrectly; this points to a lack of standardised language in this field (Ghai and& Tandon, 2023). For example, gamification is sometimes used as a verb and sometimes as a noun incorrectly. Çiftci (2018) states that the terms game-based learning and serious games are sometimes used as synonyms. Interviewees and survey participants were not sure when to use the word as a verb and when as a noun. The same goes for the term digital game-based learning; sometimes, it is used as a collective term for everything DGBL-related and sometimes for a concept that is actually gamification (Çiftci, 2018; Zohari et al., 2023). During the Face Validity part of the instrument development, the panel recommended adding definitions for DGBL and gamification at the beginning of the survey because the terms are often used interchangeably or misunderstood (as noted in Chapter 4 heading 4.3). This did not solve the problem. Interviewees and survey participants confused the terms even with the definitions available to them. The expert participants (as noted in Chapter 4 heading 4.3) commented that some survey questions did not adequately address the nuances between DGBL and gamification, leading to ambiguity. For instance, questions such as "What, in your view, is the difference between game-based learning and gamification?" were excluded because they were seen as redundant and potentially confusing due to overlapping definitions and use of these terms. In the educator interviews, this interchangeable use of terms is also found. One example (noted in

Chapter 5 heading 5.9) was when The Amazing Race was referred to as gamification when it is actually an example of game-based learning and calling audience interaction gamification (during The Amazing Race) when it is not. The confusion in terminology highlights the need for a combined effort to develop and distribute standardised definitions. This confusion may lead to misapplication of strategies and delay the development of targeted interventions and assessments. Precise terminology will enable more effective communication, collaboration, and advancement in the field (Al Fatta et al., 2018; Martí-Parreño et al., 2016; Zohari et al., 2023).

This study confirms and maintains the notion presented in Chapter 1 that gamification involves creating a reward system and competitive elements to enhance engagement and motivate learning (Cheng & Su, 2012; Hamari et al., 2014; Martí-Parreño et al., 2016; Sailer et al., 2017; Videnovik et al., 2023; Wolfe & Crookall, 1998). Gamification can be applied offline, for example, by using star charts in the classroom and online, using rewards like badges for completed tasks. However, the term 'gamification' has also been loosely used to describe converting lesson content into a game, as in Barnard-Ashton et al. (2018) with their WebQuest example, indicating that 'gamifying' learning can encompass game-based learning and gamification. Clarifying these terms in health sciences education is essential for their effective advancement and integration. This dissertation proposes that DGBL is a more comprehensive concept, with gamification being just one of its elements, while gamification by itself does not fully capture the entire scope of DGBL. (Al Fatta et al., 2018; Sailer et al., 2017).

Awareness involves recognising the existence and potential benefits of using game-based learning tools in education (Sáiz-Manzanares et al., 2021). Technology is needed to start using DGBL in health science education, and thus, it was essential to look at health science educators' use of technology. When this is understood, one can look at their awareness of DGBL. Health science educators increasingly use technology to improve their teaching practices, but their familiarity and comfort with different educational technologies like DGBL vary. While some educators may be good at integrating these tools, others may require additional training and support to incorporate DGBL into their teaching effectively. This also influences whether or not they will start implementing DGBL in their classes. Professional development and training are important to equip health science educators with the skills needed to implement DGBL and gamification. Institutions should support health science educators in integrating these technologies into their teaching practices.

The findings suggest that, while some educators know about DGBL, there is still a need to increase overall awareness and understanding of its applications and benefits.

Regarding familiarity with DGBL, less than half of the participants said they were familiar with these techniques, with an even smaller percentage having practical experience. Among those who had experience, there was high confidence in the possibility of integrating these methods into health sciences curricula. Increasing awareness through workshops, seminars, and training sessions can help educators understand the potential benefits and applications of DGBL. Through greater awareness, there can be more widespread and effective use of DGBL in health sciences education.

The study showed that many health science educators are aware of DGBL, but few understand all the concepts, as evident from the interchangeable use of concepts and terms. From the interviews, it was clear that health science educators understand that DGBL encourages student engagement. It is internationally recognised that DGBL can encourage student engagement (Xu et al., 2023). However, these findings cannot be generalised to the South African context due to the diverse demographic landscape of the country (Titus & Ng'ambi, 2016). Most health science educators had a positive attitude towards these methods, sharing examples of increased interactivity and enjoyment, highlighting the potential benefits. This is consistent with research by Abdulmajed et al. (2015), which found a positive impact of games on the teaching and learning process in health professions education. The increased engagement and retention observed through DGBL indicates its effectiveness in creating a more dynamic and interactive learning environment. Comprehensive training programmes are needed to deepen educators' understanding of DGBL and its pedagogical implications. When health science educators understand DGBL better, it can lead to more informed decisions about incorporating DGBL into curricula.

Objective 3: To explore health science educators' experiences of DGBL and gamification in their teaching practices and their perspectives on the opportunities and barriers of integrating DGBL and gamification into their teaching.

The value of DGBL in enhancing student engagement was evident in the surveys and interviews. In the surveys, most health science educators had a positive attitude toward DGBL and gamification, and in the interviews, they shared examples of increased interactivity and enjoyment. Chapter 6 Section 6.3.3. explains the value that DGBL provides in promoting student engagement. Including DGBL in the curriculum can potentially improve knowledge retention and student satisfaction(Domínguez et al., 2013). Health science educators must be trained to effectively integrate DGBL into their teaching practices to maximise its benefits. Integrating DGBL into health science education can enhance student engagement, improve knowledge retention, and foster critical thinking by providing interactive and practical learning experiences. Additionally, DGBL offers

personalised learning, encourages teamwork, and delivers immediate feedback, all contributing to a more dynamic and effective educational environment (Marinensi et al., 2023).

The qualitative and quantitative results point to varying levels of familiarity and comfort with DGBL and gamification among educators. The surveys showed general awareness but fewer implementations. With the interviews, there was more familiarity (as this was a criterion). However, some interviewees were not comfortable with DGBL and gamification due to barriers such as lack of training and resources, emphasising the need for targeted professional development and support. Less than half of the participants were familiar with these techniques, and an even smaller percentage had practical experience. Among those with experience, there was high confidence in integrating these methods into health sciences curricula, supporting the literature on DGBL's effectiveness.

In a systematic review of gamification in health professions education, van Gaalen et al. (2020) found many examples of the successful implementation of GBL. However, they could not identify whether this success was due to contextual factors as the studies were either descriptive justification or clarification.

Implementation of DGBL in health science education varies, with examples ranging from blood transfusion practices to pharmacy inspection scenarios. However, long-term effectiveness is still under investigation. Effective implementation requires careful planning, clear objectives, and consideration of students' and educators' perspectives. As mentioned above, further research is needed to establish best practices for integrating DGBL into health science education.

Another aspect that came to the fore was the considerations that need to be taken into account when considering lesson design. Designing lessons that incorporate DGBL requires carefully considering the learning objectives and outcomes. Health science educators must ensure that the game elements are aligned with the curriculum and that they enhance, rather than distract from, the learning process. Effective lesson design also involves balancing game-based activities with traditional teaching methods to provide a comprehensive learning experience.

DGBL is implemented in different forms in health science education. DGBL was found to be an effective teaching tool, indicating a positive perspective by the participants and a willingness to implement DGBL. An article by Dankbaar et al. (2017) elaborates on the effectiveness of games as teaching tools. A study was done with resident doctors who

had to play a serious game in preparation for emergency skill training and found the game had a positive impact on the training level. Participants indicated that seeing the effectiveness of DGBL in the classroom would be an encouragement. This aligns with research done by Marinensi et al. (2023), who found that educators have different interest and comfort levels and are more interested in implementing DGBL and gamification if they know it will impact their students positively.

A desire for more training was a theme in the quantitative and qualitative studies. The survey showed that health science educators want to attempt different ways of teaching DGBL and gamification but want more training. This was echoed in the survey, emphasising the necessity of institutional commitment to provide resources and training and highlighting the critical role of support systems.

Barriers to implementing DGBL were discussed in the educator survey and the interviews, including health science educator-related, technology-related and student-related issues and institutional barriers. The findings of the study are echoed by Sánchez-Mena et al. (2017), who investigated the barriers to adopting gamification among teachers. The barriers to implementation are similar to those found in the educator survey. According to the study, the main barriers to implementing gamification in education include a lack of resources (time, training, economic support) and challenges with subject fit. Barriers identified in the study that are different from those identified in the educator survey are students' apathy and classroom dynamics that are not conducive to interactive activities.

This study highlights the potential of DGBL to transform health sciences education in South Africa, emphasising the need for targeted support and training to overcome existing barriers. The barriers have been discussed in detail elsewhere. By addressing these challenges, educational institutions can use the benefits of DGBL to enhance student engagement, improve learning outcomes, and create a more dynamic and effective educational experience. Integrating DGBL into the curriculum has several implications. It requires a shift towards more interactive and student-centred learning approaches. Curriculum designers need to consider how to effectively incorporate game-based elements while ensuring they align with educational standards and learning objectives. Adequate resources and support are essential for successfully integrating DGBL into health science curricula. Social constructivism and the 21st-century learning framework can be integrated in the implementation of DGBL by fostering collaborative, interactive learning environments that promote critical thinking, creativity, and digital literacy.

Ongoing research and pilot programmes can provide valuable insights into effective implementation strategies. Institutions should support experimentation and evaluation to identify best practices for DGBL in Health Sciences Education.

Participants of the educator survey also shared their perspectives about areas that DGBL enhances. Educators were of the view that DGBL can improve areas such as student engagement, evaluation, and knowledge. This aligns with studies by Hamari et al. (2016) and Ke et al. (2016). Different viewpoints were mentioned regarding the retention of knowledge and assessment techniques in DGBL. This mirrors the ongoing discussion regarding whether games can effectively facilitate knowledge retention (Rondon et al., 2013). Engaging educators in discussions about DGBL can help address concerns and build consensus on its value and potential. Understanding diverse perspectives can inform the development of more effective and acceptable DGBL strategies.

Health science educators' experiences with DGBL vary, influencing their willingness and ability to adopt these methods in their teaching. Most health sciences educators (98.6%) had experience using technology in their teaching, with only 1.4% having no prior experience. Comparing the pre-COVID-19 pandemic to current use, 94.6% reported pre-pandemic experience, while 95.9% indicated current use. Notably, 6.8% of educators who were not using technology before the pandemic have since started, while 5.4% who were using it pre-pandemic have stopped (one due to not actively teaching). In the interviews and the surveys, health science educators were willing to explore new teaching methods despite challenges. In the surveys, they showed an openness to new technologies and the implementation of different ways of teaching. In the interviews, innovative practices and a willingness to attempt different ways of teaching were highlighted. A systematic review by Abdulmajed et al. (2015) of the trends and outcomes of gaming in health professions education showed an increasing trend of health science educators using games, which has had a positive impact on the teaching and learning process. Sharing positive experiences and success stories can encourage more educators to try DGBL. Addressing challenges and providing support can help educators overcome barriers to implementation.

7.3 CONTRIBUTION TO KNOWLEDGE

This study fills a gap in the literature by providing insights into the awareness, understanding, and experiences of health science educators in South Africa regarding DGBL and gamification. By focusing on South Africa, the study offers unique perspectives that contribute to a more comprehensive understanding of the global landscape of educational innovation. This mixed methods study offered a holistic view of health science

educators' views on DGBL and gamification. By providing recommendations, this study aimed to guide future strategies for effectively integrating DGBL and gamification into educational practice, thus contributing to advancing teaching and learning in health sciences.

The survey was conducted using the newly developed instrument, and the follow-up interviews helped cover part of the gap in the literature, contributing data and insights to the growing body of knowledge about DGBL.

DGBL is a vast field with many different aspects. This study focused on the awareness, understanding and experience of health science educators in this field. One needs to know several elements in this field of research, such as technological needs and training and curriculum development.

7.4 Recommendations

Based on the findings of this study, the following recommendations are suggested to enhance the integration of DGBL and gamification into health science education:

7.4.1 Provide training and professional development

It is recommended that regular training programmes for health science educators be implemented to assist them in becoming more knowledgeable in the field of DGBL. The study identified a lack of training as a barrier. Providing professional development can bridge this gap and facilitate the adoption of these methods.

Suggested steps that can be taken to provide training and professional development:

- Schedule workshops on DGBL
- Develop online training modules
    - Encourage participation in conferences and forums on DGBL.

7.4.2 Recommendations for integration into the curriculum

These are broader recommendations that can influence educational policy and framework development to implement DGBL into the curriculum.

Suggested steps that can be taken to integrate DGBL into the curriculum

1. Include DGBL and gamification as essential components in the teaching and learning policies for the institution.
2. Allocate funding for the development and maintenance of technological infrastructure needed for DGBL.

7.5 LIMITATIONS

The study may be subject to sampling bias, as it exclusively focuses on health science educators in South Africa, which could limit the generalizability of its findings. The reliance on self-reporting measures in surveys and interviews may introduce response bias. The interchangeability of terms like DGBL and gamification by participants and the incorrect use of terminology in the interviews may introduce misinterpretation of results. While the qualitative interviews offer valuable insights into educators' experiences, the sample size and scope may be limited. A larger and more diverse sample could provide a broader range of perspectives and enrich the qualitative analysis. The COVID-19 pandemic also hindered the study, as access to respondents was limited. Future research activities should consider these limitations and adopt methodologies to solve this problem.

7.6 RECOMMENDATIONS FOR FUTURE RESEARCH

7.6.1 Future research

It is recommended that longitudinal studies be conducted. These studies can assess the long-term impact of DGBL on student engagement and learning outcomes. Studies can also be done on the impact that implementing DGBL has on health science educators. Long-term research projects can provide deeper insights into the continuous effects of DGBL, helping educators and researchers identify areas for improvement and best practices.

A research project focusing on the interchangeable use of terminology around DGBL can be done. This project could find out what terminology is used and why.

Another research project could be investigating the effectiveness of DGBL across different educational contexts and cultural settings. This could assist in understanding the broader applicability of DGBL.

Studies that can show how DGBL works in diverse environments allowing for personalised approaches that meet the specific needs of different educational settings.

Researching the impact of specific game mechanics, such as rewards and challenges, on learning and engagement can significantly enhance the design of educational games. Understanding individual game elements can help health science educators create more effective and engaging learning experiences.

7.6.2 Education practice

Collaborative research with health science educators can be done to look deeper into their day-to-day experiences with implementing DGBL in the classroom.

7.6.3 Policy recommendations

A few policies are recommended to implement DGBL successfully in health science education:

- A training and professional development policy should dictate annual professional development for educators, incorporating workshops, online modules, and financial support for conference participation.
- The budget allocation and financial support policy requires a designated portion of the annual budget for DGBL technology and software, with transparent fund management and vendor partnerships for discounts and support.
- The recognition and rewards policy should establish a programme to acknowledge and reward innovative DGBL teaching practices using specific criteria and incentives such as grants and awards.
- An institutional support system policy is necessary to create a support network with a dedicated DGBL task force and a responsive, well-trained team to assist educators.
- A resource hub development policy should focus on creating and maintaining a central hub for DGBL tools, lesson plans, and case studies, with regular updates and encouragement for educator contributions.

7.7 Conclusion

As the researcher, I have expertise and experience in DGBL and gamification; thus, I might unintentionally prioritise certain aspects of the research or interpret findings in a way that aligns with my existing knowledge and beliefs. Recognising these potential biases is essential for maintaining the integrity and validity of the research findings. Strategies such as reflexivity, peer review, and data triangulation lessened these biases and ensured a more balanced interpretation of the research outcomes. Transparent

reporting of the research process and findings will help readers assess the credibility and reliability of the study.

Integrating DGBL in health science education presents promising avenues for enhancing learning experiences. By addressing the gaps in educator awareness and understanding and exploring their experiences and perspectives, this study contributes to the ongoing conversation on new pedagogical approaches.

By building on the insights gained from this study, future research directions could focus on investigations to determine the long-term impact of DGBL on student learning outcomes. There is also a need for further research to explain the benefits and limitations of game-based learning and gamification. Further research can involve collaborative research with health science educators to examine their day-to-day experiences with implementing DGBL in the classroom. From the identified gaps, professional development opportunities can be created to equip health science educators with the skills to design and implement digital games. An instrument can be developed to assist health science educators with implementing digital games in their classrooms.

The study aligned with social constructivist and connectivist theories by emphasising the importance of interactive, student-centred learning experiences. Both qualitative and quantitative data highlight the need for engaging teaching methods that promote active learning and collaboration. The insights into educators' experiences and perceptions of DGBL and gamification provide practical evidence of how these methodologies increase knowledge construction and connectivity in learning environments.

The study was situated within the 21st-century learning framework, emphasising critical thinking, communication, and problem-solving skills. By showcasing educators' awareness, understanding, and experiences with DGBL and gamification, the study informs evidence-based guidelines for incorporating these methodologies into education programmes, thus advancing the goals of the 21st-century learning framework. The need for professional development was highlighted in this study. Health science educators want professional development and training in implementing DGBL and gamification, which creates opportunities for collaboration between health science educators, IT support, and game developers. Support structures are needed, including technical assistance, mentoring programmes, and communities of practice, to assist health science educators in overcoming implementation barriers. Providing access to learning resources and knowledge-sharing platforms can facilitate the adoption of DGBL and gamification.

Higher education institutions should integrate DGBL and gamification into curricula to align with educational principles and design frameworks. This involves identifying learning

objectives, developing relevant game-based activities, and ensuring coherence with existing coursework.

Involving students in designing and developing gamified learning activities increases engagement and encourages a sense of ownership over the learning process. Health science educators should ask for student feedback to improve the design and effectiveness of DGBL initiatives iteratively.

The potential of DGBL in health science education in South Africa is vast and largely unexplored. The findings from this study highlight the urgent need to bridge the gap between traditional teaching methods and new learning approaches (including DGBL).

In conclusion, this research journey has been both challenging and exciting. Reading all the literature and engaging with health science educators brought new perspectives. Gaps in awareness, understanding, and implementation can be bridged by implementing DGBL, thus paving the way for more inclusive and effective learning environments that are enjoyable for health science educators and students.

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APPENDICES

Appendix A: Ethical Clearance Certificates | Human Research Ethics Committee (Medical)

Certificate No: M191152

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research & Post Graduate Affairs)

TO: Ms A Calitz
Faculty of Health Sciences
Centre for Health Science Education
Medical School
University

E-mail: Amanda.Calitz@wits.ac.za

CC: Supervisor: Professor J Bruce and Dr P Barnard-Ashton <Paula.BarnardAshton@wits.ac.za> and <HREC-Medical.ResearchOffice@wits.ac.za>

FROM: Iain Burns
Human Research Ethics Committee (Medical)
Tel: 01 1 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 2020/01/29

REF: RI 4/49

PROTOCOL NO: M191152 (This is your ethics application study reference number. Please quote this reference number in all correspondence relating to this study)

PROJECT TITLE: Health Science educator's awareness, understanding and experience of digital game based learning and gamification: a mixed methods study

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to the Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

UNIVERSITY OF TH E
WITWATERSRAND. V
JOHANNESBURG R14/49 Ms A Calitz

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M191152

NAME: (Principal Investigator)	Ms A Calitz
DEPARTMENT:	Faculty of Health Sciences Centre for Health Science Education Medical School University
PROJECT TITLE:	Health Science educator's awareness, understanding and experience of digital ~~game based~~ learning and gamification: a mixed methods study
DATE CONSIDERED:	2019/11/29
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Professor J Bruce and Dr P Barnard-Ashton

Dr CB Penny, Chairperson, HREC (Medical)

APPROVED BY:

DATE OF APPROVAL: 2020/01/29

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and ONE COPY returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. I agree to submit a yearly progress report. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in November and will therefore reports and re-certification will be due early in the month of November each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE CLEARANCE CERTIFICATE NUMBER IN ALL ENQUIRIES

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

DECLARATION:

Adherence to HREC (Medical) Ethics Application Terms and Conditions

I, the undersigned, hereby declare that I have not collected data/ done secondary data analysis or any other form of research, prior to obtaining clearance certificate from the HREC (Medical) for study no: **M191152** .

I have read and understood the terms and conditions on section 9 of HREC (Medical) application form. I confirm that it is my responsibility to ensure that I have received final HREC (Medical) Clearance before commencing any research.

Amanda Calitz

Name, Surname and Signature
Student/Staff no if applicable: 1479348

Date: 20 January 2020

Dr Paula Barnard-Ashton Prof Judith Bruce

Name, Surname and Signature
Supervisor (if applicable)

Date:

Appendix B: Turn-It-In Report

Document Viewer

Turnitin Originality Report

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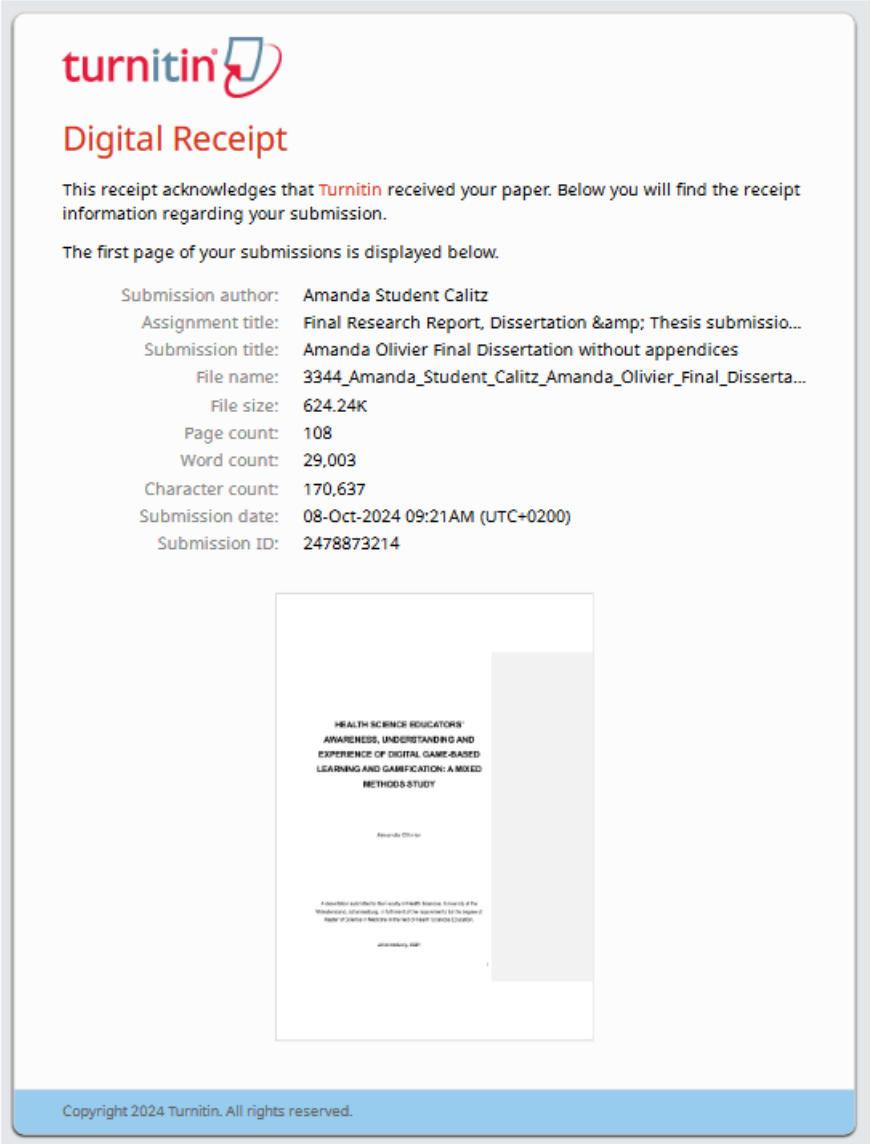

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HEALTH SCIENCE EDUCATORS' AWARENESS, UNDERSTANDING AND EXPERIENCE OF DIGITAL GAME-BASED LEARNING AND GAMIFICATION: A MIXED METHODS STUDY

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Appendix C: Consent letter for the Educator survey development

WITS UNIVERSITY

INFORMATION LETTER FOR THE EDUCATOR SURVEY INSTRUMENT DEVELOPMENT.

Good day

I am a lecturer at the University of Witwatersrand currently completing a master's in health science education degree at the University of the Witwatersrand.

I would like to invite you to take part in the Educator Survey instrument development phase of my study that is titled “Health Science Educators’ awareness, understanding and experience of DGBL and gamification: a mixed methods study”. I am inviting you as an expert participant as you hold a PhD in Education Technology, are lecturing on a Health Science Education degree program or are recognized in the field of DGBL and gamification. The purpose of the study is to provide an understanding of the potential of using DGBL and gamification as teaching tools within a 21st century learning framework. It has the potential to support the maintenance and improvement of education standards in a health sciences education context that is challenged by massification, student diversity and the ailing digital competence of health science educators. In light of the lack of an instrument to investigate DGBL and gamification in Higher Education this phase will be the development of a validated survey instrument for use in phase 2 to investigate the awareness, understanding and experience that health science educators have of DGBL and gamification.

Your participation in the study is completely voluntary. The questions will be presented to you as an expert panel participant via electronic survey using REDCap.

As an expert participant you will be asked with each round to:

1. Respond to each question as if you are a respondent to the final survey in order to validate the quality of data offered by the question.

2. Rate each question on a 1-10 scale for your expert opinion of relevance of the question to the topic, quality of the question to inform practice and clarity of the question in terms of structure and language used.

3. An open section at the end of each category will allow you to add any additional questions that they feel will be of value and comment further.

There is no risk to participation in the research project and there are no direct benefits. Your participation in the research project, however, could be valuable to understanding digital game-based learning and gamification in a South African Higher Education context.

A summary of the research project, once completed, can be made available to you at your request. Please email this request to the researcher using the details below. Results of the research project will be submitted to a peer-reviewed journal for publication.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). The ethics clearance certificate number is pending. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee, who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Your consideration to participate in this research project is greatly appreciated. If you have any questions pertaining to this research project, please contact me.

Kind regards,

Amanda Calitz

BTh (NWU) PGTD (NWU)

Email: amanda.calitz@wits.ac.za / Telephone: 011 717 3259

Dr Paula Barnard-Ashton

BSc OT, MSc OT, PhD

Supervisor

Paula.barnard@wits.ac.za

Prof Judith Bruce

DNed, BACur, BCur, MSc (Nursing), PhD

Supervisor

Judith.Bruce@wits.ac.za

CONSENT FORM FOR PARTICIPATING IN PHASE ONE OF STUDY

Title of study: Health Science Educators' awareness, understanding and experience of DGBL and gamification: a mixed methods study.

I hereby consent to take part in Phase 1 of the study as an expert participant in the instrument development.

I understand that as an expert participant I will be asked over multiple rounds to:

1. Respond to each question as if I am a respondent to the final survey in order to validate the quality of data offered by the question.
2. Rate each question on a 1-10 scale for your expert opinion of relevance of the question to the topic, quality of the question to inform practice and clarity of the question in terms of structure and knowledge used.
3. An open section at the end of each category will allow me to add any additional questions that I feel will be of value and comment further.

I understand that participation in the study is confidential and that all identifiers will be removed. I can withdraw at any time without prejudice.

Name of Participant: _____

Date: OBJ _____

Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____

Signature: _____

Date: _____

Appendix D: Final Version of the educator survey

Page 1

Expert Content Validity Educator Survey

Good day

I am a lecturer and postgraduate student at the University of the Witwatersrand currently completing a master's degree in health science education.

I would like to invite you to take part in the second phase of my study that is titled “Health Science Educators' awareness, understanding and experience of DGBL and gamification: a mixed methods study”. The purpose of the study is to provide an understanding of the potential of using DGBL and gamification as teaching tools within a 21st century learning framework. It has the potential to support the maintenance and improvement of education standards in a health sciences education context that is challenged by massification, student diversity and the ailing digital competence of health science educators.

Your participation in the study is completely voluntary. Should you choose to participate, you will be asked to complete an online survey questionnaire. By completing the survey, you are indicating that you consent to participate in this study. You will not be required to provide your

name. The survey software (Redcap) will ensure that your response is anonymous. Any demographic data that could be linked to individual participants will be coded to ensure anonymity. All data will be kept on the researcher's password protected external drive. Only the researcher, statistician and research supervisor will have access to the data.

It will take approximately 20 minutes to complete the survey questionnaire. You may return to the survey at a later stage to complete it via a link which will be sent to your email address. Your email address will not be stored.

There is no risk to participation in the research project, and there are no direct benefits. Your participation in the research project, however, could be valuable to understanding DGBL and gamification in a South African Higher Education, in the context of health sciences.

A summary of the research project, once completed, can be made available to you at your request. Please email this request to the researcher using the details below. Results of the research project will be submitted to a peer-reviewed journal for publication.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the

Witwatersrand, Johannesburg ("Committee"). The ethics clearance certificate number is R14/49. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Your consideration to participate in this research project is greatly appreciated. If you have any questions pertaining to this research project, please contact me.

Kind regards,

Amanda Calitz

BTh (NWU) PGTD (NWU)

Email: Amanda.Calitz@wits.ac.za / Telephone: 011 717 3259

Dr Paula Barnard-Ashton

BSc OT, MSc OT, PhD

Supervisor

Paula.Barnard-Ashton@wits.ac.za

Prof Judith Bruce

DNEd, BACur, BCur, MSc (Nursing), PhD

Supervisor

Judith.Bruce@wits.ac.za

The research question for this study is: Are health science educators aware of, and do they understand DGBL and gamification as teaching tools within a 21st-century learning framework, have they experienced it, and if so, how does it affect their perceptions and adoption in practice?

Definitions for the purpose of this study:

Game-based learning changes the approach to learning and teaching in a classroom. A game (online/physical) is specifically designed for learning that component of the curriculum and achievement of learning outcomes. It includes elements of competition, engagement, and immediate reward. It allows students to work alone or collaborate towards a winning outcome. Example: All the teaching and learning takes place through an Amazing Race. Students receive clues throughout the lesson, and they use that to reach their destination.

Gamification is the development of a reward system and competitive element to learning that sparks engagement and taps student motivation to learn. Example: A badge/points system in the classroom where students receive a badge for each completed task, assignment or competence.

Section 1: Lecturer usage of technology in teaching.

Did you lecture/teach using technology (tablets, computers, data projector) before the Covid-19 pandemic (before March 2020)

○ Ye ○ No

Describe how you used technology in your teaching before the COVID-19 pandemic.

Do you currently lecture/teach using technology?

○ Yes ○ No

How do you currently use technology in your teaching?

Do you design lessons with a type of device in mind? (for example: laptop, tablet, cell phone)

○ Ye ○ No

Indicate what device you design lessons for most often:

☐ laptop ☐ tablet ☐ cell phone ☐ other

Please elaborate

Section 2: Lecturer understanding of DGBL.

Do you think that there is time in the Health Science curriculum for DGBL and gamification?

○ Yes ○ No

Why do you think that there is time in the Health Science curriculum for DGBL and gamification?

Why don't you think that there is time in the Health Science curriculum for DGBL and gamification?

Lecturers often use a reward system when implementing game-based learning and gamification in their classes. Do you think that rewarding students encourages learning?

○ Yes ○ No

Why did you answer no?

On a scale from 0 (disagree) to 100 (agree) do you think that DGBL and gamification can be an effective teaching tool?

disagree indifferent agree

Please explain the reason for your answer.

_____

Indicate on the scale if DGBL and gamification enhances student engagement.

Doesn't enhance

this area of Enhances this education indifferent area of education

(Place a mark on the scale above)

Indicate on the scale if DGBL and gamification enhances summative evaluation.

Doesn't enhance

this area of Enhances this education indifferent area of education

(Place a mark on the scale above)

Indicate on the scale if DGBL and gamification enhances formative evaluation.

Doesn't enhance

this area of Enhances this education indifferent area of education

(Place a mark on the scale above)

Indicate on the scale if DGBL and gamification enhances baseline assessment.

Doesn't enhance

this area of Enhances this education indifferent area of education

(Place a mark on the scale above)

Indicate on the Likert scale if DGBL and gamification enhances knowledge retention

Doesn't enhance

this area of Enhances this education indifferent area of education

(Place a mark on the scale above)

Section 3: Lecturer implementation of DGBL.

Have you implemented DGBL and gamification in your classes?

○ Yes ○ No

What would encourage a lecturer to use DGBL and gamification in the classroom?

What barriers are you aware of that would prevent a lecturer from using DGBL and gamification in the classroom?

Do you assess students using DGBL and gamification (either baseline or continuous assessment) ?

○ Yes ○ No

How do you assess students using DGBL and gamification (either baseline or continuous assessment)?

_____

What are the benefits and shortcomings of incorporating games and simulations in student learning? Include the names of games that you use if appropriate.

Thank you for your participation. It is appreciated. A summary of the research project, once completed, can be made available to you at your request. Please email this request to the researcher at amanda.calitz@wits.ac.za

Results of the research project will be submitted to a peer-reviewed journal for publication.

Final comments:

If you would like to receive the results of this study kindly enter your e-mail address.

Appendix E: GENERATING SURVEY INSTRUMENT ITEMS (FACE VALIDITY)

Page 1

GENERATING SURVEY INSTRUMENT ITEMS (FACE VALIDITY)

INFORMATION LETTER FOR GENERATING SURVEY INSTRUMENT ITEMS (FACE VALIDITY)

Good day

I am a lecturer at the University of Witwatersrand currently completing a master's in health science education degree at the University of the Witwatersrand.

I would like to invite you to take part in the face validity section of my study that is titled "Health Science Educators' awareness, understanding and experience of digital game based learning and gamification: a mixed methods study".

The purpose of the study is to provide an understanding of the potential of using digital game based learning and gamification as teaching tools within a 21st century learning framework. It has the potential to support the maintenance and improvement of education standards in a health sciences education context that is challenged by massification, student diversity and the ailing digital competence of health science educators. In light of the lack of an instrument to investigate digital game based learning and gamification in Higher Education this phase will be the development of a validated survey instrument for use in phase 2 to investigate the awareness, understanding and experience that health science educators have of digital game based learning and gamification.

Your participation in the study is completely voluntary. The electronic Delphi technique will be used to gain expert consensus of questions to be included in the survey instrument and establish the content validity of the final instrument. The questions will be presented to you as an expert panel participant via electronic survey using.

Typically, there are 3-5 rounds to achieve consensus with initial rounds taking up to 45 minutes to complete.

You are asked to:

Respond to each question as if you are a respondent to the final survey in order to validate the quality of data offered by the question.

Rate each question on a 1-10 Likert scale for your expert opinion of relevance of the question to the topic, quality of the question to inform practice and clarity of the question in terms of structure and language used.

An open section at the end of each category will allow you to add any additional questions that they feel will be of value and comment further.

There is no risk to participate in the research project and there are no direct benefits. Your participation in the research project, however, could be valuable to understanding digital game based learning and gamification in a South African Higher Education context.

A summary of the research project, once completed, can be made available to you at your request. Please email this request to the researcher using the details below. Results of the research project will be submitted to a peer-reviewed journal for publication.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the

Witwatersrand, Johannesburg ("Committee"). The ethics clearance certificate number is R14/49. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee

secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Your consideration to participate in this research project is greatly appreciated. If you have any questions pertaining to this research project, please contact me.

Kindly complete the survey by 10 July 2020. I would appreciate feedback on their experience of completing the survey and if there are aspects that you feel should be changed.

Kind regards,

Amanda Calitz

BTh (NWU) PGTD (NWU)

Email: amanda.calitz@wits.ac.za / Telephone: 011 717 3259

Dr Paula Barnard-Ashton

BSc OT, MSc OT, PhD

Supervisor

Paula.barnard@wits.ac.za

Prof Judith Bruce

DNed, BACur, BCur, MSc(Nursing), PhD

Supervisor

Judith.Bruce@wits.ac.za

Do you consent to take part in the survey?

○ Ye ○ No

Do you identify with any of the descriptions below?

☐ Expert in digital game-based learning and gamification
☐ hold a PhD in Education Technology
☐ Health Science Educator who is currently lecturing on a health science education degree progra
☐ None of the above.

Demographic information

Name and surname:

_____

Institution that you represent:

_____

What is your occupation?

_____

E-mail address:

_____

In what country do you reside?

Afghanistan Albania Algeria Andorra Angola Antigua and Barbuda

Argentina Armenia Australia Austria Azerbaijan Bahamas Bahrain

Bangladesh Barbados Belarus Belgium Belize Benin Bhutan

Bolivia Bosnia and Herzegovina Botswana Brazil Brunei Bulgaria

Burkina Faso Burundi Cabo Verde Cambodia Cameroon Canada

Central African Republic (CAR) Chad Chile China Colombia Comoros

Democratic Republic of the Costa Rica Cote d'Ivoire Croatia Cuba Cyprus

Czechia Denmark Djibouti Dominica Dominican Republic Ecuador

Egypt El Salvador Equatorial Guinea Eritrea Estonia Eswatini (formerly Swaziland)

Ethiopia Fiji Finland France Gabon Gambia Georgia Germany

Ghana Greece Grenada Guatemala Guinea Guinea-Bissau Guyana

Haiti Honduras Hungary Iceland India Indonesia Iran Iraq

Ireland Israel Italy Jamaica Japan Jordan Kazakhstan Kenya

Kiribati Kosovo Kuwait Kyrgyzstan Laos Latvia Lebanon Lesotho

Liberia Libya Liechtenstein Lithuania Luxembourg Madagascar

Malawi Malaysia Maldives Mali Malta Marshall Islands Mauritania

Mauritius Mexico Micronesia Moldova Monaco Mongolia Montenegro

Morocco Mozambique Myanmar (formerly Burma) Namibia Nauru Nepal

Netherlands New Zealand Nicaragua Niger Nigeria North Korea

North Macedonia (formerly Macedonia) Norway Oman Pakistan Palau

Palestine Panama Papua New Guinea Paraguay Peru Philippines

Poland Portugal Qatar Romania Russia Rwanda Saint Kitts and Nevis

Saint Lucia Saint Vincent and the Grenadines Samoa San Marino Sao Tome and Principe

Saudi Arabia Senegal Serbia Seychelles Sierra Leone Singapore

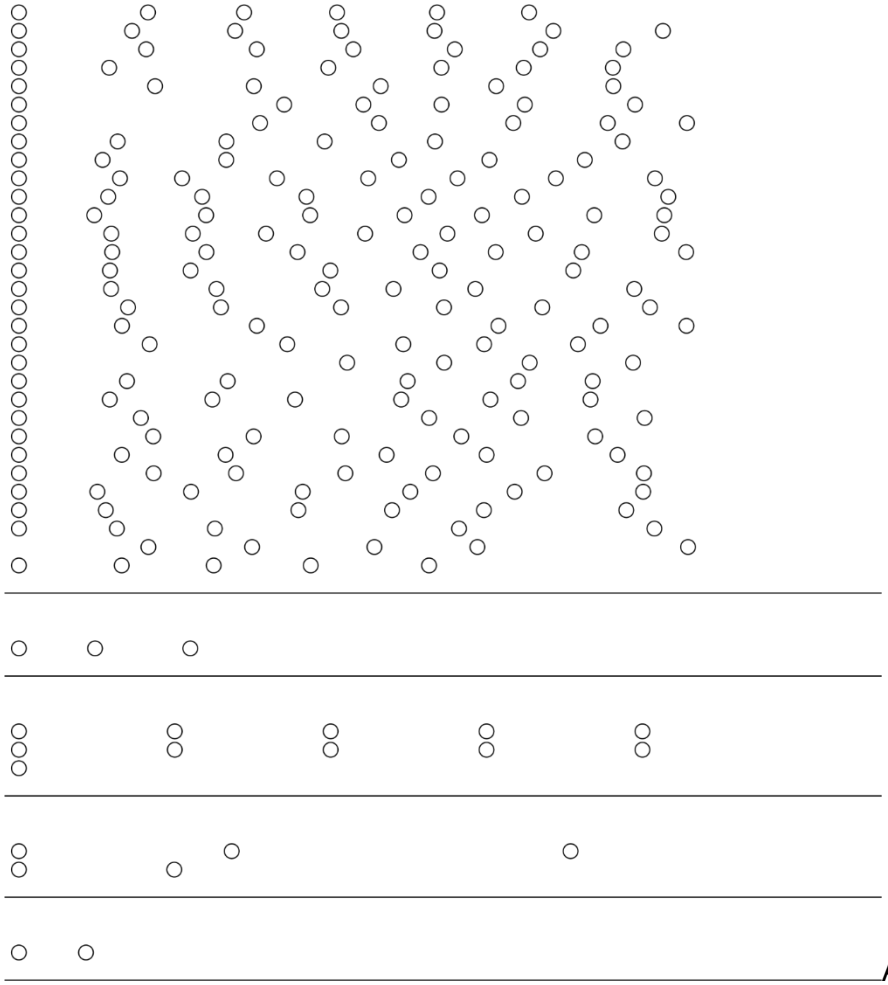
Slovakia Slovenia Solomon Islands Somalia South Africa South Korea

South Sudan Spain Sri Lanka Sudan Suriname Sweden Switzerland

Syria Taiwan Tajikistan Tanzania Thailand Timor-Leste Togo

Tonga Trinidad and Tobago Tunisia Turkey Turkmenistan Tuvalu

Uganda Ukraine United Arab Emirates (UAE) United Kingdom (UK) United States of



America (USA)

Uruguay Uzbekistan Vanuatu Vatican City (Holy See) Venezuela Vietnam Yemen Zambia Zimbabwe other

Kindly specify your gender:

Male Female Other

What is your age?

15-20 years old 21-25 years old 26-30 years old 31-35 years old 36-40 years old 41-45 years old 46-50 years old 51-55 years old 56-60 years old 61-65 years old

66+ years old

What is your Educational status?

Completed High School Undergraduate degree/ Bachelor degree Honors degree Masters degree PHD

Do you have experience with digital game based learning in a health science education setting?

Yes No

Link to your proffesional profile (for example Website or Linkedin profile)

_____

How long have you been implementing digital game based learning?

○ Haven't implemented digital game based learning yet.
○ Less than one year
○ 1-2 years
○ 3-4 years
○ 5-10 years
○ more than 10 years

The research question for this study is: Are health science educators aware of and understand digital game based learning and gamification as teaching tools within a 21st century learning framework, have they experienced it and if so how does it affect their own perceptions and adoption in practice?

1. Respond to each question as if you are a respondent to the final survey in order to validate the quality of dataoffered by the question.

2. Rate each question on a 1-10 likert scale for your expert opinion of relevance of the question to the topic, qualityof the question to inform practice and clarity of the question in terms of structure and knowledge used.

3. An open section at the end of each category will allow you to add any additional questions that you feel will be ofvalue and comment further.

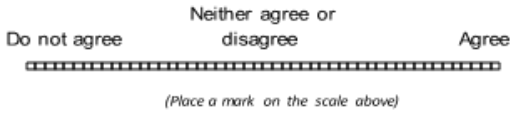
Section 1

1. **Respond to each question as if you are a respondent to the final survey in order to validatethe quality of data offered by the question.**
2. **Rate each question on a 1-10 likert scale for your expert opinion of relevance of thequestion to the topic, quality of the question to inform practice and clarity of the question in terms of structure and knowledge used.**

Did you lecture/teach using technology before the Covid-19 pandemic

○ Ye ○ No

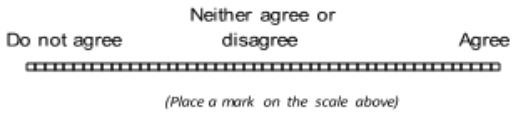
The question: "Did you lecture/teach using technology before the Covid-19 pandemic" should be included in the survey



Do you currently lecture/teach using technology?

○ yes ○ no

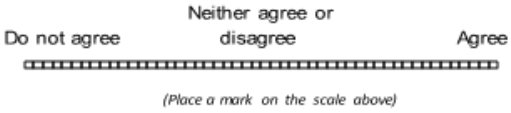
The question: "Do you currently lecture/teach using technology?" should be included in the survey.



How often do you use devices (tablet,laptop,cellphone) in your classroom?

○ every day ○ every second day ○ once a week ○ every two weeks ○ once a month
○ once every 6 months ○ never

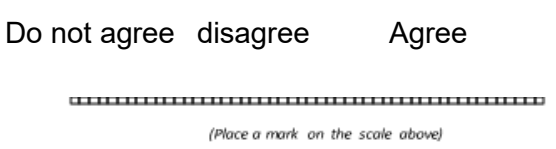
The question: "How often do you use devices (tablet,laptop,cellphone) in your classroom?" should be included in the survey.



How often do you use devices (tablet,laptop,cellphone) to play games?

○ every day ○ every second day ○ once a week ○ every two weeks ○ once a month
○ once every 6 months ○ never

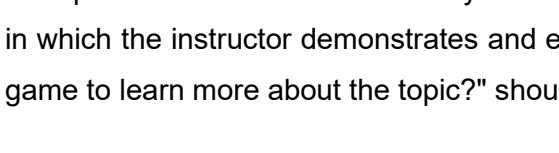
The question: "How often do you use devices (tablet,laptop,cellphone) to play games?" should be included in the survey.



For the classes that you teach, would you prefer to teach in a traditional lesson in which the instructor demonstrates and explains to the class or in a class where you play a game to learn more about the topic?

○ yes ○ no

The question: "For the classes that you teach, would you prefer to teach in a traditional lesson in which the instructor demonstrates and explains to the class or in a class where you play a game to learn more about the topic?" should be included in the survey.



Do you have any questions that you would like to add to this section?

Section 2

1. **Respond to each question as if you are a respondent to the final survey in order to validatethe quality of data offered by the question.**
2. **Rate each question on a 1-10 likert scale for your expert opinion of relevance of thequestion to the topic, quality of the question to inform practice and clarity of the question in terms of structure and knowledge used.**

Have you heard of the concept: digital game based learning?

○ yes ○ no

The question: "Have you heard of digital game based learning should?" be included in the survey.

Do not agree | Neither agree or disagree | Agree

(Place a mark on the scale above)

Have you heard of the concept: gamification?

○ yes ○ no

The question: "Have you heard of the concept: gamification?" should be included in the survey.

Do not agree | Neither agree or disagree | Agree

(Place a mark on the scale above)

Do you play games in your free time?

○ yes ○ no

The question: "Do you play games in your free time?" should be included in the survey.

Neither agree or
Do not agree disagree Agree

(Place a mark on the scale above)

If you play games in your free time. How often do you play games in your free time?

○ every day
○ every second day
○ once a week
○ every two weeks
○ once a month
○ once every 6 months
○ never

The question: "If you play games in your free time. How often do you play games in your free time?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

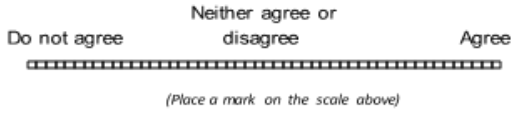
(Place a mark on the scale above)

Do you have any questions that you would like to add to this section?

Is there a place in the curriculum for digital game based learning?

○ yes ○ no

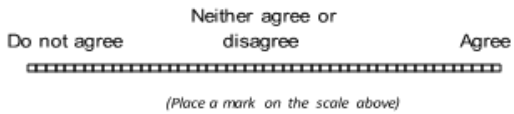
The question: "Is there a place in the curriculum for digital game based learning?" should be in the survey?



Do you think that rewarding students encourages learning?

○ yes ○ no

The question: "Do you think that rewarding students encourages learning?" should be included in the survey.



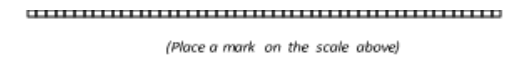
Do you think that digital game based learning is an effective teaching tool?

○ yes ○ no

The question: "Do you think that digital game based learning is an effective teaching tool?" should be included in the survey.

Neither agree or

Do not agree disagree Agree



What, in your view, is the difference between game based learning and gamification?

The question: "What, in your view, is the difference between game based learning and gamification?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

How can digital game based learning enhance education?

The question: "How can digital game based learning enhance education?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

Do you have any questions that you would like to add to this section?

Do you think that the "fail fast" principle in game based learning is an effective teaching tool?

○ yes ○ no

The question: "Do you think that the "fail fast" principle in game based learning is an effective teaching tool?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

How can the best practices/methods for designing and incorporating games and simulations in student learning be identified?

The question: "How can the best practices/methods for designing and incorporating games and simulations in student learning be identified?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

What teaching theories in your view uderpin digital game based learning?

The question: "What teaching theories in your view uderpin digital game based learning?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

What skills does digital game based learning teach students?

The question: "What skills does digital game based learning teach students?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

Does digital game based learning increase students interest in learning more about the subject that you teach?

○ yes ○ no

The question: "Does digital game based learning increase students interest in learning more about the subject that you teach?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

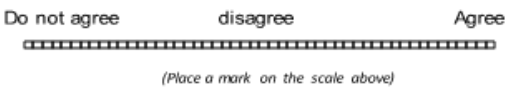
Do you have any questions that you would like to add to this section?

Have you implemented digital game based learning in any of your lessona?

○ yes ○ no

The question: "Have you implemented digital game based learning in any of your instruction sessions?" should be included in the survey.

Neither agree or

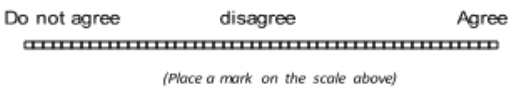


Do you think that lecturers and teachers need training to implement game based learning effectivel

○ yes ○ no

The question: "Do you think that lecturers and teachers need training to implement game based learning effectively?" should be included in the survey.

Neither agree or

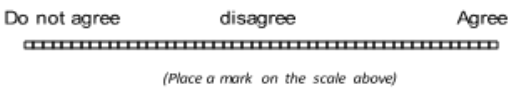


Do you plan to assess or have you assessed students using digital game based learning?

○ yes ○ no

The question: "Do you plan to assess or have you assessed students using digital game based learning?" should be included in the survey.

Neither agree or



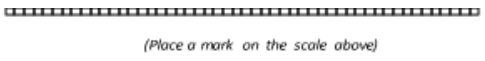
How do you use digital game based learning in your classess?

○ yes ○ no

The question: "How do you use digital game based learning in your classess?" should be included in the survey.

Neither agree or

Do not agree disagree Agree



Name the computer based games that you use in your classroom.

The question: "Name the computer based games that you use in your classroom?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

Do you have any questions that you would like to add to this section?

Have you created your own game to use in the classroom?

○ yes ○ no

The question: "Have you created your own game to use in the classroom?" should be included in the survey.

Neither agree or
Do not agree disagree Agree

(Place a mark on the scale above)

Do you use "ready made" games in your classroom?

○ yes ○ no

The question: "Do you use "ready made" games in your classroom?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

What would prevent a lecturer from using digital game based learning in the classroom?

The question: "What would prevent a lecturer from using digital game based learning in the classroom?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

What would encourage a lecturer to use digital game based learning in the classroom?

The question: "What would encourage a lecturer to use digital game based learning in the classroom?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

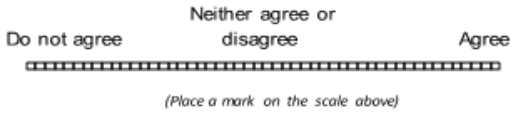
(Place a mark on the scale above)

Do you have any questions that you would like to add to this section?

Is there a place in the curriculum for digital game based learning?

○ yes ○ no

The question: "Is there a place in the curriculum for digital game based learning?" should be in the survey?



Do you think that rewarding students encourages learning?

○ yes ○ no

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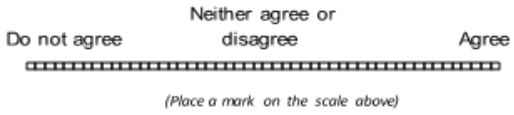

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Do not agree disagree Agree



What, in your view, is the difference between game based learning and gamification?

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Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

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The question: "How can digital game based learning enhance education?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

(Place a mark on the scale above)

Do you have any questions that you would like to add to this section?

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○ yes ○ no

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Neither agree or

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Neither agree or

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Do not agree disagree Agree

(Place a mark on the scale above)

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○ yes ○ no

The question: "Do you think that lecturers and teachers need training to implement game based learning effectively?" should be included in the survey.

Neither agree or

Do not agree disagree Agree

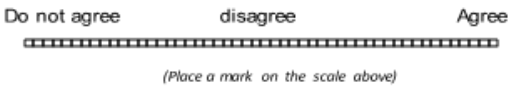
(Place a mark on the scale above)

Do you plan to assess or have you assessed students using digital game based learning?

○ yes ○ no

The question: "Do you plan to assess or have you assessed students using digital game based learning?" should be included in the survey.

Neither agree or



How do you use digital game based learning in your classess?

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Neither agree or

Do not agree disagree Agree



Name the computer based games that you use in your classroom.

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Do not agree disagree Agree

(Place a mark on the scale above)

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The question: "Have you created your own game to use in the classroom?" should be included in the survey.

Neither agree or
Do not agree disagree Agree

(Place a mark on the scale above)

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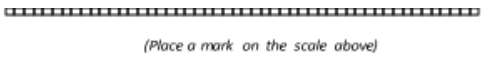

(Place a mark on the scale above)

What would encourage a lecturer to use digital game based learning in the classroom?

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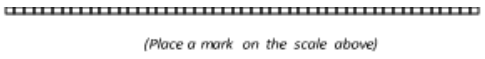
Neither agree or

Do not agree disagree Agree



(Place a mark on the scale above)

Do you have any questions that you would like to add to this section?

Appendix F: Consent letter Educator Survey



INFORMATION LETTER FOR THE EDUCATOR SURVEY.

Good day

I am a lecturer at the University of Witwatersrand currently completing a master's in health science education degree at the University of the Witwatersrand.

I would like to invite you to take part in the second phase of my study that is titled “Health Science Educator’s awareness, understanding and experience of DGBL and gamification: a mixed methods study”. The purpose of the study is to provide an understanding of the potential of using DGBL and gamification as teaching tools within a 21st century learning framework. It has the potential to support the maintenance and improvement of education standards in a health sciences education context that is challenged by massification, student diversity and the ailing digital competence of health science educators.

Your participation in the study is completely voluntary. Should you choose to participate, you will be asked to complete an online survey questionnaire. By completing the survey, you are indicating that you consent to participate in this study. You will not be required to provide your name. The survey software (Redcap) will ensure that your response is anonymous. Any demographic data that could be linked to individual participants will be coded to ensure anonymity. All data will be kept on the researcher's password protected external drive. Only the researcher, statistician and research supervisor will have access to the data.

It will take approximately 20 minutes to complete the survey questionnaire. You may return to the survey at a later stage to complete it via a link which will be sent to your email address. Your email address will not be stored.

There is no risk to participation in the research project and there are no direct benefits. Your participation in the research project, however, could be valuable to understanding digital game based learning and gamification in a South African Higher Education in the context of health sciences.

A summary of the research project, once completed, can be made available to you at your request. Please email this request to the researcher using the details below. Results of the research project will be submitted to a peer-reviewed journal for publication.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). The ethics clearance certificate number is pending. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Your consideration to participate in this research project is greatly appreciated. If you have any questions pertaining to this research project, please contact me.

Kind regards,

Amanda Calitz

BTh (NWU) PGTD (NWU)

Email: amanda.calitz@wits.ac.za / Telephone: 011 717 3259

Dr Paula Barnard-Ashton

BSc OT, MSc OT, PhD

Supervisor

Paula.barnard@wits.ac.za

Prof Judith Bruce

DNed, BACur, BCur, MSc(Nursing), PhD

Supervisor

Judith.Bruce@wits.ac.za

CONSENT FORM FOR PARTICIPATING IN THE EDUCATOR SURVEY.

Title of study: Health Science Educators' awareness, understanding and experience of DGBL and gamification: a mixed methods study.

I hereby consent to take part in the Educator Survey as a participant you will be asked to complete an online survey questionnaire. By completing the survey, I am indicating that I consent to participate in this study. I will not be required to provide my name.

It will take approximately 20 minutes to complete the survey questionnaire. I may return to the survey at a later stage to complete it via a link which will be sent to my email address.

I understand that participation in the study is confidential and that all identifiers will be removed. I can withdraw at any time without prejudice.

Name of Participant: _____

Date: _____

Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____

Signature: _____

Date: _____

Appendix G: Consent Form: Interviews

INFORMATION SHEET FOR INTERVIEWS.

Good day

I am a lecturer at the University of Witwatersrand currently completing a master's in health science education degree at the University of the Witwatersrand.

I would like to invite you to take part in phase 3 of my study that is titled “Health Science Educators’ awareness, understanding and experience of DGBL and gamification: a mixed methods study.” The purpose of the study is to provide an understanding of the potential of using DGBL and gamification as teaching tools within a 21st century learning framework. It has the potential to support the maintenance and improvement of education standards in a health sciences education context that is plagued by massification, student diversity and the ailing digital competence of health science educators.

In the survey that you completed as part of the 2nd phase of my study you have indicated that you have experience in Health Science Education on the use of DGBL and gamification, and that you would and be willing to participate in the interview phase. For this reason, I would like to invite you to an interview to discuss the topic in more depth. The interview will be via a Teams call (virtually) or face to face and will be conducted by myself. All interviews will be conducted in English and audio recorded, transcribed and anonymised to ensure your confidentiality.

Your participation in the study is completely voluntary. You are welcome to withdraw at any time.

There is no risk to participation in the research project and there are no direct benefits. Your participation in the research project, however, could be valuable to understanding digital game based learning and gamification in a South African Higher Education context.

A summary of the research project, once completed, can be made available to you at your request. Please email this request to the researcher using the details below. Results of the research project will be submitted to a peer-reviewed journal for publication.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). The ethics clearance certificate number is pending. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Your consideration to participate in this research project is greatly appreciated. If you have any questions pertaining to this research project, please contact me.

Kind regards,

Amanda Calitz

BTh (NWU) PGTD (NWU)

Email: amanda.calitz@wits.ac.za / Telephone: 011 717 3259

Dr Paula Barnard-Ashton

BSc OT, MSc OT, PhD

Supervisor

Paula.barnard@wits.ac.za

Prof Judith Bruce

DNed, BACur, BCur, MSc(Nursing), PhD

Supervisor

Judith.Bruce@wits.ac.za

CONSENT FORM FOR AUDIO RECORDING AND TRANSCRIPTION OF INTERVIEW FOR STUDY PARTICIPATION

Title of project: Health Science Educator's awareness, understanding and experience of DGBL and gamification: a mixed methods study.

I hereby consent to audio recording and transcription of the interview.

I understand that:

- The recording and transcription will be stored in a secure location (a locked cupboard or password protected computer) with restricted access to the researcher and the research supervisor.
- The recording will be transcribed and any information that could identify me will be removed,

- The recordings will be erased within either (a) two (2) years of the publication of the research findings, or (b) six (6) years, if no publications arise from this research
- Anyone wishing to access this information in the future will first have to obtain the approval of the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg
- Direct quotes from my interview, without any information that could identify me, may be cited in the research report or other write-ups of research.
- I can withdraw from the study at any time.

Name of Participant: _____

Date: _____

Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____

Signature: _____

Date: _____

Appendix H: Data Extraction Form Scoping Review

Author and year of publication	Location of study	Institution	Nature of study	Study population	Implementation of gbl	Student Perspective	Lect Pers
Titus et al 2014	South Africa	University	Conference proceeding	Sports Science students	DGBL is beneficial in a sports science course. that game-based learning improves group collaboration and enhances student construction of knowledge in a sports sciences course		
Foss et al 2014	Norway	University	Randomized Controlled	Nursing Students	Promote active learning Offer immediate feedback Work in a controlled environment Motivational learning Reduce anxiety Reduce monotony		

					The implementation of a game (The Medication game) to improve students exam results didn't provide significantly improved exam results.		
Abdulmajed et al 2015	USA	University	Systematic Review		Games have positive impact on the teaching/learning process. ? Games can be used as a context for formative assessment. ? Assessment tools need to fully capture the learning that may be occurring in the games. ? Conceptual assessment framework represents six models, which can guide us in the design and assessment of educational games		
Tang, A et al 2017	Singapore	University	Randomized Controlled	Nursing students	Serious game to teach blood transfusion practice	Given that the experimental group has acquired	

					Baseline assessment before playing the game Didactic learning might not be sufficient for acquiring knowledge on blood transfusion This study provided evidences on potential of gaming technologies in engaging students' learning and developing their knowledge and confidence on safe blood transfusion practice. The findings have encouraged us to continue developing the serious game to realize its full potential. Given the flexibility, practicality, and scalability, it serves as a promising pedagogical approach to optimize learning when blended with high-fidelity simulation.	higher levels of knowledge, it is unsurprising that this group demonstrated increased confidence levels in performing the blood transfusion procedure after the gaming intervention.	

Barnard-Ashton et al 2018	South Africa	University		Occupational Therapy	In another study reported on the introduction of a WebQuest with gamification elements that allow undergraduate students to work at their own pace as part of an orientation session to the University of the Witwatersrand's online environment. Students found the WebQuest beneficial to learning but were undecided about the enjoyability of the activity because of technical difficulties and its time-consuming nature. Once again no evidence was reported from the educator's perspective.		
Titus, S 2019	South Africa	University	Case study	sport psychology	There are at least two major lessons to consider when developing games in health sciences education, i.e. game design and group		

					dynamics. Game design takes into account time and academic challenge, i.e. games should be designed with degrees of difficulty so that students are able to improve their competence with subject matter embedded in the digital game. Lack of time resulted in anxiety and therefore time allocation had to be adjusted in the final game. Group dynamics takes into account that groups should be randomised to avoid the formation of cliques. This, coupled with small groups of not more than five players per team, allows for better productivity, interaction, integration and group cohesion. These are integral design features to be embedded in a digital game for learning to ensure interaction, engagement and co-		

					construction of knowledge in a fun and meaningful way. This innovation offered new insight into the development of a digital game to facilitate engagement in the health sciences, and it is a novel way to support a current blended learning environment. Declaration.		
Bayram, S 2019	Turkey	University	Randomized trial	Nursing students	A game-based virtual reality phone application is used as a simulation to teach psychomotor skills in nursing education. In this study, an increase was observed in the final mean scores for the skill of suctioning a tracheostomy tube in both control and ex-perimental group students.		

					Using a game-based virtual reality phone application as a support for formal nursing education develops the knowledge and skills of students.		
Gentry, S V 2019	United Kingdom	University	Systematic Review		Although serious gaming and gamification interventions appear to have much potential, rigorous evaluation is required to assess whether they can lead to effective learning. There Serious gaming/gamification has the potential to reach a global audience and hence has been identified as a possible educational strategy that could contribute to transformation of health professions education. Results from our review show that serious gaming/gamification		

					in pre- and post-registration health professions education could result in increased knowledge, skills, and satisfaction when compared to traditional education and, perhaps, other modalities of digital education Most of the current literature on the effectiveness of serious gaming/gamification has been performed in high-income countries, which limits the applicability of this review's findings to low- and middle-income countries. This is a key gap in the evidence, as low- and middle-income countries are most affected by the worldwide shortage of trained health workers [46]. Other limitations of the evidence base include the lack of		

					studies assessing patient outcomes, or clinician behavior The cost of serious gaming devices might be a barrier for use compared with traditional lectures or text books. For example, some of the included studies used game consoles, which many health care workers, particularly in low- and middle-income settings, may not have access to. Other included studies used lower-cost modes of delivery, such as projecting a serious game to a group of students who played together. However, none of the eligible studies provided any information about economic outcomes of education or adverse or unintended effects of the intervention, which limits our understanding of the		

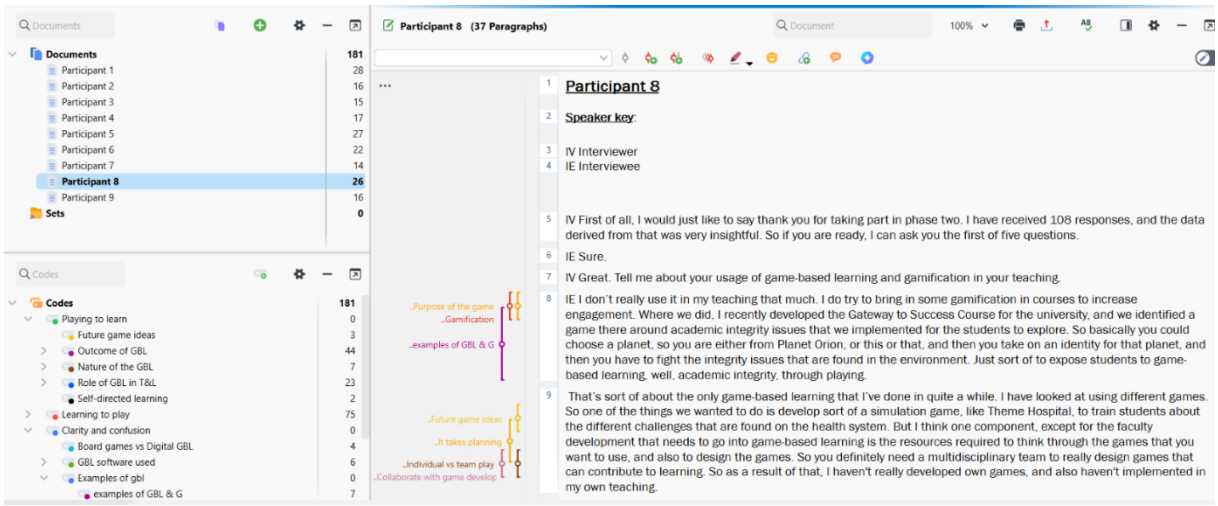
					feasibility of implementing these interventions in practice and our understanding of the applicability of serious gaming/gamification as a cost-effective solution. Considering the types of interventions that may be effective, based on classification of interventions by original design intention, there were no clear patterns suggesting differing effectiveness between custom designed games and commercia		
Volejnikova-Wenger S 2020	Australia	University	Interpretative phenomenology	Nursing Students	Environmental hazard and risk assessments are an essential compo- nent of healthcare in community and residential settings. The need for competent professionals to cater for the growing	Interpret phenom was us answer question 'What health s experien using a game t environm	

					demand in the com- munity and aged care sector requires innovative and adaptable learning tools, which engage learners and provide a comprehensive assessment platform for education and employment providers. Serious games research has been mostly concerned with knowledge outcomes of par- ticipants and scarcely investigated the perceptions and experiences of students who use a serious game. Within the KNavEL model the themes of Knowing, Navigating, Engaging, and Learning provide understanding about how participants learn using serious games. Knowledge of subject matter, navigating this and more importantly the technology, impacts engagement with the	hazard safety assessm commun resi- healthca settings key inter determin how was experien using a game.

					learning tool, with acquisition of new knowledge informing the next circuit of learning. This model reflects students' experiences, identifies the important components of an effective and engaging serious game and offers insights for future development of these innovative learning tools. Comments such as 'my critical thinking was activated', and 'this game is engaging I want learn more' are important messages which confirm the value of serious games in health care education. Further, insights obtained from this research may extend under- standing and application of serious games in varied disciplines in	

					healthcare education. Funding	
Shaikh, R 2021	South Africa	University	Case Study	Undergraduate Pharmacy students	Game created for Pharmacy students	
Arruzza E, Chau M. 2021	Australia	University	Scoping review	Undergratuade students		

Appendix I: Example of Coding (Interview)



Appendix J: Interview Guide

Interview guide

Good morning/afternoon. Thank you for agreeing to take part in this study. The aim of the study is to provide insight into the introduction of game based learning in the MSc Nursing Education curriculum. I will be recording the interview for the purpose of transcription and data analysis. If you feel uncomfortable at any time or don't want to answer a question please let me know and I will stop the interview.

(The questions below are a guide. Open ended questions will be followed by prompting questions to clarify answers)

Questions

Objective 1: To determine the general experience the participant had when game based learning was introduced.

Question: What was your experience of game based learning?

Probing questions: 1. Did you learn anything new?

2. How did it make you feel?

Objective 2: To determine which contexts or situations have influenced the participants experience of the phenomenon.

Question: What influenced your experience of game based learning?

Probing questions: 1. Did your computer skills influence you?

2. Your access to the internet?

3. The time you have available?

Objective 3: To investigate whether the participants would introduce game based learning in their own teaching practices.

Question: Would you use game based learning to teach your students? Why?

Probing questions: 1. Do you think that game based learning can be used in your classroom?

2.Do you see any benefits to bring game based learning in your teaching?