



Exploring escape rooms as a game-based learning approach to promote student
motivation

by

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DECLARATION

I declare that the dissertation which I hereby submit for the degree Magister Educationis at the University of Pretoria, is my own work and has not previously been submitted by me or anyone else for a degree at this or any other tertiary institution.

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ABSTRACT

This dissertation offers the results of a completed master's project that used a mixed-method approach within a pragmatic paradigm and an exploratory sequential mixed-method design. The study aimed to research and enhanced student motivation by deploying a virtual escape room with a game-based learning approach. With the growing importance of student motivation, particularly in the global pandemic and online learning context, the research sought to address the challenge of understanding and engaging Generation Z effectively through innovative teaching and learning approaches enabled by technology-supported learning environments, such as an escape room.

The research intended to find trends and motivating elements leading to student motivation by conducting a case study focusing on a game-based virtual escape room. The researcher designed the escape room using an associated Microsoft Excel document containing the problems for the scenario. For the purpose of leaving the room, the terms “escape room” and “document” were used interchangeably. Following the game, the researcher collected data by administering a Qualtrics survey with 546 participants responding, and five participants were chosen for semi-structured interviews. Purposive, voluntary, and convenience sampling strategies were used to collect data. The survey data collected was downloaded as a Microsoft Excel file from Qualtrics and loaded onto SPSS to produce the tables and graphs. The semi-structured interviews were recorded via Blackboard Collaborate and transcribed using Otter.ai, and the transcriptions were organised into tables in Microsoft Word.

This study's findings add to the theoretical knowledge of student motivation by shedding light on the potential of a game-based learning approach to improve motivation. Furthermore, this study informs future learning and teaching possibilities by revealing motivational variables and tactics that can be used to improve educational experiences. This study contributes to the field of educational gaming and instructional design by investigating student motivation through the lens of a game-based learning strategy within a virtual escape room.

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Exploring online escape rooms as a game-based learning approach to promote student motivation

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This Ethics Clearance Certificate should be read in conjunction with the Integrated Declaration Form (D08) which specifies details regarding:

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- No significant changes,
- Informed consent/assent,
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ETHICS STATEMENT

The author, Ciska Snyman, whose name appears on the title page of this dissertation, has obtained for the research described in this work, the applicable research ethics approval. The author declares that she has observed the ethical standards required in terms of the University of Pretoria's Code of Ethics for researchers and the Policy guidelines for responsible research.

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ABBREVIATIONS AND ACRONYMS

Table 1: Abbreviations and Acronyms

Abbreviations and Acronyms	
AIM	Academic Information Management
GBL	Game-based Learning
ARCS	Attention, Relevance, Confidence and Satisfaction Motivational Model
SRQ	Sub research question
SPSS	Statistical Package for the Social Sciences
CAT / RTT	Computer Application Technology
IT	Information Technology

CHAPTER 1: INTRODUCTION

1.1 Introduction

The educational ecosystem has undergone monumental transformation over the last two decades, with significant advances in technology and pedagogical approaches. This transformation, as noted by Veldkamp et al. (2020a), has been characterised by a shift from traditional classroom-based teaching to more interactive and immersive methods of instruction. This shift has been facilitated by the incorporation of technology in education, which has enabled the development of new approaches, such as gamification and game-based learning.

As a result of the COVID-19 pandemic, educational institutions were forced to make a shift from traditional teaching and learning methods to online learning when they had to adapt to the pandemic. Although educators have had numerous opportunities to utilise technology and to diversify their methods, such as through digital game-based learning and innovative delivery approaches (Chen & Hwang, 2014), studies conducted during COVID-19 have shown that students lack motivation while studying online (Markowitz, 2020).

Shatto and Erwin (2017) conducted research on the complex issue of bridging the generational gap between Generation Z's younger members and their instructors. The generation that succeeds the Millennial generation is known as Generation Z (1995 - 2010), or simply Gen Z (Cantillon, 2019). They are frequently distinguished by their comfort with technology, a strong emphasis on individuality, and a concern for diversity and social issues because they were raised in a highly digital and connected environment (Benítez-Márquez et al., 2022).

As this generation reaches adulthood and becomes a more powerful demographic, it is anticipated that they will substantially impact many facets of society in this case teaching and learning (Dwivedi et al., 2021). One of the focal points of the study was the distinct set of characteristics that typify Generation Z students. These characteristics can have a significant impact on how they learn and communicate with their teachers, so educators must understand and adapt to these characteristics to

facilitate a more effective learning experience. For example, the ability of students to focus is limited, and they do not engage in the process of teaching and learning in a meaningful way; hence, motivation and focus are lost (Partovi & Razavi, 2019).

Motivation for students in the digital age is generally a vital concern among lecturers as student lack of motivation might lead to disinterest in their learning process (Granito & Chernobilsky, 2012). Motivating students is a recurrent issue in learning, where many frameworks such as Herzberg's two-factor theory, McClelland's three needs theory, McGregor's Theory X, Maslow's hierarchy of needs and Keller's ARCS motivational model have been applied to comprehend and explain the various factors that influence human behaviour and motivation. These frameworks provide a theoretical foundation for understanding how various motivators, such as rewards, goals, self-efficacy, and social influence, can influence an individual's behaviour and motivation. Motivational frameworks are used in education to better understand how to motivate students and to improve their academic performance. They are also used to identify potential barriers to student motivation and to develop strategies to overcome them. To maintain student motivation and focus, researchers have found solace in game-based learning (Breien & Wasson, 2021). This approach involves incorporating gaming elements into the learning context (Corkill, 2009). Game-based learning has the potential to engage students in real-world situations, while digital game-based learning can immerse them in virtual environments (Taub et al., 2020).

An example of a successful game-based learning activity is the use of escape rooms. In an escape room, players are trapped in a room and must utilise clues and puzzles within the room to solve problems and escape before a time limit expires (Clarke et al., 2017). These escape rooms are often designed to simulate various fictional environments, such as elevators, locked spaces, or prison cells. Escape rooms have gained popularity for team-building exercises and recreational purposes (Costa et al., 2020).

The original concept of escape rooms stems from video games that consist of escape room situations in a gameplay setting. The players must solve a puzzle by interacting with other players in that room to escape and advance to the next level (Schaffhauser, 2017). Escape rooms in an educational context could potentially involve puzzles, hints

and riddles related to the topic or theme of the content, which must be solved in a specific period of time before students can move on to the next room and ultimately escape from the room (Corkill, 2009). While there are no specific resolutions, there are numerous approaches to help educators with this predicament, such as incorporating game-based learning, more specifically educational escape rooms (Granito & Chernobilsky, 2012). Completing the steps in the escape room and reaching the next room or escaping the room will give students a feeling of satisfaction and a sense of accomplishment, which can promote motivation (Klawe, 2017). Adding to the emotions of satisfaction and accomplishment, escape rooms in an online educational context could contribute to student motivation because students currently in the classes are predominantly technology-orientated Generation Z (Cantillon, 2019). This study focuses on how an online escape room can support student motivation, considering the potential lack of motivation associated with online studying (Meşe et al., 2021), the significant opportunities afforded by technology (Beer & Mulder, 2020), and its impact on student motivation (Klawe, 2017).

1.2 Background

The first year at a higher education institution is crucial because it lays the foundation for the remainder of a student's studies (Kift, 2014). An essential aspect of a first-year student is motivation towards learning the content of their modules. Educators should understand motivation as it forms part of every aspect of students' lives. The development of an educational virtual escape room has laid a solid foundation for fostering an understanding of the factors that drive student motivation, as well as providing a promising opportunity to improve the quality of learning and teaching (Moffett & Cassidy, 2023). This cutting-edge tool has enormous potential to assist educators in gaining valuable insights into students' individual preferences and experiences, which can then be used to optimise instructional strategies and to create a more engaging and personalised learning experience (Psyché et al., 2019b). Virtual escape rooms can inspire students to take ownership of their learning journey and to achieve their full potential by facilitating active, experiential learning and fostering a sense of curiosity and exploration. In the digital age of the 21st century (Psyché et al., 2019a), educational trends have sparked innovative approaches to meaningful content delivery (Eukel et al., 2020). Through engaging students with diverse digital learning

tools, such as online educational escape rooms, their interest in expanding knowledge and improving technological skills may be stimulated. Utilising these tools has the potential to enhance student motivation, encouraging proactive learning, comprehension, and application of the content (Hogle, 2017).

1.3 Problem Statement

The adoption of digital tools in teaching and learning has grown in importance in today's educational landscape, particularly among the Generation Z cohort. They expect to encounter digital tools in their educational experiences because, as true digital natives, they have grown up with technology as a fundamental aspect of their daily lives. Despite the availability of digital educational tools, many educators continue to use traditional paper-based methods, which can lead to a lack of engagement and motivation among students, especially those in their first year of study (Ordu , 2021). In addition to occasional shifts by educators back to traditional teaching methods, there is a perpetual emergence of new learning and teaching strategies. Factors such as insufficient student participation and decreased academic performance can collectively drive the demand for fresh and innovative approaches to teaching and learning interventions. As an educator who works closely with a large group of first-year students, I have noticed that, when traditional teaching methods are used, students lose interest. This presents a two-fold challenge: first, students' motivation levels need to be addressed in order to encourage active participation and learning; and second, digital tools must be incorporated into the learning experience to meet students' expectations and enhance their overall engagement (Francis & Hoefel, 2018). Previous studies did not explore student motivation within the context of a virtual escape room using Microsoft Excel knowledge and game-based learning features. This study aimed to address this gap in research.

1.4 Purpose and Rationale

In response to the evolving needs of students in teaching and learning approaches (Schwieger & Ladwig, 2018), the integration of technology has revolutionised education, enhanced accessibility and enabling novel modes of communication (Raja & Nagasubramani, 2018). However, understanding the expectations and requirements of the Generation Z cohort is crucial for ensuring effective teaching and learning

experiences (Kışla & Karaolan, 2020). Therefore, this research was undertaken to investigate the potential of incorporating a game-based learning approach through an online virtual escape room activity, specifically designed around a Microsoft Excel module.

The results of Lai et al. (2012) show that game-based cooperative learning can potentially improve both students' learning outcomes and motivation. Students demonstrate a stronger desire to put time into the learning process than the conventional cooperative learning technique. Furthermore, Trajkovik et al. (2018) observed that game-based learning activities, which boost students' motivation in the classroom, have the potential to foster critical thinking, develop communication skills, and establish an interactive learning environment for students. Therefore, the research is conducted to investigate how gaming elements support student motivation.

The study was also done to obtain valuable insights for educators to create more motivational, effective and engaging learning experiences for their students in the digital age. To examine the virtual escape rooms within the framework of the Attention, Relevance, Confidence, and Satisfaction (ARCS) motivation model presents the potential for significant contributions in elevating student motivation and engagement. This has the promise of advancing pedagogical approaches and addressing the evolving requirements of students.

1.5 Research Question

In this study, the question is posed: 'How can educational escape rooms support the development of student motivation with a game-based learning approach?'

The current study sought to investigate two sub questions in order to address the research question at hand effectively, including:

- Sub Research Question 1: To what extent does the attention, relevance, confidence, and satisfaction model (ARCS) influence the design of a virtual escape room?
- Sub Research Question 2: How do gaming elements support student motivation?

1.6 Research Design and Approach

The primary objective of the study was to examine how this addition of a game-based learning approach could enhance student motivation and engagement in the context of the digital age. The study employed a mixed-methods approach to gather data, utilising both quantitative and qualitative methods to obtain a comprehensive understanding of the impact of a virtual escape room on student motivation. The use of a mixed-methods approach was chosen to provide a comprehensive and in-depth investigation of the effect of a virtual escape room on student motivation because it enables the combination of quantitative data (Biesta, 2010), which provides statistical insights, and qualitative data, which provides rich context and participant insights (Berman, 2017).

Quantitative data were collected through a post-game survey to measure changes in student motivation, engagement, and experiences. On the other hand, qualitative data were obtained through semi-structured interviews to gain deeper insights into the factors influencing student motivation and engagement within the game-based learning environment. This dual approach captured a well-rounded perspective. It allowed the researcher to quantitatively measure changes while also qualitatively examining the subtle factors influencing student motivation and engagement within the game-based learning environment (Barroga & Matanguihan, 2022). The dual approach used quantitative data from post-game surveys and qualitative insights from semi-structured interviews (Durrani & Kamal, 2020).

The post-game survey and semi-structured interview questions were designed with the attention, relevance, confidence, and satisfaction (ARCS) motivation model in mind to measure the elements of the model to determine the participant's motivation. To ensure a thorough and in-depth analysis of the research question, the researcher combined a survey and semi-structured interviews for data collection (Byrne & Humble, 2006). This allowed the researcher to quantitatively measure changes while also qualitatively exploring the complex factors that affect student motivation and engagement in the game-based learning environment (Gobo, 2023).

The research consisted of two distinct phases conducted within a pragmatic framework, focusing on exploring the potential of an educational escape room in supporting student motivation while learning Microsoft Excel. Figure 1 visually represents the interconnected research stages that guided the study. These questions were addressed through a meticulously designed research approach that encompassed various research instruments and involved a diverse study sample.

Chapter 3 provides a comprehensive overview of the research design, encompassing detailed information on the methodology, data collection procedures, and analytical techniques employed. This chapter offers a comprehensive account of the research framework, highlighting the essential steps taken to address the research questions in a robust and systematic manner. By taking a pragmatic approach, the study sought to offer insights into the potential impact of online escape rooms in fostering student motivation and engagement in the context of Microsoft Excel.

Figure 1: Research Approach



As recommended by Berman (2017), this study uses an exploratory mixed-method design and a sequential strategy to answer the research question. Li et al.'s (2015) research, which employed an explanatory sequential design to examine the factors influencing digital-generation teachers' use of technology in the classroom, serves as a model for this strategy.

1.7 Significance of the study

The importance of this study is in examining how game-based learning, particularly through virtual escape rooms, might improve student motivation and address a crucial issue in the evolving environment of education. The research focuses on the motivational issues faced by Generation Z students, who are renowned for their tech-savvy nature, individualism, and social awareness. It attempts to provide educators

with insights so they may design interesting and successful learning experiences. The study, which makes significant contributions to pedagogical tactics in the digital era, analyses the effect of virtual escape rooms on student motivation and engagement while learning Microsoft Excel using the ARCS motivational model.

Chapter 1 serves as an introduction to the study, presenting the rationale behind the research question. Chapter 2 offers a comprehensive literature review, while Chapter 3 delves into the research's methodological design and data collection procedures. Chapter 4 is dedicated to the analysis and presentation of the collected data, and finally, Chapter 5 concludes the study.

1.8 Concept Clarification

Virtual escape room

An online game that mimics the experience of a real escape room is called a virtual escape room (Hartman-Caverly, 2022). The goal of a virtual escape room is for players to continue through the game and finally to 'escape' from the room by solving a series of puzzles, challenges, and clues. Players can explore and interact with the three-dimensional world of virtual escape rooms using a computer or mobile device. To find answers and complete puzzles, players may need to look for hidden objects, translate messages, crack codes, or manipulate objects (Fasulo et al., 2017). Virtual escape rooms can be played alone or with a team, and the challenges frequently call for cooperation and communication between players. While some online escape games are more open-ended and suitable for players of all ages and skill levels, others are created for specific age groups or skill levels. Overall, virtual escape rooms provide an entertaining and difficult opportunity to exercise your problem-solving abilities and to collaborate with others or play individually in a virtual environment (Pornsakulpaisal et al., 2023).

Game-based learning

Game-based learning (GBL) is a teaching approach that makes use of games to improve the learning process (Pan et al., 2021). To engage students, make learning

more dynamic and interesting, and encourage a deeper knowledge of the subject matter, it entails incorporating game design ideas and components into educational activities. Game-based learning (GBL) exposes students to games with educational themes and goals. Gamified learning is an innovative instructional method that uses the power of games to improve students' educational experiences. GBL, whether non-digital or digital, is intended to engage students by incorporating game design concepts and elements into educational activities (Balakrishna, 2023).

GBL can take many forms, including developing games for various devices and platforms such as computers, smartphones, and board games, as well as for teaching a wide range of subjects and abilities such as arithmetic, language instruction, social skills, and critical thinking (Cózar-Gutiérrez & Sáez-López , 2016). Game-based learning exposes students to games with educational themes and objectives that can be analogue or digital in nature. The goal of these games is to provide a fun and dynamic approach to learning that has the potential to deepen understanding of the subject matter (Chen & Liua, 2013). GBL can help to foster a more interactive and engaging learning environment for students of all ages and backgrounds by incorporating game design concepts and elements into educational activities (Liu et al., 2020).

Generation Z

Generation Z refers to the youngest generation currently enrolled in the educational system. Between the mid-1990s and the early 2010s, this generation was born. (Benítez-Márquez et al., 2022). Students from Generation Z are currently enrolled in primary, intermediate, secondary and postsecondary institutions of learning. Given that they have all grown up with access to the internet, social media, and mobile devices, this generation is known for being digitally fluent (Dwivedi et al., 2021). They are accustomed to absorbing information quickly and anticipate always having access to it. In addition to being more varied than earlier generations, they are more conscious of social issues and want to change the world for the better.

Students from Generation Z may have different learning preferences and expectations than students from earlier generations in the context of schooling (Hernández de Menéndez et al., 2020). These students favour technologically advanced and dynamic

learning environments and are more inclined to communicate and exchange information online (Haleem et al., 2022). In assisting Generation Z students to realise their full potential, educators must adjust to these shifting preferences and figure out how to engage and inspire them (Yalçın-İncik & Incik, 2022).

ARCS Motivational Model

The ARCS motivational model, developed by John Keller in 1987, is a well-known instructional design framework. The model was created to address the issue of low learner motivation in traditional classroom settings, and it offers a systematic approach to developing and delivering instruction that is engaging, relevant, and meaningful to students (Keller, 2009). The acronym ARCS stand for Attention, Relevance, Confidence, and Satisfaction, which are regarded as the four key elements of effective learning motivation. According to the model, these elements should be present in any learning environment in order to maximise motivation and promote learning (Wang et al., 2020).

The first component is attention, which is concerned with capturing the learner's attention and interest in the learning experience. This can be accomplished by employing visual aids, intriguing stories, humour, and other attention-grabbing techniques (Montero, 2020). The second element is relevance, which emphasises the importance of making learning material meaningful and relevant to the needs and interests of the learner. This can be accomplished by emphasising the practical applications of the learning material and how they relate to the learners' goals and objectives (Ucar & Kumtepe, 2019). Confidence is the third element, and it entails increasing the learner's self-confidence and decreasing anxiety by providing positive feedback, clear instructions, and opportunities for practice and feedback (Li & Moore, 2018). Satisfaction is the final component, and it focuses on giving the learner a sense of accomplishment and satisfaction through recognition of their achievements, feedback, and reinforcement (Lederman & Lederman, 2015). Overall, the ARCS model is an important framework for instructional designers and educators who want to create more engaging and effective learning experiences that promote learner motivation, engagement, and success (Keller, 1979).

1.9 Summary

This study focused on exploring the motivation and engagement, it's by product (Martin, 2022) of students by using a virtual escape room with a game-based learning approach, as indicated in the introduction to the study. The researcher focused on motivation and engagement for students in education because they are critical to academic success and lifelong learning. This study was motivated by the profound changes brought about by the transition from the 21st century to the era of the Fourth Industrial Revolution, along with the evolving needs and challenges arising from the COVID-19 pandemic and the demands of a new generation. These factors have influenced the educational landscape significantly, necessitating the exploration of novel approaches to meet evolving requirements (Reaves, 2019). In addition to this transition, the academic world has also been gifted with new technological advancements such as advanced devices, programmes, software, and immersive virtual and augmented reality that can help to improve and make learning more relatable and enjoyable for students in this 21st century (Moncaleano & Russell, 2018).

Generation Z, as the first truly digital native generation, has distinct educational needs that must be met through innovative teaching and learning interventions. These students expect to use digital tools in their learning experiences because technology is so deeply embedded in their daily lives. As a result, educators have a plethora of opportunities to create and design interventions that can engage and motivate Generation Z students toward a more fulfilling educational experience. With the use of technology, software and programs, the researcher used an educational virtual escape room, to understand, support and promote the motivation of the students. The aim of this study was to examine students' motivation for solving Microsoft Excel functions by using virtual escape room games as a means by which to motivate them.

The past two decades have witnessed significant changes in education, including a shift towards more interactive and technology-driven teaching methods; however, the COVID-19 pandemic accelerated the need for innovative approaches to motivate Generation Z students, leading to the exploration of game-based learning, specifically through escape rooms, as a means to enhance engagement and motivation in the online learning environment. A discussion of the literature about the topics of game-based learning and escape rooms is covered in the next chapter. In addition, Chapter 2 describes the theoretical framework that underpins the study.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter served as an introduction to the literature review, outlining the primary focus of the researcher's investigation. The aim was to explore a wide range of literature pertaining to game-based learning, escape rooms, and student motivation within a virtual learning environment. In pursuit of this objective, the researcher examined studies encompassing student generations, academics, educational technology, motivational models, gaming motivation, and the ARCS model of motivation. The overarching goal of this review was to gain a comprehensive understanding of how game-based elements could influence motivation in the context of a virtual escape room environment. Furthermore, a dedicated section in this chapter delved into the ARCS motivational model, which served as a guiding framework for the entire study.

In order to understand the impact of game-based learning elements on student motivation, the researcher referred to the literature regarding the influence of game-based learning elements within an online educational escape room. Using a comprehensive online literature search method combined with Google Scholar to identify existing literature on a wide variety of topics relevant to game-based learning, virtual educational escape rooms, and motivational theories, an online literature search was carried out using various databases. There were several keywords related to student motivation, motivational theories, online educational escape rooms, escape rooms, educational escape rooms, gameplay and game-based learning that were used in the research. In addition to examining the reference lists of the journal articles, the researcher also used the references to gather further information and to have access to primary sources.

While the online literature search was limited to English resources and studies conducted from September 2001 to June 2020, various databases, namely ERIC, ScienceDirect, SCOPUS, ResearchGate, Academic Search Complete, AccessScience, African Journals OnLine, Computer Science Database, EBSCOhost, Emerald Insight, ProQuest, Google Scholar, PLoS, SA ePublications, SpringerLink and

Technology Collection were used. As a result of this online search for sources, the literature review begins with an outline of Generation Z students, in terms of who they are, what they know, how they are different from previous generations and how this knowledge influences teaching and learning. The second part will discuss game-based learning and its educational value in terms of gameplay and motivation. An overview of virtual escape rooms follows the discussion on creating and playing an escape room and students' experience concerning motivation and gameplay. The educational escape room discussion is followed by a review of motivational theories and the history of their influence on teaching and learning. The literature review concludes with the theoretical framework and its components.

2.2 Generations Z

In order to explore the deeper importance of the body of work connected to the identity of Generation Z in the field of education, the researcher combined the primary research question and the sub-research topic. Generation Z is the generation of university students born after 1997 (Yalçın-İncik & Incik, 2022). The most notable characteristic of Generation Z students is the vitality of technology in educational practice to cultivate creativity and motivation in preparation for the future (Seemiller & Grace, 2017). Although many generations have passed through higher education institutions, educators use the same teaching methods regardless of the generation (Schwieger & Ladwig, 2018). Schwieger and Ladwig (2018) pointed out that Generation Z students possess characteristics and expectations such as immediate satisfaction in results, competitiveness, and constantly seeking new ideas and experiences, resulting in their being demotivated when traditional teaching methods are deployed.

The COVID-19 epidemic presented issues for Generation Z, a group distinguished by their digital nativity, as they dealt with them in the context of education (Vacchiano, 2022). Though the participants highlighted their need for flexibility and individualised learning experiences, their capacity to adapt to online learning systems was noteworthy (Sconti, 2022). Due to isolation and the blending of home and school life, educators began to provide special attention to mental health assistance and coping mechanisms to protect the mental health and well-being of this generation. To sort through the massive amount of internet content, Generation Z also developed their

digital literacy and information appraisal skills (Giray, 2022). Since fostering a strong feeling of community is important to Generation Z, maintaining a sense of community and social contact faced issues in the virtual learning environment (Benítez-Márquez et al., 2022).

The generation before Generation Z, Generation Y grew up with the development of technology, whereas Generation Z students cannot imagine a life without, for example, the internet; thus, they have technology incorporated into their everyday life (Cantillon, 2019). However, both Generation Y and Z expect educators to adapt their teaching styles by veering from traditional methods and adjusting hybrid teaching systems with the inclusion of innovative technology (Reyes et al., 2020). To evolve as an educator and to teach students to be lifelong learners, one must evaluate one's teaching methods to be prepared for this unique group of students (Endres et al., 2020).

This group of Generation Z students face challenges in the learning environment, such as difficulty focusing, not engaging in traditional face-to-face teaching, and the need for more technology use in the modules (Shatto & Erwin, 2017). Therefore, engaging students in active and adaptive learning exercises, utilising technology, and breaching the generational divide could limit the effects of these challenges (Williams et al., 2017). Roseberry-McKibbin (2017) points out that it is imperative to remember that technology integration to improve the motivation of Generation Z in a learning environment does not mean using an online quiz system or showing a video to the students but instead (Roseberry-McKibbin, 2017) creating an innovative exercise like an immersive learning opportunity such as an escape room that requires critical thinking skills and challenging content knowledge (Sidekerskienė & Damaševičius, 2023).

Generation Z students are equipped with unprecedented access to vast amounts of information in comparison to previous generations at a similar age (Ang et al., 2022). Through smartphones, laptops, smart TVs, and the internet, information is readily available with a mere touch or click, providing instant access (Talmon, 2019). A relevant study conducted by Liu et al. (2020) explored the use of online game-based learning to generate enthusiasm among students by introducing novel approaches to learning beyond the methods to which they were accustomed.

Consequently, an online game-based learning approach holds the potential to captivate and engage this particular student group. However, it is crucial for students to remain vigilant regarding issues such as cyberbullying, safety, privacy, and ethical concerns (Zhong et al., 2021). These safety concerns have increased the need for privacy concern, such as in protecting personal information when using technology. In their study, Gyan and Jyotsna (2017) noted that students find comfort behind computer screens and that they prioritise cyberethics (Gyan & Jyotsna, 2017). Cyberethics refers to one's actions in the virtual world having repercussions in the real-world (Bothma et al., 2017).

Prior to Generation Z, collaborative online gaming with other players was not as common as today because people used to play games mainly as individuals, whereas today, most games are played online with a player being alone in a room competing against others online worldwide. Generation Z has normalised playing games online with people worldwide and considers gaming a fragment of their personality (Bassiouni & Hackley, 2014). Hence, a game-based approach to virtual escape rooms can motivate students because it integrates elements that Generation Z is fond of, such as online aspects, immediate results, and challenging gameplay (Halbrook et al., 2019) into one activity.

Beard et al. (2008) assessed the features and instructive essentials necessary to instruct new generations properly (Beard et al., 2008). The authors found among Generation Z, although still in their early educational stages, a yearning for customisation, on-demand availability, and a fondness for instant educational benefits, including game characteristics (Beard et al., 2008). Some of these characteristics, such as customisation, for example, selecting an avatar, and instant benefits like scores, are typical of games and, in this case, escape rooms (Contreras-Espinosa & Eguia-Gomez, 2020). Seemiller and Grace (2017) point out that members of Generation Z want to be agents of change in society and to leave their mark. Generation Z students are creative and prefer to work independently, making this need for change problematic (Seemiller & Megan, 2017). Thus, educators should support Generation Z students in their higher education journey with innovative teaching methods (Davies et al., 2013). With the change in teaching methods, the assessment methods also need to change.

Traditional assessments measure the knowledge and skills of students with tests and exams. These assessment forms simply show that the students are often focused on remembering or understanding the content rather than on challenging creativity, critical thinking and problem solving (Slate et al., 2011). Hence, these students require more than a simple question-and-answer approach to learning (Nicholas, 2020). Generation Z students require a form of learning that incorporates real-life comprehension and innovation that can be applied to their daily lives and future careers (O'Boyle et al., 2017).

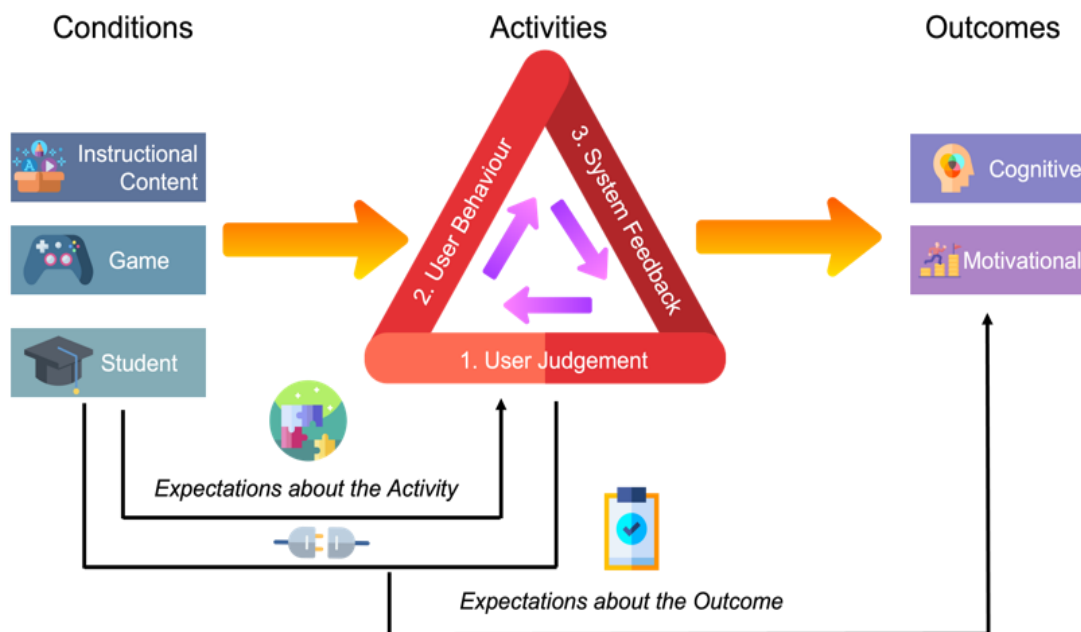
A creative teaching approach related to the course and that is meaningful to Generation Z students can promote motivation, allowing educators to be agents of change in the educational journeys of these students (McCombs, 2010). Using a game-based learning example, such as escape rooms, can be used as a new approach to assessments; ideally, as a formative assessment that can assess skills in an escape room such as problem-solving, critical thinking, and the assimilation of content knowledge (Clason et al., 2019) can improve student motivation (Grier et al., 2021).

2.3 Motivation in Gaming

The researcher utilised the sub-research question, 'How do gaming elements bolster student motivation?' as a guiding framework for their literature search on motivation in gaming. Because Generation Z is used to nonstop entertainment, traditional practices have difficulty holding their attention. Their motivation is increased when technology and engagement techniques are used successfully. Therefore, examining the motivational perspective of game-based learning points to a game that engages and motivates the student by providing an enjoyable experience with the ultimate objective of sustaining participation (Turkay et al., 2014). Game-based learning can be viewed from two different standpoints: the learning and the gaming perspective. Delacruz (2012) assumes that when a student plays a game that consists of educational content, the student's interaction with the game and its elements will motivate the student by building on their subject content, which will improve their learning (Delacruz, 2012; Haque et al., 2014). Therefore, the motivation to use a game like an educational escape room depends on the desire to play and to understand what is being taught

(Schrier, 2018). Adding challenges to games, such as solving puzzles to progress or unlock items, is crucial to motivation in gaming (Vidergor, 2020). According to Strickland and Kaylor (2016), a well-designed game can promote student motivation to learn. They also indicate that the game could motivate students in the less popular modules such as mathematics, science, and languages (Strickland & Kaylor, 2016). Plass et al. (2010) showed that a game-based learning approach could spark students' attentiveness to the content of these modules, leading to motivation to continue to learn/play. They also stated that a game-based learning approach could widen students' concentration so that they are involved beyond just getting a mark or answering a question (Plass et al., 2010).

Figure 2: Game-based Learning Motivation Model (Mattheiss et al., 2009)



The game-based learning motivation model proposed by Mattheiss et al. (2009), proposes three interrelated but dependent components, namely conditions, activities, and outcomes, as illustrated in Figure 2. Conditions focus on how content knowledge can impact cognition and affect. In their work, Heckhausen and Heckhausen (2006) discuss the concept of playing a game during which time the game system analyses the student's activities and behaviours as they are fully engaged in the game. The conditions, game, and outcomes can construct an enticement for achieving the end goal, which will escape the room and, as the first step, increase student motivation.

The student's preconceived expectations of the game, gameplay and outcomes can affect the student's motivation to play the game (Mattheiss et al., 2009). Game-based learning offers an imperative benefit over traditional teaching, which is motivation to play. Hence, researchers such as Garris et al. (2022), and Wang and Cheng (2022) concentrated on the motivational aspects of educational games. The ARCS motivational model used in this research study emphasises what motivate students. The four elements of the ARCS motivational model: attention, relevance, confidence, and satisfaction, can elicit an understanding of what motivates a student while playing in a virtual escape room and how to design learning opportunities for future students (Keller, 2009).

The level of engagement within content-driven educational games might differ from entertainment games because entertainment is designed for relaxation. Unlike entertainment, content-driven games are intended for educational purposes. In this way, the educator's responsibility is to make students eager to play an educational game for learning to take place (Hoffman & Nadelson, 2010). Research has been conducted to understand which elements in these entertainment games contribute to motivation and engagement and how they can be used in educational games. As Squire (2011) identified, these motivational elements are musical score, narrative/fantasy, game mechanics, visual aesthetics, and incentive systems. The function of these motivation elements in learning and teaching was centred in the behaviourist tradition, emphasising efforts, needs and behaviour. Motivation in video games was similarly rooted in behaviourist theories, reinforcing the tools to improve engagement and motivation within games (Koivisto & Hamari, 2019).

Inspiring student motivation through game-based learning is possible with educational escape rooms, and this strategy has important implications for Generation Z. Generation Z favours interactive and gamified educational experiences because they were raised in the digital era (Eukel et al., 2020). Learning is made more fun by escape rooms' dynamic and immersive environment, which appeals to their demand for interesting, interactive content (Giray, 2022). It fits students' need for hands-on, experiential learning because escape rooms require active engagement, problem-solving, and critical thinking (Schaffhauser, 2017). A trademark of escape rooms,

immediate feedback appeals to Generation Z's need for quick gratification and helps them retain the information (Hartman-Caverly, 2022).

Additionally, escape rooms frequently give students freedom and choice, letting them decide as they go along, which aligns with Generation Z's propensity for personalised and independent learning (Alsawaier, 2018). Escape rooms incorporate technological, collaborative, and storytelling components to accommodate its tech-savvy, social, and narrative-driven character (Cook, 2016). Leaderboards and other achievement-related features like prizes encourage this generation to perform well (Breien & Wasson, 2021). Generation Z's practical and development-focused mindset is also attracted to the real-world applications and escalating challenge structure of escape rooms (Benítez-Márquez et al., 2022).

2.4 Educational Virtual Escape Rooms

The concept of virtual escape rooms as educational games and their design process served as key focal points within the literature. Schaffhauser (2017) refers to an educational escape room as gaming to learn. In his view, a game that challenges students to escape a room influences their motivation levels. An escape room consists of tasks to solve problems and puzzles within a specific time frame to reach the goal (Stone, 2016). Originally, escape rooms were real rooms where people would enter and solve puzzles to get out. The traditional escape room is a group game for teams to bond or have fun. Online platforms now offer virtual escape rooms where one can play and escape the room online, either individually or as a group. More educators are incorporating escape rooms into classrooms, lecture halls, and online classrooms to accommodate student preferences and the blended-learning trend (Macías-Guillén et al., 2021).

An educational escape room is a creative method of teaching and learning that could aid this generation of students in terms of customisation and demand (Cantillon, 2019). Students play a game with various scenarios or storylines created by the escape room designer in an escape room where players are immersed in the game (Veldkamp et al., 2020b). The students' immersion is vital to the escape room because their attraction to the scenario and puzzles can explain their motivation to escape the room

(Douglas & Hargadon, 2001). To provide efficient teaching and learning, educators need to understand the new generation's expectations and to re-examine teaching and learning approaches (Kışla & Karaoğlan, 2020).

The online educational escape rooms enhance essential skills, such as problem-solving, time management, and focusing under pressure (López-Pernas et al., 2019). Stone (2016) also points out that educational escape rooms incorporate some of the most critical 21st-century skills such as critical thinking, not only for the students but also for the educators who need to adapt to new educational trends to grow with their students and to be lifelong students together (Stone, 2016). According to Vergne et al. (2020), an escape room can introduce educators and students to programming, deemed a vital skill for future workplaces (Vergne et al., 2020).

Puzzles are the questions, riddles, activities, issues and challenges in escape rooms. It was initially a game of teamwork, and the puzzle gave each group member a chance to contribute (Nicholson, 2015). Wiemker et al. (2015) describe physical escape rooms as consisting of three components: cognitive puzzles, physical puzzles, and meta-puzzles. Puzzles that utilise the game players' logic and critical thinking abilities are cognitive puzzles. In the physical puzzle category, one can solve a puzzle with their body, such as crawling through a tunnel or moving an object. In meta-puzzles, one fills in gaps and creates connections concerning the storyline (Wiemker et al., 2015).

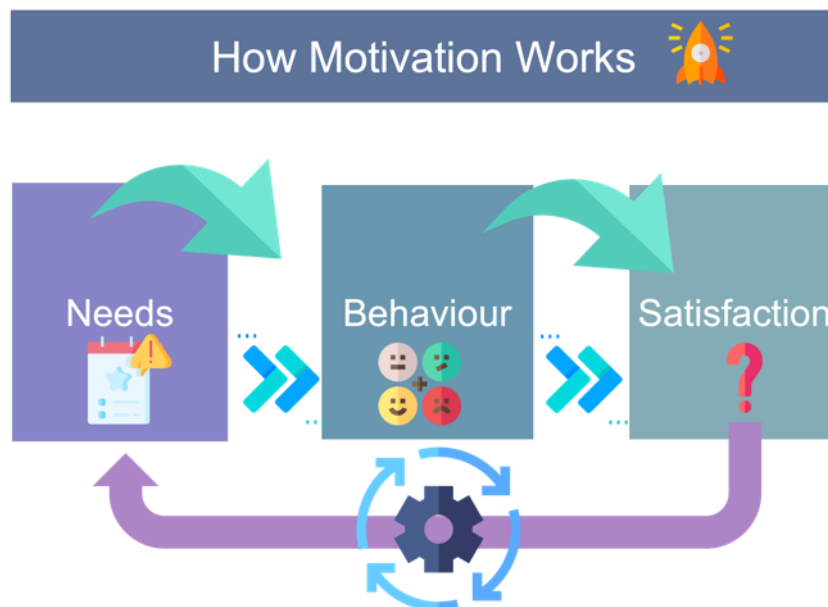
Virtual escape rooms mostly involve the use of cognitive and meta-puzzles. Physical puzzles are often excluded from online escape rooms depending on the level of immersion in the game. If the escape room game is fully online, and physical puzzles are needed, the game could be played with virtual reality headsets online in a team setting and include physical puzzles. In an example where, physical puzzles are not needed, students could practise mathematics or correlation skills as alternative game puzzles (Gorev et al, 2018). Ultimately, these decisions depend on the game designer and their goals (Kuo et al., 2022). Students will practise mathematics, correlation, reading, pattern recognition, searching, memorisation, logical reasoning and observation to acquire knowledge effectively (López-Pernas et al., 2019). Escape rooms motivate students to try to understand and connect with the material before or

while they attempt a learning activity (Clarke et al., 2017). This connection can clarify what and how this game motivates the students to learn using motivational theories.

2.5 Motivational Theories/Models

The literature search aimed to explore various motivational theories influencing students, providing insights into what motivation is, how it functions, and its connection to gaming as a guiding framework. Motivation is a dynamic process that is essential in propelling people toward their goals and meeting their own needs (Haque et al., 2014). Figure 3 illustrates the cyclical nature of motivation. The first stage in this process, according to Jensen and Toates (1997), is recognising that individuals have several requirements that vary from person to person. These distinct requirements, on the other hand, serve as the foundation for one's motivation, ultimately determining behaviour. The major goal of this conduct is to meet those specific demands. Whether the activity meets the needs effectively or falls short, it has a knock-on effect by which individuals reassess and perhaps adjust their needs, so creating a new cycle of motivation that circles back to their needs to begin the cycle over again (Jensen & Toates, 1997). This continuous cycle emphasises the complexities.

Figure 3: How Motivation Works (Adapted from Jensen and Toates (1997))



A multitude of motivational theories and models exist, such as Adams' equity theory (Al-Zawahreh & Al Madi, 2012), Vroom's expectancy theory (George & Humphrey,

2021), Locke's goal-setting theory (Jeong et al., 2021), Skinner's reinforcement theory (Fayyaz et al., 2021.) and Keller's (2009) ARCS model (Laurens-Arredondo, 2022). Motivational theories, also called motivational models, can help educators and researchers to understand what motivates an individual, ultimately improving teaching and learning methods (Granito & Chernobilsky, 2012). Higher education students are likely to lack motivation in their studies owing to underlying factors like adjustment and freedom issues in a new environment (Noyens et al., 2019) and lack of technology integration (Shatto & Erwin, 2017). There are two main types of motivational theories: content and process theories (Kian et al., 2014).

2.5.1 Content Theories

Figure 4 presents a thorough overview of the five major content theories, providing educators and game designers with a structured framework for understanding and applying these ideas in their respective areas. This insight paves the way for the development of customised tactics, treatments, and educational games that maximise motivation and, as a result, improve learning results (Kim et al., 2019).

Figure 4: Content Theories

<p>Maslow's Hierarchy of Needs</p> <p>Maslow puts needs in a hierarchy where the needs must be satisfied from the bottom upwards. (Freitas & Leonard, 2011).</p>
<p>Herzberg's Two Factor Theory</p> <p>Herzberg believes that two factors are essential in motivation, hygiene and motivators (Alfayad & Arif, 2017).</p>
<p>McClelland's Three Needs Theory</p> <p>McClelland's theory argues that we have three needs, achievements, affiliation, and power (Osemeke & Adegboyega, 2017).</p>
<p>Alderfer's ERG Theory</p> <p>ERG Theory of Motivation is a shortened version of Maslow's Hierarchy of Needs (Yang et al., 2011).</p>
<p>The ARCS Motivational Model</p> <p>The ARCS (attention, relevance, confidence, and satisfaction) model evaluates the students' drive for motivation and focuses on what makes the students motivated (Jeon, 2020).</p>

Content theories are extremely important in understanding and improving motivation in a variety of contexts, including education and gaming (Borkowski, 2009). These

theories provide useful insights for educators and game designers alike by looking into the aspects that influence the motivation of individuals to finish tasks. In an educational setting, content theories help instructors understand students' various needs and ambitions (Uzonna, 2013). Educators can modify their teaching practices to better engage and inspire students by understanding the underlying motivational elements. They can, for example, include relevant content that matches with students' inherent objectives and aspirations, making the learning experience more meaningful and inspiring (Harackiewicz et al., 2016).

Moreover, content theories find practical applications in the realm of gaming. Game designers can leverage these theories to explore and enhance student motivation within educational games (Dinçer, 2020). By integrating elements that tap into individuals' inherent needs and aspirations, games can create a compelling and immersive experience that fosters motivation to learn and achieve (Laksana et al., 2021). For example, they can add relevant content that matches with students' intrinsic objectives and aspirations, making the learning experience more meaningful and inspiring. By considering content theories, educators and game developers can gain valuable insights into the underlying psychological mechanisms that drive motivation. This knowledge empowers them to design more effective learning experiences, to leverage motivation, and to create engaging educational content that resonates with students' individual needs and aspirations (Gui et al., 2023).

2.5.2 Process Theories

Figure 5 depicts a summary of the five basic process theories used in motivation research. These theories give frameworks for understanding the multifaceted nature of motivation and its impact on humans (Satir & Beji, 2022). Researchers and practitioners gain a significant understanding of how internal and environmental factors interact to shape motivation by researching these theories (Tao et al., 2022). This understanding allows for the creation of intervention approaches that can result in positive improvements in motivation levels (Dökme et al., 2022).

Figure 5: Process Theories

<p>Adam's Equity Theory</p> <p>Adam's theory believes that people can only be motivated if they feel their treatment is fair compared to that of other people (Inuwa, 2017).</p>
<p>Vroom's Expectancy Theory</p> <p>Vroom's theory believes that someone will behave based on what they expect the result of that behaviour will be (Parijat & Bagga, 2014).</p>
<p>Taylor's Motivation Theory</p> <p>Taylor believes that motivation is driven by compensation, for example, money (Menard et al., 2018).</p>
<p>Bandura's Self-Efficacy Theory of Motivation</p> <p>The Self-Efficacy Theory of Motivation considers motivation a task (Tagkalogou & Kasser, 2018).</p>
<p>Skinner's Reinforcement Theory of Motivation</p> <p>Skinner's Reinforcement Theory of Motivation explains what motivates good and bad behaviour (Olusadum & Anulika, 2018).</p>
<p>The ARCS Motivational Model</p> <p>The ARCS (attention, relevance, confidence, and satisfaction) model focuses on what motivates a student and how those elements can be altered to improve motivation (Li & Moore, 2018).</p>

Process theories of motivation investigate how people are driven and how that motivation may be affected and altered. Understanding the complexities of this process enables people to control their motivation levels efficiently in pursuit of desired outcomes (Seth & Bayne, 2022). These theories shed light on the basic parts and mechanisms of motivation, providing critical insights into its developmental features (Tudor, 2011).

Process theories are important in the realm of motivation research because they provide both theoretical foundations and practical applications. They provide significant information for individuals, corporations, and educators looking to boost motivation and drive desired behaviours (Cook & Artino, 2016). Evidence-based therapies and techniques to improve motivation, enjoyment, and accomplishment can be developed by investigating the processes underlying motivation (Lunenborg, 2011). The study of process theories of motivation reveals the driving forces behind people's actions as well as the malleability of motivation itself. These theories give frameworks for understanding and intervening in motivation-related phenomena, with the goal of increasing motivation and cultivating desirable outcomes in a variety of circumstances (Rhee, 2019). Individuals and practitioners can adopt educated ways to optimise

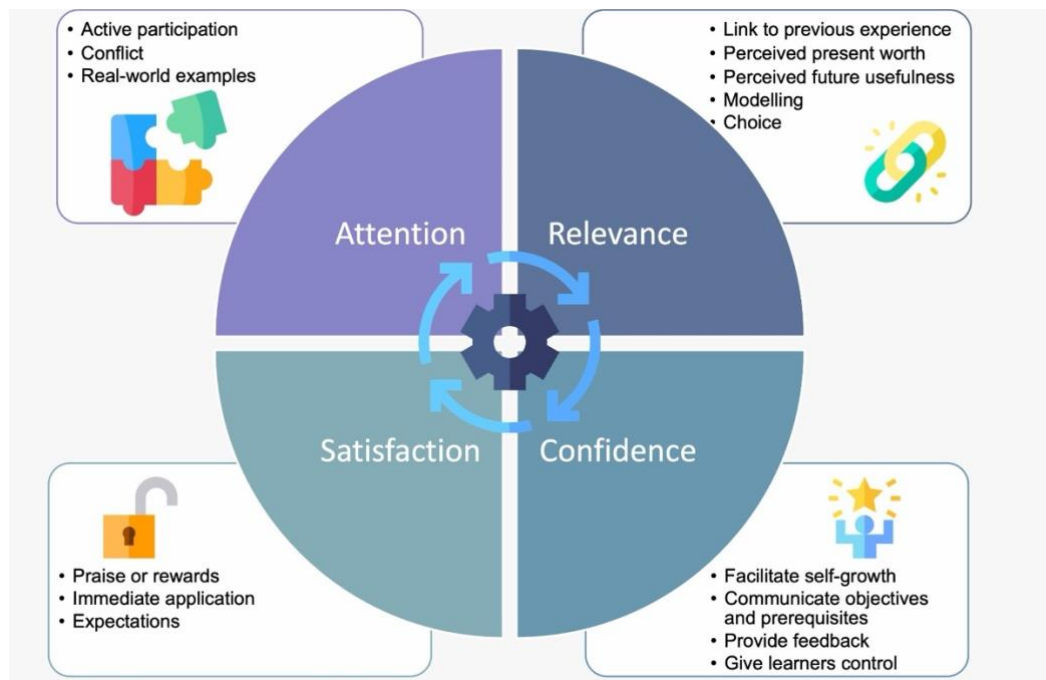
motivation by uncovering the complexities of motivation processes, and so facilitate personal growth, productivity, and overall success (Holbrook & Chappell, 2019).

The theoretical framework selected for this study is the ARCS model created by John Keller (Wang et al., 2020). Known as both a content and a process theory, the ARCS motivational model consists of four sections: attention, relevance, confidence and satisfaction (Keller, 2009), and it evaluates students' determination to finish a task, what motivates them in completing that task, how their motivational elements can be used to improve the task at hand and how motivational elements motivate students (Durrani & Kamal, 2020).

2.6 ARCS Motivational Model as a Theoretical Framework

A theoretical framework specifies a rationale for predictions about the connection among variables of a study (Lederman & Lederman, 2015). The American educational psychologist John Keller initially introduced the ARCS motivational model as an instructional design model in 1979 (Tsai et al., 2022). He suggested that more emphasis should be placed on what motivates students (Keller, 2009). In addition to using the ARCS model of motivation as a strategy for problem-solving in learning, it can also create interactive learning experiences. It sustains and stimulates students' motivation to learn (Li & Keller, 2018). As seen in Figure 6, the ARCS motivational model focuses on four elements: attention, relevance, confidence, and satisfaction, with each particular trait linked to it.

Figure 6: The ARCS Motivational Model (Keller, 1983)



2.6.1 Attention

Attention should be gained with the assistance of inquiry arousal and perceptual arousal. Inquiry arousal can occur when a student's inquisitiveness is aroused by challenging puzzles that need to be solved (Ucar & Kumtepe, 2019). Perceptual arousal can arise when a student's attention grows with emotions of surprise, disbelief, or doubt (Keller, 2009). Various methods can be employed to grasp students' attention, such as active participation, conflict, and real-world examples. (Keller, 1979). **Active participation** involves creative learning activities such as games allowing students to be dynamic contributors to the learning process (Montero, 2020). As the students get more involved in the learning process, their chances of completing the activity increase (Keller, 2009). **Conflict** involves proposing a scenario or presenting a statement as a method to seize students' attention. This method will make the students want to explore the topic (Keller, 2009).

Real-world examples focus on the fact that students will be more likely to learn if they believe that what is being presented will aid them in the real-world (Susanti & Imbri, 2020). In students' personal and professional lives, 21st-century skills, such as critical

thinking and problem-solving, are essential. Explaining the use of these skills could grip the students' attention (Keller, 1979). The escape room will grab the students' attention as an innovative method for learning and practising specific Microsoft Excel content. The students will participate actively because the game will be set up in a crime scheme scenario where one must follow the steps, complete the puzzles to progress, solve these puzzles with Microsoft Excel skills and ultimately solve the murder. In addition to incorporating the attention strategies recommended by ARCS, the researcher went above and beyond by integrating gaming elements into the escape-room experience. By employing clues, puzzles, surprises, enjoyment, time limits, novelty, and variety skilfully, the researcher effectively captivated participants' attention.

2.6.2 Relevance

The focus given to the students' need to be relevant for student motivation to take place (Ma & Lee, 2021). Keller (2008) suggests using experience, perceived present worth, perceived future usefulness, modelling, and choice to guarantee relevance. Students can establish connections by linking perceived present and future worth with previous experiences. Using this proven motivational strategy, students realise that they are expanding their knowledge base, which keeps them motivated (Reynolds et al., 2017). In addition to believing that online learning is practical and carries perceived future usefulness, this is another factor that keeps them engaged in the course (Keller, 1979).

Students require updated knowledge and skills to deal with a **particular** daily situation or problem (Durrani & Kamal, 2021). They are more likely to be motivated if they see how the online learning course will equip them with new skills to help them resolve their **current** difficulties (Keller, 2009). The opinion of students of how the online learning course will assist them determines their **future usefulness**. This is crucial in determining their motivation to attend the learning course (Siti Nurshahidah et al., 2021). Knowing that others have applied the knowledge or skill presented successfully makes students **perceive** the online learning course as appropriate and valuable and is the first step to success (Lin et al., 2020). **Modelling** involves demonstrating the practical application and significance of the content being learned. Another factor that

increases relevance is giving students a **choice** as to their instructional strategy. As a result, adult students know precisely what they want to learn and how they want to learn (Afjar et al., 2020). The virtual escape-room game is relevant for this sample of participants because Microsoft Excel is the main component in a compulsory first-year module that needs to be passed in order to graduate. Playing this game and completing the puzzles allows students to learn more about the specific Microsoft Excel functions and to practise precisely what they have learnt.

2.6.3 Confidence

The goal of confidence is not to feel superior to others, but it is an inner knowing that you are capable (El-Daw & Hammoud, 2015). Feeling confident means being certain of who you are and what you are capable of – not arrogantly, but realistically and securely (Sheldrake, 2016). In this component, students can develop success expectations, enabling them to control their learning processes. Confidence levels and success expectations are correlated. A person's confidence level is their belief that they can complete a task related to their success expectations (Greenacre & Chapman, 2014). Therefore, students should be provided with estimations of the probability of success (Tsai et al., 2022). Confidence is a vital component of the study because it is essentially what drives motivation, not only in the players of the game but also in the players' confidence levels in finishing the game, as stated by Plass et al. (2010). Game-based learning has the potential to enhance students' interest in module content which results in motivation (Plass et al., 2010).

Educators and instructional designers design activities to instil the first step of confidence in students by helping them to believe that their goals can be achieved. In other words, if students feel that they are unlikely to achieve their goals, this will reduce their motivation (Keller, 1979). An instructional designer's responsibility is to plan for learning activities that build students' confidence with feedback, give them control, facilitate self-growth, and communicate objectives (Grebe, 2021). **Facilitating self-growth** encourages students to take small steps and immediately shows them their progress in the learning course. They will be motivated by seeing their progress, resulting in their believing in themselves, leading to self-growth, which indirectly leads to motivation (Xia, 2020).

Communicating objectives and prerequisites involves the students being aware of what they need to accomplish before they begin. One of the factors building confidence for students is realising that they can attain the goals and objectives of the course by participating in the online learning course (Milman & Wessmiller, 2020). Additionally, it is crucial for them to understand clearly what they should expect throughout the online learning course and how they will be evaluated at the end (Haque et al., 2014).

Providing feedback is another important aspect of building confidence and motivating students (Grebe, 2021). It is imperative that students grasp where they stand before continuing their online learning course. It is critical to note that students feel confused if no feedback is provided as they cannot determine their progress in the online learning course. Feedback, especially constructive feedback, is vital for students to proceed confidently to the following online learning activity or to review a previous activity (Jeon, 2020). Students may benefit from constructive feedback to reinforce good practices. Doing so provides students with some **degree of control** over the learning process, provides them with a sense of independence, and ensures that they are in control of their success (Keller, 2009). Essentially, it makes them feel that they are responsible for their learning. Providing students with the opportunity to select the learning method that best suits their needs motivates them to engage in the online learning course. As a result, they are involved actively in the learning process (Reynolds et al., 2017). This study is expected to contribute to the improvement of the teaching approach used in the module Academic Information Management (AIM) as well as to contribute to an understanding of how students prefer to learn in order to achieve peak motivation levels. To help students achieve explicit knowledge objectives, the game includes feedback mechanisms that assist them in setting and achieving their individual learning objectives.

2.6.4 Satisfaction

Satisfaction can be linked to motivation in educational games. Kang and Tan (2014) state that the link between satisfaction and motivation in correlation with gaming directly links to the feeling of being fully immersed in the experience of the game (Kang & Tan, 2014). A sense of accomplishment accompanies self-satisfaction. From an educational perspective, students can feel satisfied with their performance, or a

learning opportunity based on the outcomes, which can relate to their motivation towards the latter (Wang et al., 2017).

Based on the ARCS model (Keller, 2009), motivation increases when students are satisfied with their achievements in a learning activity (Susanti & Imbri, 2020). The purpose of a **reward or praise** component in the learning process is to present students with rewards, whether a sense of accomplishment or praise from educator (Ucar & Kumtepe, 2019). Students are more likely to be satisfied with an activity if they feel they have achieved something and their efforts have been recognised (Wang et al., 2020).

Students benefit from the **immediate application** of the skills or materials they are learning since they feel these will be helpful in their future workplace and academic studies. This can be accomplished by encouraging students to use their newly acquired knowledge and skills in real-world settings or involving them in problem-solving activities (Reynolds et al., 2017). Students will feel internally satisfied as they will find the time, money, and effort invested into the online learning course worthwhile (Sdravopoulou et al., 2021). **Expectations** will allow students to view the coherent criteria and penalties for success. The students should be aware of the expectations of the task, such as the instructions and the rubrics (Xia, 2020). When students understand and know what is expected of them, it increases their chance of success and motivation to succeed in the task (Hsu, 2020).

2.7 Summary

This literature review discussed various aspects of game-based learning, specifically virtual escape rooms, motivation, and motivational models. Emphasis was placed on Generation Z's perspectives of learning and how a game-based learning approach, using a virtual escape room, can motivate students to acquire knowledge and complete an activity designed with the ARCS motivational model as the theoretical framework. This approach to teaching and learning is not merely brought about but also influenced by various aspects such as COVID-19, technological educational advancements, the growth of online learning and alternative assessment adjustment (Jakob, 2021). The rise of educational games combined with Generation Z interests allows for

incorporating a virtual escape room to enhance the motivation of these students by giving them an educational game in the sense of a recreational activity that doubles as a learning assessment. The following chapter will explore the research methods and strategies employed in conducting the study and the data collection process.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In this chapter, the researcher adopted a paradigmatic viewpoint as the most suitable approach for the study since it enabled a thorough exploration of student motivation. A comprehensive explanation of the methodology employed in the research is provided throughout this chapter. The design of the game used in the study aligned with the research approach, design, and the software utilised. To ensure adherence to the ethical policies and procedures of the researcher's institution, detailed elaboration is provided on sampling, data collection, data analysis, and quality criteria.

3.2 Paradigm

A paradigm in a research study refers to a framework or perspective that guides the overall approach and methodology used to investigate a particular phenomenon or research question (Rehman & Alharthi, 2016). This study was approached from a pragmatic lens. Pragmatism signifies a worldview emphasising what works rather than what is objectively and absolutely 'true'. Earlier pragmatists rejected the idea that social inquiry can access truths about the real-world by applying only one scientific method (Kelly & Cordeiro, 2020). Pragmatism is a deconstructive paradigm that advocates using mixed methods in research to circumvent the contentious issue of truth and reality (Maarouf, 2019). To determine whether a research question is valid, it must focus on 'what works' (Kaushik & Walsh, 2019). The pragmatic paradigm emphasises the truth as the best method to understand the research problem of a study (Shank, 2013). In a pragmatic study, the focus is on the individual decision-maker within a real-life scenario. During a pragmatic study, the first step is identifying and viewing a problem within its broader context (Ramanadhan et al., 2021). As a result, research inquiry is initiated to understand better and to solve the problem.

The researcher attempted in this study to understand how an educational escape room, coupled with game-based learning, would promote student motivation. Thus, pragmatism provides the opportunity to integrate the current experience, such as the game, into the research study, which provides the researcher with reliable answers to understand the student's motivation genuinely (Biesta, 2010). The pragmatic paradigm

in education emphasises the link between learning and real-world application, as well as the value of experience learning. It is a comprehensive framework that includes ideas, methodologies, approaches, and principles for addressing research problems effectively (Gobo, 2023). The pragmatic paradigm, which arose from the pursuit of practical problem-solving, promotes inquiry-based ways to address real-world difficulties. The mixed-method research approach is frequently applied in a pragmatic paradigm. This investigation into motivation with a game-based learning approach calls for a mixed-method research approach, which can be considered pragmatic (Avdagic et al., 2021).

3.3 Approach

The mixed-method approach is a research approach that combines qualitative and quantitative methods in a single study to address a research question (Wisdom & Creswell, 2013). In mixed-method research, qualitative and quantitative approaches are employed at different points during the research. These approaches will most likely affect the purpose, overall design, methods, sampling, data collection, analysis, and interpretation of the results of the study (Creswell et al., 2003). Considering the complexity of social phenomena, different approaches are necessary for their understanding; therefore, a mixed-methods approach was commenced in this study. Through the utilisation of a mixed-method approach, the drawbacks linked to specific methods were neutralised or minimised effectively. It was recognised that all methods inherently possessed limitations, leading to the choice of this approach to enable the gathering of a comprehensive understanding and to ensure the attainment of a holistic perspective. Furthermore, the strengths of qualitative and quantitative approaches can complement one another (Byrne & Humble, 2006). A collaborative and applied approach to research is suitable specifically for this purpose.

Moreover, the mixed-methods approach enables researchers to address confirmatory and exploratory questions simultaneously (Wasti et al., 2022). As the researcher was interested in the extent to which the existing ARCS motivational model influences the game design and progression of the ARCS elements in the escape-room game (confirmatory) and how one designs an educational escape room (exploratory), the mixed-method approach was suitable for this study since it allowed the researcher to

understand of both confirmatory and exploratory questions (Reuter et al., 2020). As a result, theories could be formulated and tested concurrently. According to Greene and Caracelli (2003), different research methods can produce seemingly contradictory results, which can be explained by the mixed method approach.

Quantitative research is a methodical examination of phenomena by collecting quantifiable data and executing computational, mathematical, or statistical techniques (Roni et al., 2020). This research approach can find patterns, make predictions, test relationships, and generalise the results to a broader population (Watson, 2015). To gain more profound knowledge and understand societal awareness, quantitative research is used (Stickley et al., 2022). A quantitative approach is used by researchers to determine how occurrences or conditions alter people's behaviour (Taherdoost, 2022). Statistical data and numbers are used to demonstrate the unbiased nature of quantitative research (Barroga & Matanguihan, 2022). The researcher selected the quantitative approach because of the possibility of large numbers of students participating in the study and the possibility of generalising the results, which was ideal for the statistical data collected through the Qualtrics survey (Liu, 2022). The inclusion of confirmatory and exploratory questions in the quantitative part of the study served to enrich the overall discussion.

In contrast to quantitative research, qualitative research is an approach that pursues an in-depth understanding of social phenomena within a natural setting (Mainardi & Crescentini, 2009). This approach collects and analyses non-numerical data to understand expectations, concepts, or opinions and to generate new research ideas (Pathak et al., 2013). Qualitative analysis is used to draw conclusions, along with deeper analysis of quantitative data (Bouncken et al., 2021). In this study, a qualitative approach was selected to explore the participants' behaviours, insights, and experiences in depth. To capture and describe the intricacies of complex phenomena, semi-structured interviews were employed, allowing for a comprehensive understanding of the subject matter (Thambu et al., 2021).

Quantitative and qualitative methods can be combined and used in sequence (Copeland et al., 2021). In this study, the researcher utilised quantitative and qualitative methods to complement each other for more significant data to be collected and analysed. Quantitative and qualitative methods support one another and allow a better

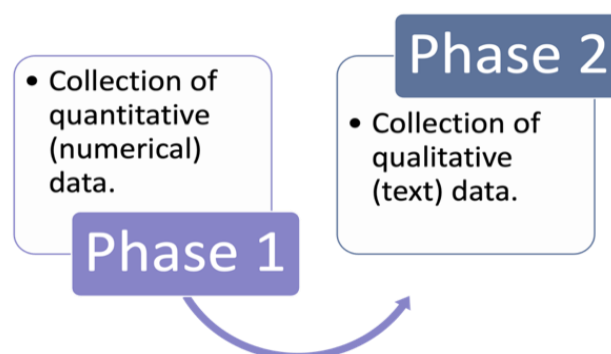
understanding of collated data sets. The researcher gathered quantitative data from a survey in this study, while qualitative data were collected from semi-structured interviews. The survey established participants' attitudes towards a topic in the mixed-method research approach, followed by in-depth semi-structured interviews to uncover individual perspectives (Patton, 1999).

3.4 Research Design

This study utilises an exploratory sequential mixed-method design appropriate for the research question (Berman, 2017). Li et al. (2015) conducted an explanatory sequential design investigating why digital-generation teachers use technology in the classroom. They focused first on gathering data quantitatively with a survey and, second, on gathering qualitative information through interviews (Li et al., 2015). This design intended to explain quantitative results with qualitative data. The research design consisted of two distinct phases: quantitative and qualitative procedures (Creswell, 1999).

Similar to the work of Li et al. (2015), the first phase of this study consisted of the collection of the quantitative (numerical) data, and the second phase consisted of the qualitative (text) data that were collected and analysed to clarify or expand upon findings, as illustrated in Figure 7. Prior to data collection, the researcher meticulously planned, designed, and developed a virtual escape-room game and its corresponding components as an integral part of the study design. This served as the foundation for the investigation, with the virtual escape room created utilising the Room Escape Maker platform (Room Escape Maker, 2022).

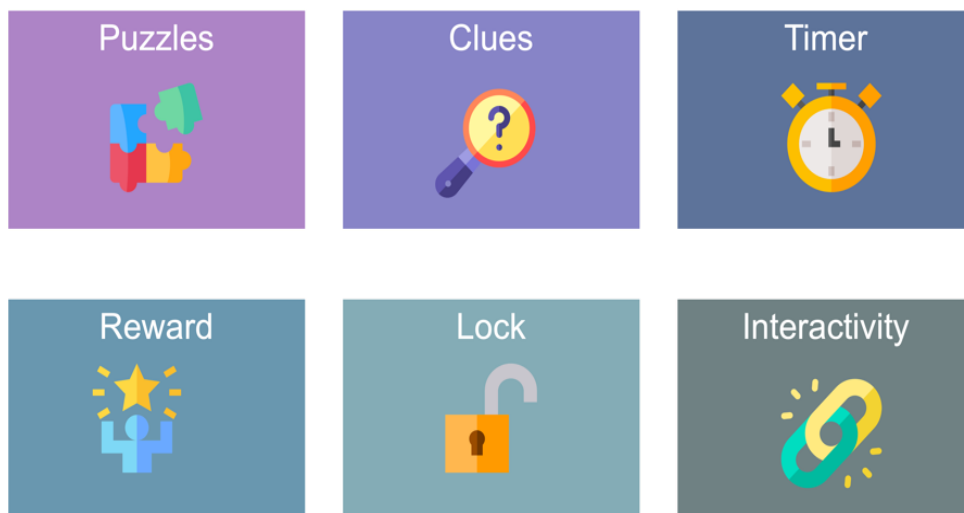
Figure 7: Research Design



3.5 Room Escape Maker

The researcher created a virtual escape room based on three Microsoft Excel functions: *AND*, *IF*, and *COUNTIF*. The escape room was developed together with a Microsoft Excel spreadsheet. The activity was designed around a story of a murder scene and required the students to immerse themselves into the story as a character who needed to escape from the murder scene. To do this, they needed to use the functions in Microsoft Excel that would give them clues that they could use to help them escape the room. As each clue led them closer to escaping the room, they would indirectly learn and apply their knowledge of Microsoft Excel functions. Alsawaier (2018) states that adding a story in game-based learning is regarded as one element that promotes student motivation and engagement. Figure 8 depicts the gaming elements in this virtual escape-room game based on what was available inside the Room Escape Maker platform.

Figure 8: Gaming Elements



As discussed in Chapter 2 as part of attention, the gaming elements pertain to the ARCS because the puzzles and clues integrate active participation, conflict, and real-world examples (Zirawaga et al., 2017). Relevance linked with interactivity creates a connection to previous experiences, perception of current value, perception of future value, modelling, and choice (Ahmad, 2019). Using a reward and timer facilitates self-growth, communicates the objectives and prerequisites, provides feedback and gives

students a sense of control which forms part of confidence. As part of the satisfaction, the points linked to locking and unlocking items in the room and escaping the room, relate to praise and rewards, immediate application, and expectations (Ma & Lee, 2021).

A content area for the escape room was created on the learning management system (Blackboard) where the student could access all links, documents, and information about the game (Figure 9). This activity formed part of their class content and aligned with the module outcomes. Students had the opportunity to complete the task anytime during the week in which Microsoft Excel Module 1 to 4 was presented. Step 1 took the students to a question where they were asked to consent to play the game. The activity instructions also provided them with the Microsoft Excel file and the link to the escape room. The students read the activity instructions, and if they selected yes, they gave consent to play the game and to complete the survey as part of the data collection. Students who selected no were still able to play the game and to skip the survey step of the activity. They then followed the steps on the screen to download the Microsoft Excel file and open the link to the escape room. The instructions also provided a password to access the escape room website, as illustrated in Figure 9. There are six puzzles built into the escape room that they need to solve. Similar to what was found in this study, Matli and Joubert (2016) state that puzzles are known for motivating students in game-based learning.

Figure 9: Step 1: Escape Room

QUESTION 1


This escape is being used as an activity to help students with Excel. The information gathered will be used to improve the teaching and learning of this module and provide information on creating creative activities to help the students with the content. By selecting "Yes", you consent to play the escape room and answering a survey about your experience. All the data will be anonymous, and your name, surname and student number will not be used in the research or published anywhere. (please see this letter if you need more information) [Letter of Consent](#)

Do you give your consent to do the escape room, a survey and possibly a short interview to help us improve this module and activities for future students?

Please use your name and surname as your username in the Escape Room Game.
Please email ciska.aim@gmail.com if you have any queries.

- Please download the Escape Room Instruction file below.
- Download this file and open it by clicking the file: [Escape Room_Instruction and Start File.xlsx](#)
- Open this link <https://roomescapemaker.com/u/CiskaSnyman/solvethemurder>
- Read the instruction file before starting the Escape Room Game.
- The game Password is. [Excel](#)
- **Remember to select your answer below and click on Save and Submit.**

Thank you, and enjoy the game 😊



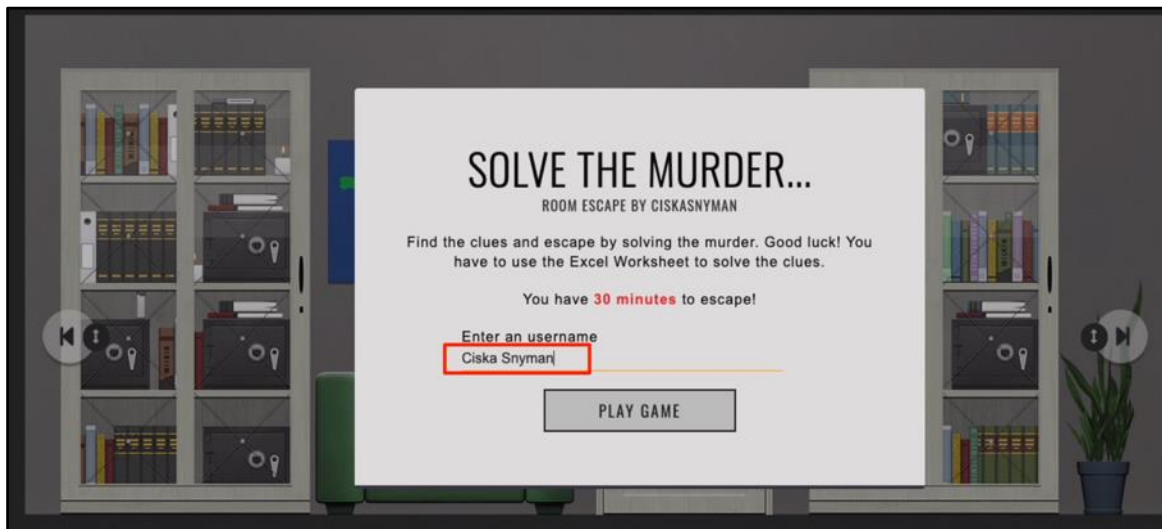
Yes 👍

1. Open the instruction file and read the instructions [Escape Room_Instruction and Start File.xlsx](#)
2. Open <https://roomescapemaker.com/u/CiskaSnyman/solvethemurder>
3. Enter your Name and Surname
4. Password: Excel
5. Play the Game and solve the murder!
6. Complete the Survey

No 🙅

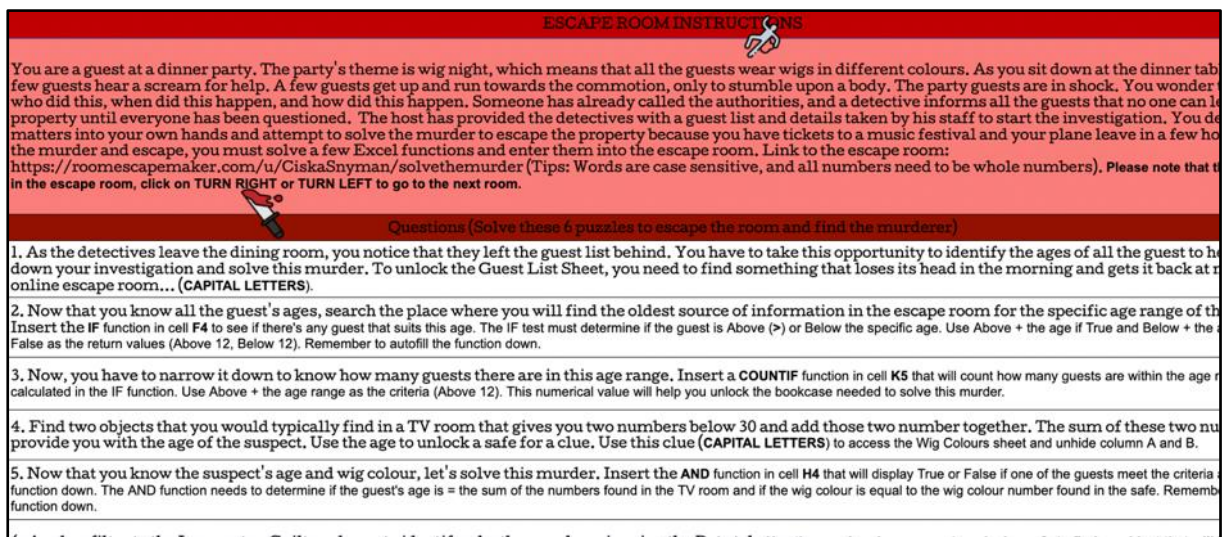
Upon entering the escape room, students find themselves at a murder scene (Figure 10). This game was based on a classical murder scene scenario, and it allowed the students to participate in problem-based learning where they solved the murder using Microsoft Excel. Additionally, it enabled the students to see what Microsoft Excel can accomplish. As a result of seeing the murder scene, the students could gain a sense of authority to solve the crime. A perfect match was achieved between the theme of this game and the websites of Room Escape Maker because it was appropriate for the scenarios, as well as the colour scheme and available icons. This benefitted the study by utilising the aesthetic aspect of the game. In addition, the aim was that this theme would contribute to student motivation as their understanding of Microsoft Excel formulas would assist them in escaping the room and solving the murder (Figure 10).

Figure 10: Virtual Escape Room



Using both the escape room and the Microsoft Excel sheet, students were guided to apply Microsoft Excel functions to discover clues to unlock something in the room (Figure 11). Each time they unlocked something in the room, they received the information they could input on the Microsoft Excel sheet to complete the calculation using Microsoft Excel functions.

Figure 11: Game Navigation



As illustrated in Figures 10–13, the students worked back and forth between the escape room and the Microsoft Excel sheet to complete the six puzzles, solve the murder, and escape the room. The Microsoft Excel workbook comprised two distinct

sheets: one dedicated to puzzles and another serving as the guest list. Essentially, the puzzle sheet functioned as the set of instructions, while the guest list sheet provided the space where participants could apply the instructed formulas and features, as outlined in the puzzles.

Figure 12: Puzzle 1–4



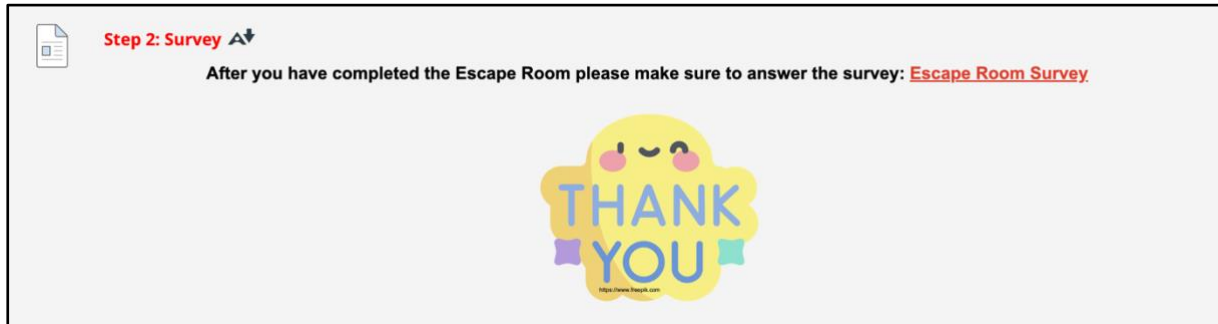
Figure 13: Puzzle 4–6



When the murder was solved and the students had escaped the room, they would return to the learning management system. The activity was completed, and the data collection process began. The students then completed step 2, which is the survey, as illustrated in Figure 14. Students were provided with a link to the survey so that they

could complete it. The survey was designed on Qualtrics, and the data was captured for analysis.

Figure 14: Survey



3.6 Sampling

The population is the entire group with the trait that is being studied, however, it is frequently difficult to examine the entire population due to considerations like size, time, or money (Ponelis, 2015). The population for this study was first-year students. A smaller, representative subset of the population is chosen by sampling, which enables researchers to make conclusions without looking at the entire population (Martínez-Mesa et al., 2016). To make sure the sample accurately reflects the characteristics of the population, various methods, such as random or stratified sampling, are used. As a result, it is easier to conduct research and draw conclusions from a larger group (Murairwa, 2015).

The researcher aimed to gauge the response and participation rates within a substantial group of 8,732 students. A total of 546 students voluntarily engaged with the game and subsequently completed the Qualtrics survey, resulting in a response rate of approximately 6.24%. To further delve into the experiences and perspectives of these participants, the researcher conducted semi-structured interviews with a subset of five participants, accounting for roughly 0.91% of the survey respondents.

The researcher employed a mixture of purposive, voluntary and convenience sampling techniques. Purposive sampling allows the researcher to select a precise participant because it focuses on the phenomenon the researcher wants to study (Martínez-Mesa et al., 2016). The researcher conducted purposive sampling by selecting the AIM

module where the escape room was played by a large number of students. In the process of participant selection for the study, the researcher employed a voluntary sampling approach. Participants were recruited in person or online. Voluntary sampling involves little effort in controlling sample composition (Murairwa, 2015). In this study, the researcher knowingly selected the AIM module with 8732 students, hoping for many participants in the game. Convenience sampling relies on collecting data from a conveniently available population to participate in the study (Ponelis, 2015).

The sample criteria in this study were 8732 first-year students from a higher education institution. These students were enrolled for the Academic Information Management (AIM) module, in which the escape room is presented. Owing to the researcher's position as a lecturer and Blackboard administrator for this module, the game could be incorporated into the module schedule and presented on the learning management system. The compulsory module aims to equip first-year students with information and computer literacy skills to assist them in their daily lives and future workplace environments. The escape room was made available on the university learning management system, where 9,000 students could play the game voluntarily, but only 546 students played the escape room game. The number of participants (N) comprised 546 students who played the game and completed the quantitative survey. A sample (N=5) was drawn from the population using purposive and convenience sampling to collect qualitative data in a semi-structured interview.

3.7 Data Collection

As part of the pragmatic paradigm method to data collection, the researcher used a combination of quantitative survey and qualitative semi-structured interview to collect the data. As shown in Table 2, this table describes how the data is collected, how it is documented, and where the data comes from. The researcher designed the questions for the Qualtrics survey and semi-structured interviews, and these questions underwent reliability testing by a statistician prior to commencing the research with the participants.

Table 2: Data Collection

Data Collection Technique		Documentation Method	Data Group
Quantitative	Surveys	<ul style="list-style-type: none"> • Qualtrics data analysis • Record of responses 	Distributed to all participants who played the escape-room game.
Qualitative	Semi-structured interviews	<ul style="list-style-type: none"> • Recording • Verbatim transcription 	Five participants played the game and escaped at different times.

3.7.1 Survey Questionnaire

Surveys were used as a quantitative method to collect data concerning participants by asking questions in a survey format (SRQ1). A survey allows the researcher to collect a large amount of quantitative data and to analyse it statistically to draw meaningful conclusions on the phenomenon of motivation (Podesva & Sharma, 2013). After completing the escape room activity, the students completed a survey in [Qualtrics](#) software, Version EX of Qualtrics. Copyright © 2022 Qualtrics. Qualtrics is a web-based software that allows users to create surveys and to generate reports using various distribution means. With this software, researchers can collect and create visualisations based on the data collected in multiple formats such as Word, Microsoft Excel, PowerPoint, SPSS and Google. The survey was designed to explore motivation using the ARCS motivational model by recording the students' overall experiences with the game, exploring their motivational levels and influences while playing it, and using the Microsoft Excel file and its contents. The survey link was distributed to participants via the learning management system, emphasising its voluntary nature. Ethical approval for survey distribution and research conduct was obtained from the ethics committee and the Head of the AIM modules department. A statistician validated this survey to identify trends and confirm validity (see Table 3). The survey was administered to students immediately after playing the game as step 2 in the escape room experience ([Appendix B: survey](#)).

3.7.2 Semi-structured interviews

Semi-structured interviews are used as a qualitative method to collect data (SRQ2). Semi-structured interviews occur when the interviewer asks only a few predetermined questions while the rest are not predetermined since semi-structured interviews allow the interviewer to add additional questions if needed during the interview (Dearnley, 2005). The interviews were conducted with open-ended questions, allowing attentive, informal cooperative communication on Blackboard Collaborate (Alshenqeeti, 2014). Motivation is the phenomenon under investigation. The researcher formulated specific questions based on the ARCS model (Laurens Arredondo & Valdés Riquelme, 2021) to align with the research question: To what extent does the attention, relevance, confidence, and satisfaction model (ARCS) influence an escape room? ([Appendix A: Interview questionnaire](#)). True to the nature of semi-structured interviews, most of the questions were formulated or adjusted while the interview took place, permitting the researcher and the participants the adaptability to go into specifics in terms of clarification if required (Jamshed, 2014).

In accordance with the consent of the participants, the interview was conducted and recorded online on Blackboard Collaborate. In order to collect qualitative data, five students who solved the murder and escaped the room within a specific time frame were interviewed: two escaped in at least 20 minutes, two in under 20 minutes, and one in no more than 10 minutes. This variety was chosen in order to be able to accommodate players of differing skill levels. It was found that students who escaped between 10 and 15 minutes were more likely to be successful than those who escaped after 20 minutes. Owing to the varying experiences of the interviewees and the different elements of the game that they encountered, the semi-structured interviews allowed for a variety of responses.

3.8 Data Analysis

The study employed abductive reasoning, a combination of inductive and deductive reasoning (Mitchell, 2018). With the inductive approach, we can answer the **what** question, and with the deductive approach, we can answer the **why** question (Żelechowska et al., 2020). Charles Sanders Peirce developed abductive reasoning, a form of logical inference, in the third decade of the 19th century (Hidayah et al., 2020).

After the semi-structured interviews, the most straightforward and most likely conclusions were drawn (Karlsen et al., 2021). The quantitative data from Qualtrics were exported to Microsoft Excel as raw data. It is essential to note that the survey allowed for free responses in two of the questions, and as such, those variables were excluded from the discussion because they are open-ended questions. The data was evaluated using Cronbach alpha tests, and reliability was confirmed for the Likert questions in the survey, as shown in Table 3. Cronbach alpha values of 0.7 and higher are acceptable and confirm data reliability (Sekaran & Bougie, 2013).

Table 3: Cronbach Alpha Interpretation

Survey Questions based on Elements in Theoretical Framework	Question Number	Cronbach alpha Values	Interpretation
Attention	Q6, Q7, Q8, Q9, Q10, Q11, Q12	0.8415	Acceptable
Relevance	Q6, Q8, Q11, Q12, Q14, Q15	0.9077	Acceptable
Confidence	Q10, Q13, Q14, Q16	0.8304	Acceptable
Satisfaction	Q8, Q14, Q17, Q18, Q19	0.9103	Acceptable

Thus, it is clear that overall, the reliability of the questions is reasonably good. It was essential to note that for those instances where multiple answers were chosen (if neutral was one of the answers, then we used that option. Otherwise, if they selected agree and strongly agree, we selected the option closest to neutral. If both agree and disagree were selected, then the option was changed to neutral), the data were adapted to provide the most accurate response.

3.8.1 Quantitative data analysis

Quantitative data analysis emphasises analysing number-based data using various statistical techniques to produce meaningful and readable results (MacInnes, 2020).

The first level of analysis is descriptive analysis, where the data are summarised, and patterns are discovered. The two main subdivisions are descriptive and inferential statistics. Descriptive statistics portray the sample, and inferential statistics predict the population's delivery (Liang, 2021). To investigate these predictions, the following descriptive statistics were carried out to draw on the analysis. The percentage was used to demonstrate how a value or group of respondents within the data relate to a larger group of respondents (Kaliyadan & Kulkarni, 2019). Frequency was used to display the number of times a value is found (Amrhein et al., 2019).

The second level of analysis is inferential analysis, where the relationship between multiple variables is displayed to generalise results and make predictions. The following inferential statistics were analysed to draw on the predictions. Correlation describes the relationship between two variables (Byrne, 2007). Regression was used to show or predict the relationship between two variables (Cousineau, 2020). The statistical analysis for the survey results was created using the software R project (R Core Team, 2020).

3.8.2 Qualitative data analysis

The qualitative data were collected via semi-structured interviews. Content analysis was used as the data analysis method for the semi-structured interviews. Content analysis is a data analysis method used to make valid and replicable interpretations by translating and coding documented materials and recognising patterns within participants' feedback (Elo et al., 2014). In this study, the content analysis method was used to understand and transcribe the voice recordings from the semi-structured interviews. The researcher used the qualitative data analysing tool [Otter.ai](https://otter.ai) to transcribe the data and identify response patterns. Otter.ai is a website that offers transcription tools for data analysis and meetings (Otter.ai, 2022). The researcher used content analysis because it looks candidly at communication through transcriptions and emphasises the fundamental characteristics of social communication (Elo et al., 2014). The transcription themes are linked to the ARCS model by determining patterns in the data collected.

3.9 Quality Criteria

Qualitative research quality criteria ensure adherence to desired standards. They measure rigour and credibility. Mixed methods integrate qualitative and quantitative elements, enhancing comprehensiveness and validity (Frambach et al., 2013). Quantitative investigations have specific criteria. Internal validity measures accurate cause-and-effect assessment. External validity examines generalisability. Reliability assesses consistency and replicability, while objectivity ensures impartiality and lack of bias.

As discussed in 3.8 the study's questions demonstrate reasonably good reliability, with adjustments made for multiple answer choices. Quantitative data analysis, as described by MacInnes (2020), involves statistical techniques for meaningful results. This analysis includes descriptive and inferential statistics, as outlined by Liang (2021), with percentages and frequencies used to portray relationships and occurrences within the data. Additionally, the data's reliability was confirmed through Cronbach alpha tests for the Likert questions in the survey, as indicated in Table 3. Cronbach alpha values of 0.7 and higher, as per Sekaran and Bougie (2013), are considered acceptable and confirm data reliability.

3.9.1 Qualitative Quality Criteria

Figure 15 presents a clear overview of essential quality requirements, which help to increase the credibility of qualitative research. They can be used by researchers to assess the design, data collecting, and analysis procedures of their studies, guaranteeing conformity to relevant criteria. Following these quality standards improves the credibility and dependability of qualitative research findings. This increases the effect and utility of qualitative research in terms of giving relevant insights and contributing to knowledge across fields. In qualitative research, trustworthiness is critical for building confidence in the research process and conclusions (Frambach et al., 2013).

Figure 15: Qualitative Quality Criteria

Confirmability considers problems regarding the quality of the research study (Treharne & Riggs, 2015). The researcher has ensured confirmability by not participating in the interview and not adding their personal views.

Transferability considers to what extent the research findings can be transferred to other perspectives. Transferability can ensure that the research findings can help future research take place or form a basis (Leitch, Hill, & Harrison, 2010). Transferability was enhanced when the researcher described the research context and assumptions meticulously.

Dependability guarantees that the findings are dependable and can be used over time to assist other educators in improving motivation (Treharne & Riggs, 2015). The researcher has ensured dependability because the findings are consistent with the raw data that was collected.

The credibility of a research study considers how believable the research study is for the researcher and the participants (Treharne & Riggs, 2015). The researcher has ensured credibility by making sure that the level of agreement between the researcher and the participants was appropriate.

These four pillars work together to strengthen a research study's credibility overall by convincing readers and researchers alike that the research is reliable, usable, consistent, and impartial.

3.9.2 Quantitative Quality Criteria

Figure 16 depicts graphically the key features of quality criteria in quantitative research, assisting researchers in analysing research methodologies, data collection methods, and analysis techniques to ensure they fulfil the requisite quality. By adhering to these standards, researchers increase the validity, reliability, and objectivity of their findings, hence, increasing credibility and contributing to knowledge growth in their respective domains.

Figure 16: Quantitative Quality Criteria

Internal validity is a way to test if the research was conducted in a trustworthy manner (Louder, Thompson, Banks, & Bressel, 2019). The researcher has ensured internal validity by not being biased towards the findings.

External validity refers to the degree to which the findings might be generalized in other situations. (Galizzi & Navarro-Martinez, 2018). The researcher has ensured external validity by making the findings applicable to other fields of study.

Reliability is the degree to which the research design produces dependable results (Moon, 2019). The researcher ensured reliability by keeping the participant's details anonymous, which also aided the interviews in terms of honesty and reliable responses as discussed in Chapter 3 under sections 3.8 and 3.9.

Objectivity refers to the degree to which the research is unaffected by prejudice (Flinton, 2020). The researcher has ensured objectivity by not tampering with the findings to their desired outcome for the research.

These quality standards are critical in determining the rigour and credibility of qualitative research. Confirmability highlights the importance of researchers remaining objective, ensuring that personal biases do not influence the findings. The term dependability refers to the consistency and reliability of the research process, which ensures that the findings can be duplicated and validated. The degree to which the findings can be extended or adapted to different situations or populations improves the external validity of the research. The legitimacy and trustworthiness of the findings are established by approaches such as member checking and triangulation (Nowell et al., 2017).

3.10 Ethical Considerations

Ethical principles were implemented with every step and decision in the research process. The researcher's ethical stance directly influences the research process (Connelly, 2016). The ethics policy of the selected higher education institution demands the implementation of informed consent, voluntary participation, anonymity, pseudonyms, and confidentiality. Informed consent is vital to the study. The participants were made aware that participation in the research was voluntary, and by no means compulsory (Pitak-Arnnop et al., 2012). Informed consent states that there is a voluntary agreement between the participants and the researcher (Connelly, 2016). This agreement is not stipulated as a signed document but as a process where

the participants understand the research study and the risks it holds (Pitak-Arnnop et al., 2012). The participants were made aware that the research would remain strictly anonymous. Anonymity protects the privacy of the participants concerning their details and their answers to the questions (Pitak-Arnnop et al., 2012). Anonymity could motivate participation and cooperation (Connelly, 2016). The participants were assured that their answers would not be linked to their identities, since they would have the protection of pseudonyms. A fictional name was given to the participants, resulting in confidential findings (Connelly, 2016).

Ethical clearance was granted by the Faculty of Education's ethical clearance board, and the research study was permitted to take place with approval from the module's head of department. Written consent was obtained from the department where the research was to take place. Written consent forms were administered to the individuals participating in the interviews (Appendix D). The participants were informed that the interviews would be recorded for transcription purposes. The concepts mentioned above in Figures 15 and 16 were implemented in the data collection process to ensure optimal quality criteria for the participants and the findings. The researcher ensured that the interview- and survey questions were credible in order to produce a truthful and valid phenomenon.

3.11 Summary

The purpose of this chapter was to provide an overview of the methodology used in this study. It was decided that the pragmatic paradigm would be used because it integrated well with the mixed-method approach and focused on establishing whether the research question was valid while emphasising what worked well about the approach. Through the use of a mixed-methods approach, the researcher was able to collect quantitative and qualitative data in phases in order to gain a full understanding of student motivation through a game-based learning approach by analysing the statistical data and supporting the findings with the qualitative data. After the escape-room game was completed, a Qualtrics survey was made available on the learning management system so that the quantitative data could be collected as a final step after the qualitative data had been collected. During the second phase of the study, semi-structured interviews were conducted with five participants in order to gain a

deeper understanding of the motivational aspects of the project and to compare the findings with those of the survey.

An explanatory sequential mixed-method design was implemented using purposive and convenience sampling techniques to select participants. On the learning management system, the virtual escape-room link, the instructions, a Microsoft Excel document, and a link to the survey were all made available as a part of the content. Following the completion of a virtual escape room that was based on a game-based learning approach, the participants completed a comprehensive survey created on Qualtrics, along with a virtual semi-structured interview conducted after playing the virtual escape room. In order to analyse the data, descriptive and inferential statistics as well as content analysis were used. The forthcoming chapter will explore the insights derived from the collected data.

CHAPTER 4: ANALYSIS AND INTERPRETATION OF THE RESULTS

4.1 Introduction

This chapter discusses the findings that will help to address the research questions posed and provides an interpretation of those findings. This chapter also presents the results of the online surveys conducted on Qualtrics and the in-depth interviews conducted with five participants via Blackboard Collaborate, including the results of the online surveys conducted on Qualtrics. This chapter begins by explaining the statistical data that were collected from the study and then proceed to analyse and interpret the data. The statistical data were examined thoroughly and bolstered by the findings obtained from the comprehensive semi-structured interview, since both sources intertwine seamlessly. The following discussion of the findings is based on the ARCS framework that was used in order to sequence the findings logically in the framework. There is an in-depth assessment and critical argument regarding the main themes that can be drawn from the data, backed up by relevant literature presenting an in-depth discussion of the main themes.

4.2 Participants' Background

To determine the level of computer literacy of the students, the researcher asked them what computer-related courses they had taken during secondary school. This was intended to examine whether the results of this study were influenced by prior knowledge and whether the perception that background knowledge makes the game easier is actually true, given the results of this study. Computer Application Technology (CAT) and Information Technology (IT) are some of the optional subjects that students can take during their secondary school years. CAT introduces students to the different components of a computer system and the use of computers in daily life (Adegbenro & Olugbara, 2019), while IT focuses on logical and computational problems and the physical and non-physical components of electronic transmission, access, and manipulation of data and information (Crawford, 2000). Microsoft Excel forms part of the CAT and IT syllabus. Microsoft Excel is a spreadsheet software that was used to arrange and consolidate data and formed the basis of the virtual escape room game (Divisi et al., 2017).

Table 4: Distribution of subjects taken in secondary school

Participant response	Count	Frequency
IT	48	8.8%
CAT / RTT	65	11.9%
CAT / RTT and IT	4	0.7%
None of the above	429	78.6%

According to Vista (2020), Microsoft software, particularly Excel, holds prominent status as a vital 21st-century skill within the modern workplace. In the survey, the students had to indicate whether they had registered for CAT and/or IT in the last three years of their secondary school studies. About 78.6% (n=429) of the participants stated that they had not taken CAT or IT as a subject in secondary school, as illustrated in Table 4.

According to Hanımoğlu (2018), students who are exposed to technological devices think more deeply about their subject areas and can deal with complex subjects at a significantly younger age. The impression is that students who took a computer-based subject in secondary school would do better in this game, but the results show otherwise. Although 78.6% of the students had not taken CAT or IT in secondary school, 84% managed, after four short Microsoft Excel modules were taught on the basics of Microsoft Excel, to solve the murder and to escape the room (n=461).

4.3 Discussion of the Results

The following graphs visually summarise the results of the questions forming part of each section of the ARCS model in correlation with the semi-structured interviews. A five-point Likert scale was selected for the quantitative survey (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree). This scale was selected for the convenience of the participants and was appropriate for the type of questions. Participants also require less time and effort to complete a survey form, which they can do easily using mobile devices (Taherdoost, 2019). Additionally, the scale offers respondents a variety of options without overwhelming them (Croasmun & Ostrom, 2011). A total of 546 out of 8732 participants completed the survey, while five individuals engaged in a semi-structured interview. The survey encompassed a range of questions, including a binary yes-or-no, three open-ended, one multi-select, and fourteen Likert scale questions (Appendix X). On the other hand, the semi-structured

interview featured a series of 13 open-ended questions (Appendix Y). All these questions were meticulously crafted and structured according to the ARCS (Attention, Relevance, Confidence, Satisfaction) model.

A dual analysis of the data was performed using both quantitative and qualitative techniques. Qualtrics was used to handle the survey's quantitative data, which was then exported as Microsoft Excel and uploaded to SPSS where a number of algorithms were used to calculate the replies and percentages for the Likert scale questions in relation to the [Cronbach Alpha](#) test discussed in Chapter 3 section 3.8 and the [Spearman correlation analysis](#) discussed in Chapter 4 section 4.6. The creation of tables and graphs in Microsoft PowerPoint was also based on the quantitative data. On the other hand, the qualitative information from the semi-structured interviews was initially collected from Blackboard Collaborate as MP4 files. The transcription of these files, which distinguished between the interviewer and the participants, was then loaded to Otter.ai. The transcribed information was then downloaded into Microsoft Word and examined there to find recurring themes and patterns in the participants' responses as discussed in [Chapter 3](#).

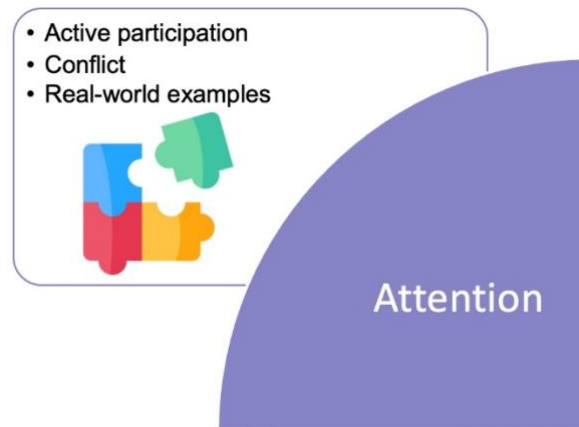
4.4 Findings

The responses to each of the Likert-scale questions are displayed visually, indicating the number of results supported by open-ended questions that formed part of the survey and are supported by the semi-structured interview data. The survey questions and semi-structured interview questions were designed according to the ARCS model (Figure 5). The research study conducted a sequential mixed method design (Birgili & Demir, 2022) to explain quantitative results with qualitative data. The semi-structured interview questions were used to probe a deeper understanding and to build on the survey questions. In order to understand and interpret how educational escape rooms support the development of student motivation with a game-based learning approach, the findings are presented according to the ARCS motivational model in the sequential order of the components, namely attention, relevance, confidence, and satisfaction (Susanti, 2022), as discussed in Chapter 2, Section 2.7.

4.4.1 Attention

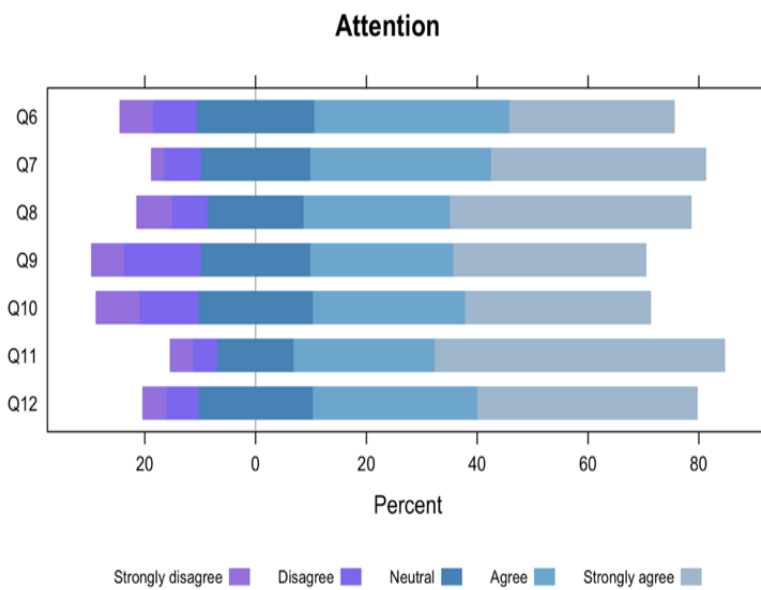
Attention refers to the perceptual and inquiry arousal of the participants while playing the game (Keller, 1979; Ucar & Kumtepe, 2019). According to Cicekci and Sadik (2019), various aspects grip the attention of students. Figure 18 outlines the key features depicted for the component of attention in the ARCs model.

Figure 15: Attention Features



In this study, attention includes elements such as clues (Figure 20; Q6), surprise (Figure 21: Q7), enjoyment (Figure 22: Q8), time limit (Figure 23; Q9, Figure 24; Q10), novelty (Figure 25; Q11), and variety (Figure 26; Q12) (Garris et al., 2002). As illustrated in Figure 19, the responses for Strongly Agree range between 29.7% and 52.2%, which indicates that the educational escape room created with a game-based learning approach held the students' attention.

Figure 16: Attention



Questions:

Q6 - The clues in each room helped me escape the room.

Q7 - The set-up of this game surprised me.

Q8 - I enjoyed the game-based learning approach.

Q9 - The time limit made it competitive.

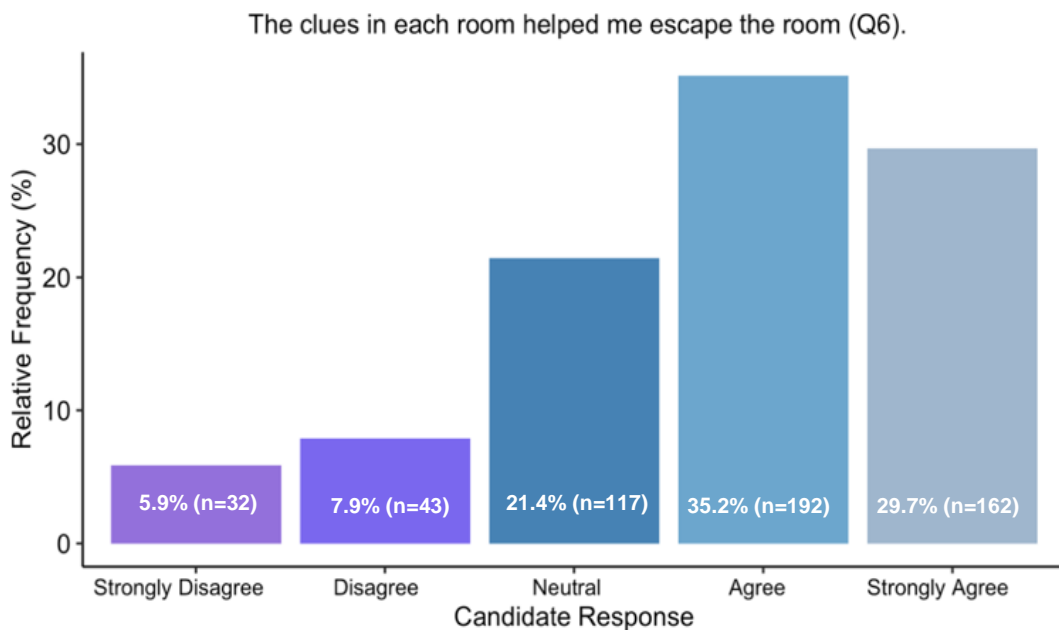
Q10 - The time limit motivated me to escape the room.

Q11 - The use of an escape room to learn more about Microsoft Excel was a new way of learning.

Q12 - The various type of questions / Microsoft Excel functions kept my attention during the game.

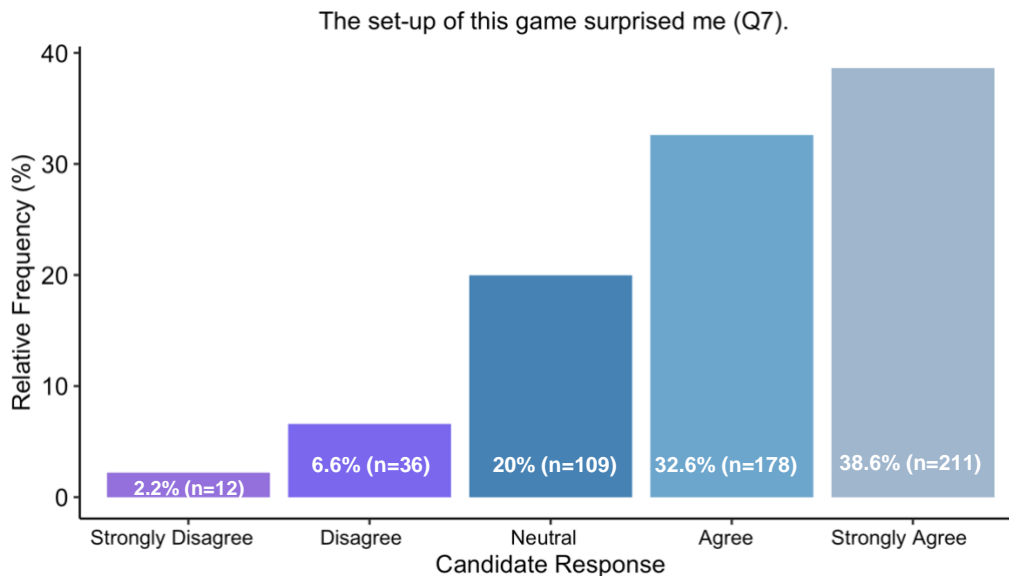
The students' acceptance of this new approach to testing Microsoft Excel knowledge was evident when P1 said: "I like that I had to search for things because I've never done an escape room before. So, it was quite challenging for me personally. And I really wanted to beat that time limit".

Figure 17: Escape Room Clues (Q6 - Survey)



Various gaming elements were incorporated into the escape room, and **clues** were one of them. These clues, which were discussed in Chapter 3, Section 3.5, guided the students between the Microsoft Excel file and the escape-room link to solve the puzzles. The participants found the clues useful, as 64.9% (n =354) agreed that the clues helped them to finish the game (Figure 20; Q6).

Figure 18: Game set-up (Q7- Survey)



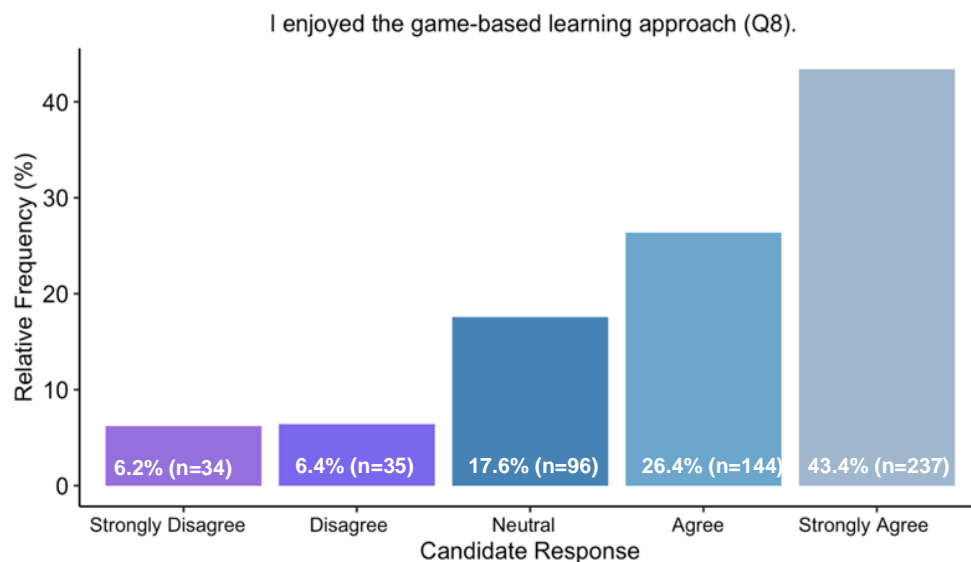
P3 mentioned that it was the creativity that made students enjoy the game. The creativity of the game's set-up was planned meticulously with design principles and the ARCS model to capture students' optimistic attention (Figure 21 - Q7). The researcher planned, designed and created the game. The aesthetic features and detail were also noted as necessary, as P2 said that the attention to detail kept their interest, and P5 mentioned that playing in an online escape room was exciting since the participant had never heard of it before. For P4, the challenge of solving the murder kept the participant's attention.

Gaming elements such as **clues** used in this escape-room game influence a student's motivation towards playing the game (Delacruz, 2012). It is demonstrated in this study, where participants indicated that the timer and clues motivated them to escape the room as quickly as possible to compare their time with that of their friends. The results

in this study also point toward the clues supporting and driving student motivation, as P3 replied, “I liked how each puzzle has a clue connected to it”.

Although the gaming elements, such as clues (Figure 20; Q6), surprise (Figure 21; Q7), enjoyment (Figure 22; Q8), time limit (Figure 23; Q9, Figure 24; Q10), novelty (Figure 25; Q11), and variety (Figure 26; Q12) captured the participants’ attention, these elements also linked incidentally to the educators and game designer in terms of planning, designing, creating, and distribution of the game, since it requires creativity from the beginning (Khikmah, 2019). Creativity can be viewed as a separate gaming element, but in conjunction with the set-up of this escape-room game, creativity forms the basis of each gaming element respectively (Figure 20; Q6).

Figure 19: Game-based Learning Approach (Q8 - Survey)



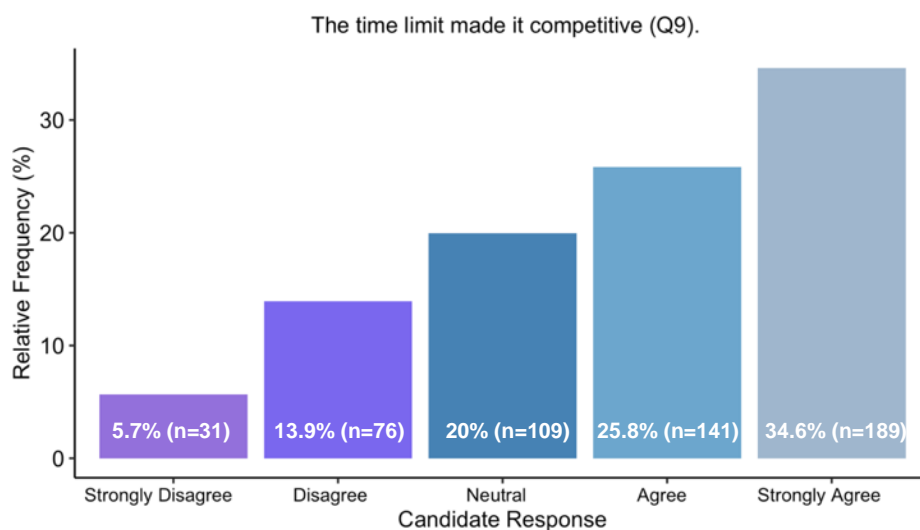
Similar to this study, Garris et al. (2002) concur that the game-based learning benefits, such as clues and puzzles in games, is favoured above traditional teaching, which inherently drives motivational aspects in educational games. Survey results indicated that 69.8% (n=381) of the participants **enjoyed** the game-based learning approach (Figure 22; Q8). Pho and Dinscore (2015) add that the game-based learning approach allows students to engage with the content actively, which is also evident in the participants’ responses in this study. P3 stated:

*I loved the game-based learning set-up of the game and did not expect it to be interactive. I thought it was only the Excel file, but then I saw it was connected to the escape room. It was such a **surprise**.*

This supports the notion that game-based learning could be a favourable alternative to traditional teaching methods (López-Fernández et al., 2021).

The participant's favouritism for the game-based learning approach is supported by how the participants believe an educational escape-room approach would be more beneficial than traditional teaching approaches. P4 believes that the approach is a good method for reinforcing content taught, while P5 replied, "I would just actually drop all the other stuff and just say everyone just does these games. It's way better". The **time limit** was proven to be a major driving component in terms of competitiveness with peers.

Figure 20: The time limit made it competitive (Q9 - Survey)

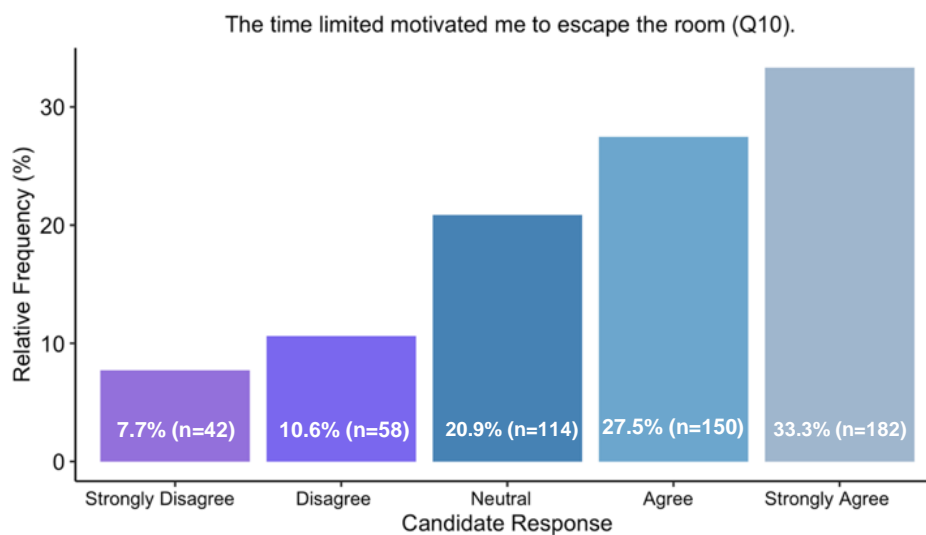


The results indicated in Figure 23 (Q9) that 60.4% (n=330) of the students felt that the time limit made them competitive in solving the murder and escaping the room. DiMenichi and Tricomi (2015) state that competition between peers has been associated with improved learning and attention based on effort.

The **competitive** aspect also correlates with attention and motivation in the sense that it connects inherently by holding the players' attention while participants are playing to motivate them to finish the game (Figure 23; Q9). P3 stated that, at first: "I did not see the time limit until I saw comments about it in the chat box, then I got very stressed and competitive at the same time. I wanted to finish before the time ran out."

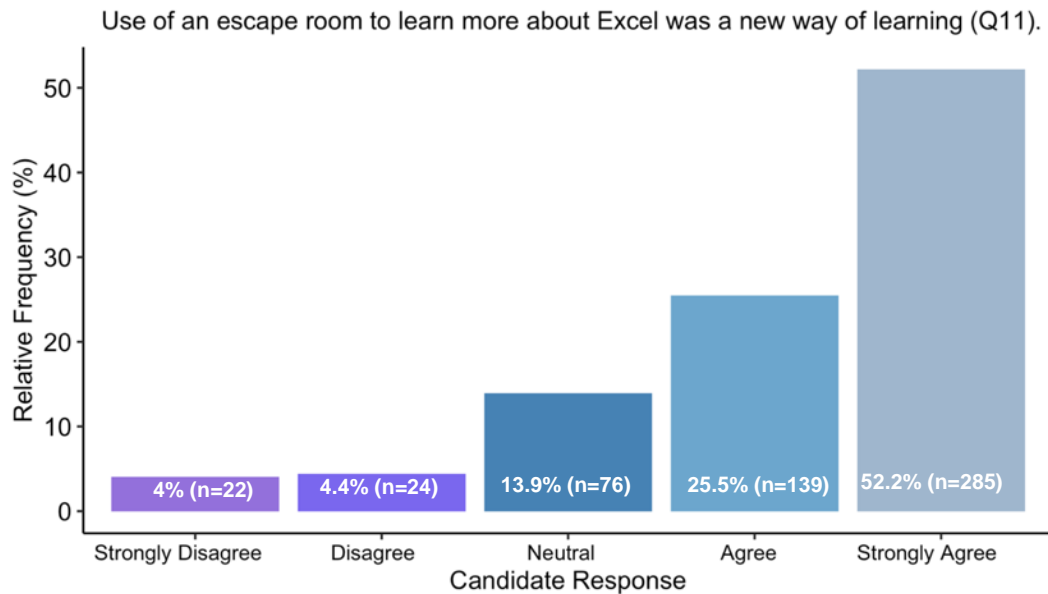
P2 responded: "I don't want to say that I am always competitive, but this game made me want to beat my friends in solving the murder before them", demonstrating the competitiveness of having a time limit.

Figure 21: The time limit motivated me to escape the room (Q10 - Survey)



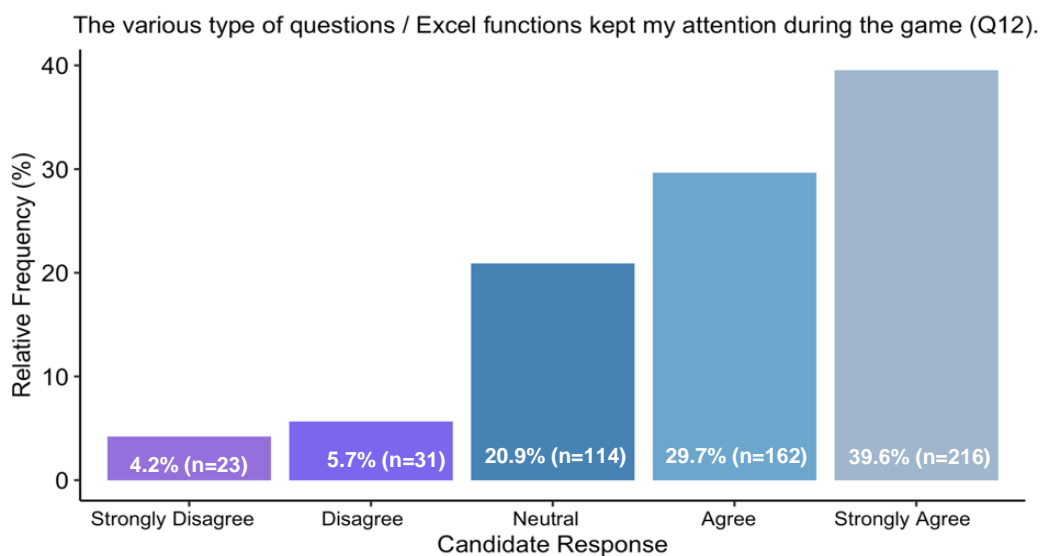
Of the students, 60,8% (n=332) agreed and strongly agreed that the **time limit** also motivated them to escape the room (Figure 24; Q10). The participants supported this statement in their responses to what motivated them to escape the room. P4 was curious to discover who the murderer was and to test their Microsoft Excel skills, while P5 replied, "The excitement and encouragement from the lecturer in my session and the time limit motivated me".

Figure 22: Use of an escape room to learn more about Microsoft Excel was a new way of learning (Q11- Survey)



In response to the evolving educational environment, traditional methods of teaching continue to transform into learning environments coupled with virtual experiences that are becoming increasingly important for institution leaders, educators, and key stakeholders in the student body (Singh et al., 2021). Figure 25 (Q11) exemplifies that 77.7% (n=424) of students felt that the virtual escape room was a novel supplementary method over traditional activity methods.

Figure 23: The various type of questions / Microsoft Excel functions kept my attention during the game (Q12- Survey)



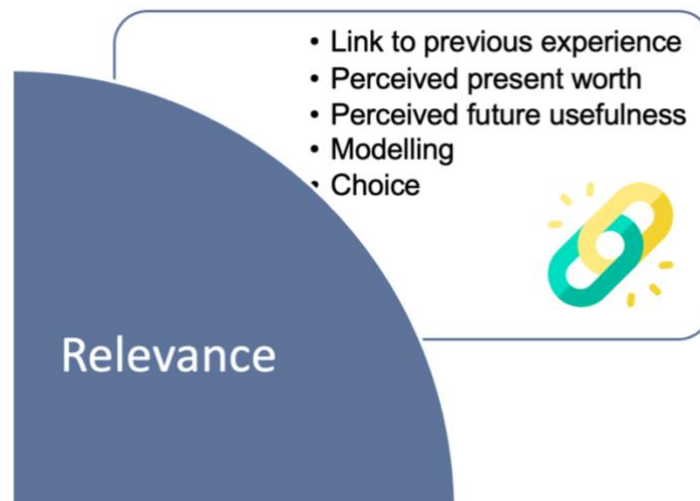
P1 stated that, although new, an educational escape-room approach would be more beneficial than traditional teaching approaches because “It is more fun and interesting than a normal document-based activity”. Not only is it new, but gaming makes learning easier for them (P2). The escape room mainly tested the players’ Microsoft Excel competencies, where players productively completed an IF, AND and COUNTIF function, applied conditional formatting, and unlocked a worksheet. The variety of Microsoft Excel functions kept the players focused and motivated to complete the steps in the game, as shown in Figure 26 (Q12).

Based on the provided information, the participants not only found great **enjoyment** in the escape-room experience but also maintained a high level of engagement throughout. This was accomplished through the utilisation of various game elements such as clues, surprises, enjoyment, time limits, novelty, and variety, which effectively captured and sustained their attention. It is worth noting that an impressive 69.3% (n=378) of participants mentioned explicitly that their attention was consistently maintained as a direct result of the incorporation of these gaming elements.

4.4.2 Relevance

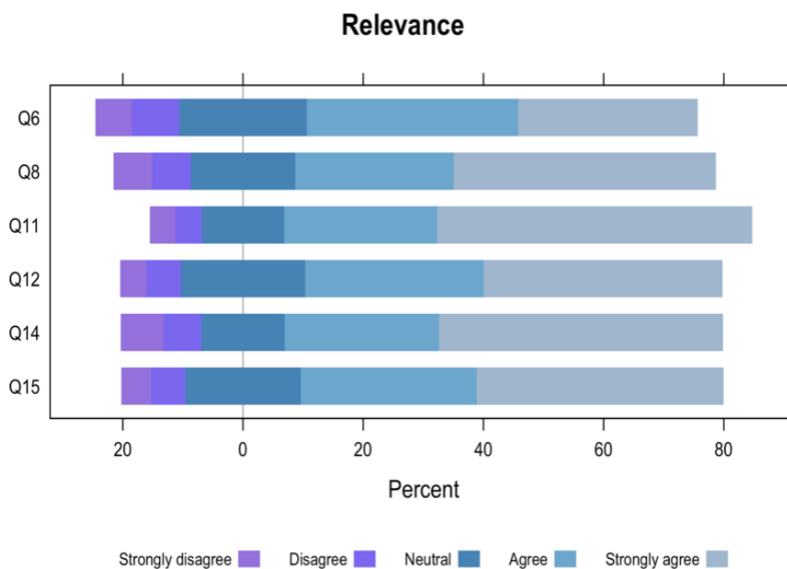
Coupled with the features from the ARCS model for the relevance component in Figure 27, relevance indicates that the activity given to students is relevant to the content, context and material, and in alignment with the module’s outcomes and the student’s personal academic goals (Grebe, 2021).

Figure 24: Relevance Features



However, these ARCS aspects cannot be seen in isolation. Alexiou and Schippers (2018) deem that aspects such as **clues** (Figure 20; Q6), **enjoyment** (Figure 22; Q8), **novelty** (Figure 25; Q11), **perceived present worth** (Figure 29; Q15) concern both attention and relevance. The interconnectedness of the attention and relevance gaming elements is embedded in the game content and design. As illustrated in Figure 28, more than half of the responses lean toward Strongly Agree, which denotes that the educational escape room created with a game-based learning approach is relevant to the content of the module and its learning goals.

Figure 25: Relevance



Questions:

Q6 - The clues in each room helped me escape the room.

Q8 - I enjoyed the game-based learning approach.

Q11 - The use of an escape room to learn more about Microsoft Excel was a new way of learning.

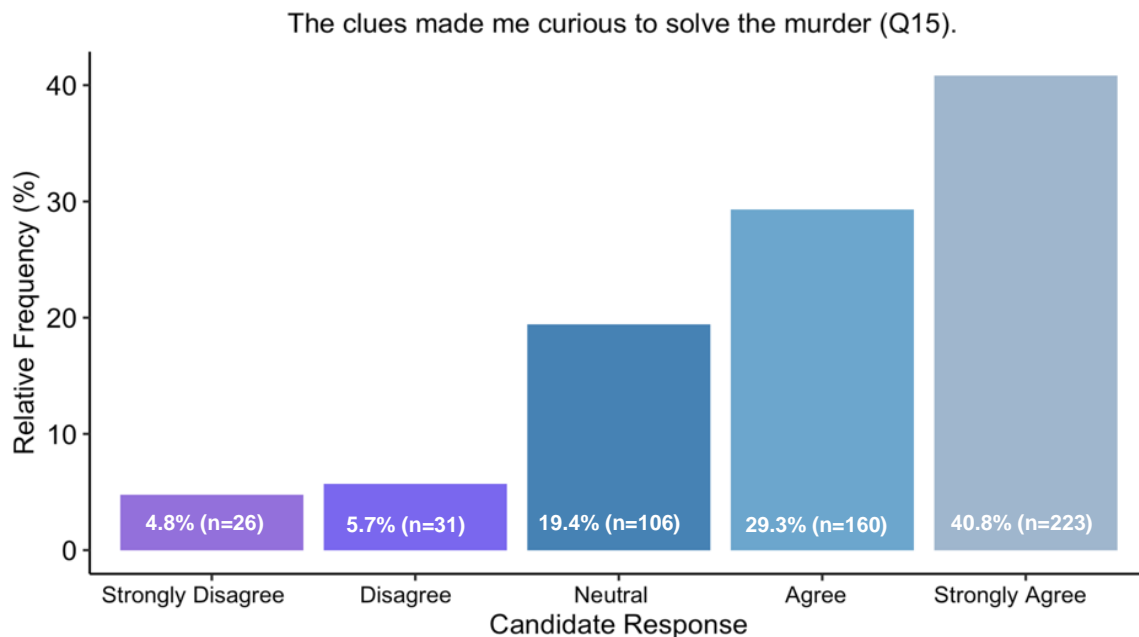
Q12 - The various type of questions / Microsoft Excel functions kept my attention during the game.

Q14 - I am likely to partake in an escape room in the future.

Q15 - The clues made me curious to solve the murder.

P1 responded that the escape room game was based on the four Microsoft Excel modules covered in the module, whilst P4 said: “We used the formulas we learned in class, we used in the escape room. It is thus relevant since it is based on the content we did prior to the game”.

Figure 26: The clues made me curious to solve the murder (Q15- Survey)

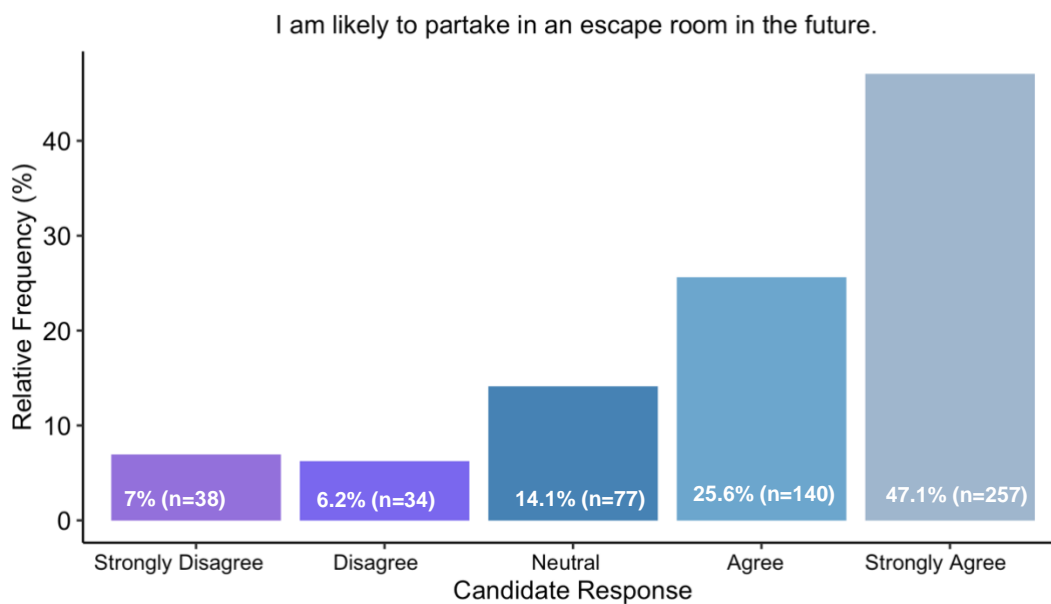


Clues serve a dual purpose of not only capturing students' attention effectively but also of aiding players (64.9%, n=354) in successfully escaping each room by solving the murder, as indicated in Figure 20 (Q6). Furthermore, the participants expressed unanimous agreement (70.1%; n=383) that the presence of clues sparked their curiosity significantly to unravel the mystery, as illustrated in Figure 29 (Q15). It is evident in the data collected that the participants felt supported by the clues and deemed them relevant (Figure 20; Q6, Figure 29; Q15), as supported by P3: "The clues were very relevant to the game and Microsoft Excel. It was all connected so one could not be skipped; you needed all the clues for the puzzles".

All the clues were connected and purposefully guided the players through all the steps and questions, so that it was not possible to skip one as all the clues were needed to solve the puzzles. As stated by P1, the clues were intertwined, and you needed one clue from the document to unlock something in the room or vice versa. The clues were key to performing the required Microsoft Excel functions successfully in order to escape the room and solve the murder. As P2 mentioned: "The clues were very important in solving the puzzles and doing the Microsoft Excel functions".

P5 stated that the clues were relevant to the puzzles and getting to the next step, which was one step closer to escaping the room. The escape-room game was designed in association with the Microsoft Excel sheet to allow players to connect with the puzzles in the Microsoft Excel sheet and the clues in the virtual escape room. Players had to make the links to finish the game. Of the participants, 64.9% (n=354) agreed that the clues (Figure 20; Q6), puzzles (Figure 39; Q19), variety (Figure 21; Q7) of questions and Microsoft Excel formulas were relevant during the game (Figure 25; Q11).

Figure 27: I am likely to participate in an escape room in the future (Q14- Survey)



The participants also deemed the escape-room game relevant in learning about computer literacy. P3 stated, “The game was appropriate, especially now with COVID, online learning and the fourth industrial revolution. I think all modules need to make assessments more creative”. It is evident that students are tired of repeatedly undertaking traditional assessment forms, as supported by Kişla & Karaođlan (2020). Participants repeatedly mentioned that the game-based learning approach was enjoyable (Figure 22; Q8), as supported by 69.8% (n=381) of them. Educators must examine the expectations of students and adapt their methods of assessment and mode of delivery (Kişla & Karaođlan, 2020) better to suit the information needs of Generation Z students. Students are eager to participate in activities that include escape rooms in future learning opportunities, as 72.7% (n=397) responded that they

are likely to participate in an escape room in the future, as demonstrated in Figure 30 (Q14).

Over the past few years, an increased interest in flexible and durable educational methods and tools has taken place (Jones & Walters, 2015). As a pedagogical method, games are becoming increasingly popular. Students consider virtual escape rooms a new and exciting teaching tool. P1 experienced the game as fun and innovative while testing basic literacy skills that are not part of the module content. The escape-room game not only tests Microsoft Excel skills but also crucial 21st-century skills, such as problem-solving and critical thinking, which are expected by Generation Z students in their need for innovative educational activities and future workplace needs (Roseberry-McKibbin, 2017). Of the participants, 77.7% (n=424) indicated that they favoured using an escape room to learn and practise their Microsoft Excel skills as opposed to traditional activities (Figure 25; Q11) because the participants stated that they are bored with the format of assessment traditionally used. As mentioned by P5: “It incorporated all the skills that we need to know to be computer literate”. The alternative motive of the escape-room game was to enhance computer literacy as it is the foundation of the module.

From the above-mentioned information, it is evident that the participants found the content of the virtual escape room and the Microsoft Excel sheet containing the puzzles relevant to the module, as well as the actual escape-room game that the participants played. The aspect of relevance was a driving factor for the participants’ curiosity, motivating them to finish the escape room game (Moffett et al., 2023)

4.4.3 Confidence

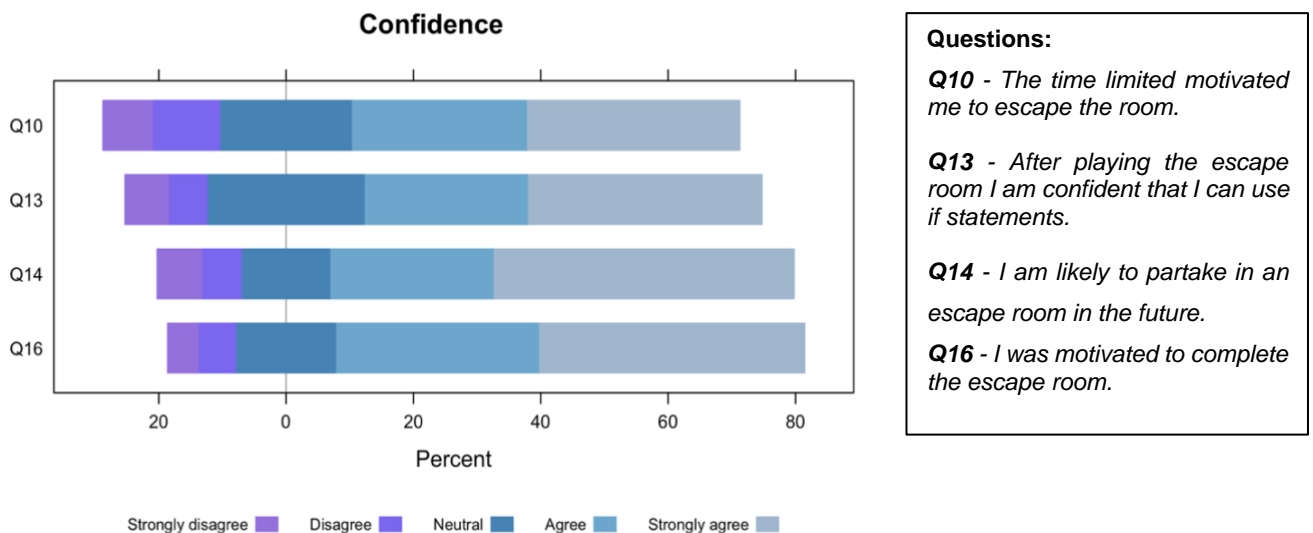
In this study, the survey statements that relate to confidence (Figure 31) focused on elements such as being motivated by the time limit (Figure 24; Q10), students’ confidence in using the set Microsoft Excel functions (Figure 33; Q13), students’ willingness to play a similar game in the future (Figure 30; Q14), and students’ motivation to complete the escape-room game (Figure 34; Q16).

Figure 28: Confidence Features



Motivation is the key to learning almost anything, and confidence is the key to motivation. A student who feels confident in their knowledge requirement journey will feel motivated (Leitão et al., 2022). These statements focused on the aspects that connect to confidence, such as facilitating self-growth, providing feedback, giving students control and communicating clear objectives and prerequisites.

Figure 29: Confidence



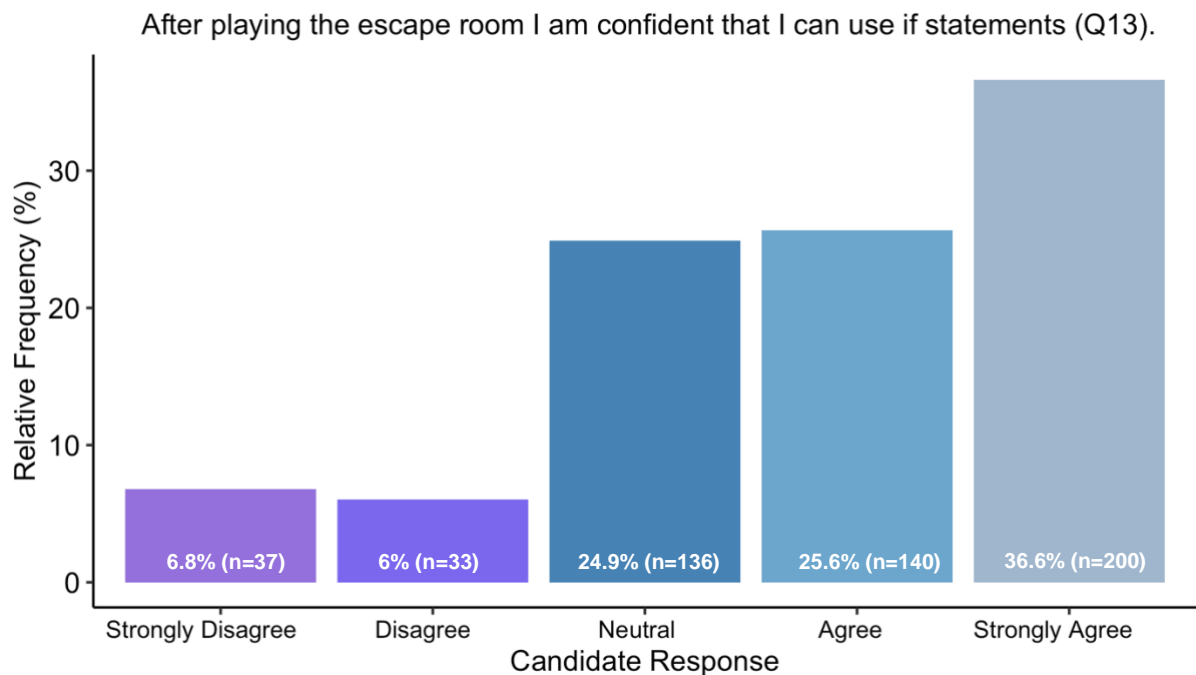
As illustrated in Figure 32, most of the responses indicate that the students Strongly Agree that the escape room with a game-based learning approach aided their confidence, indirectly motivating them to solve the murder and to escape the room.

This indicates that students' confidence levels were heightened, making them feel motivated to play the game, solve all the puzzles, and find the key to escape the room in order to solve the murder.

The participants agreed that the time limit imposed in the game served as a motivating factor in their quest to escape the room, highlighting its connection to the students' confidence. Notably, a significant majority of 60.8% (n=332) confirmed their agreement with this statement, as depicted in Figure 24 (Q10). P1 stated that they felt proud when they completed the escape room, and P2 mentioned that it made them feel that they had achieved something. Similar to El-Daw and Hammoud (2015), the researcher believes that when students complete a puzzle, their confidence level rises because it gives them the confidence to tackle the next puzzle after successfully completing the previous one. This means that their confidence builds up gradually throughout the game, which ultimately leads to the next element of the ARCS Model: satisfaction.

El-Daw and Hammoud (2015) state that the continued building of step completion led to game players accumulating confidence with each level or puzzle they move on from. This is evident in the participants' responses regarding solving the puzzles and finding items inside the escape room to unlock the door. P5 indicated: "I felt more and more confident in my ability to finish the game after solving each puzzle. I believed that I could finish the game when I unlocked the safe that had the key in. I felt confident".

Figure 30: After playing the escape room, I am confident that I can use the IF statements (Q13 - Survey)

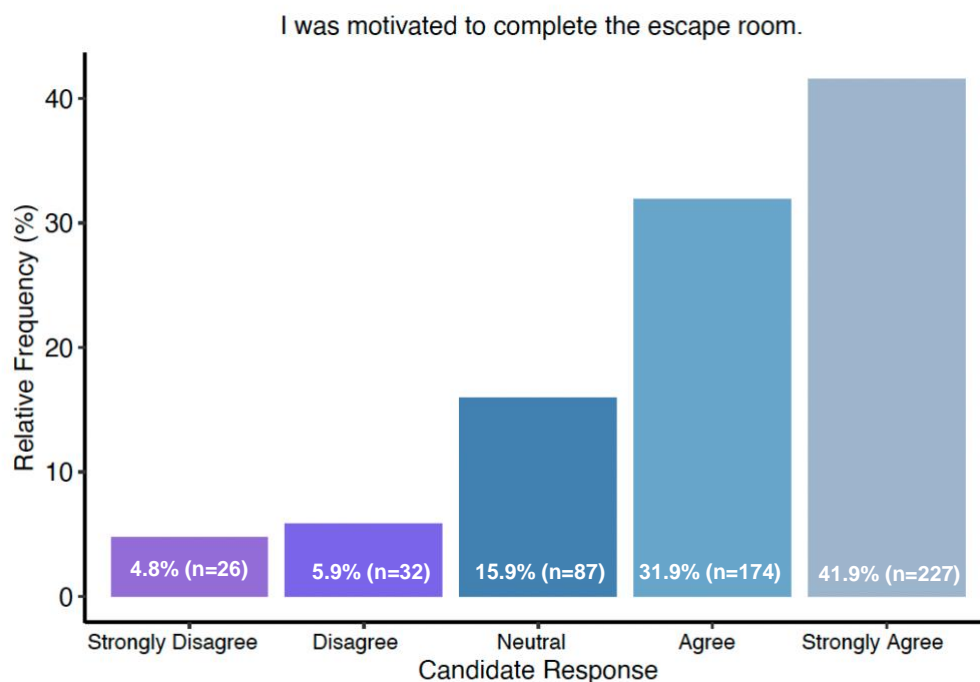


The escape room game directly connects the time limit, competitiveness, and confidence. Arce and Valdivia (2020) agree that incorporating a time limit into gamification on a digital platform can make students more competitive, directly improving their confidence levels (Arce & Valdivia, 2020). This is evident when P1 stated that they are not always competitive, but that the game makes them feel competitive because they want to beat their fellow classmates to solve the murder before them. P2 mentioned that they felt even more competitive when they saw the facilitator put a poll in the session to answer 'yes' when they finished the escape-room game. Small incorporations in such timed sessions while a game is running can improve confidence, since P3 felt that seeing other students say that they are done with the game made them even more competitive because they also wanted to finish. P3 describes the feeling as a simultaneous mixture between stress and excitement.

On that juxtaposition, P4 felt that the game was shorter than expected and stated that students who did not know Microsoft Excel took longer to complete the game, but they had done Microsoft Excel in school and managed to finish the game quickly. This can be viewed as common logic in the sense that knowing the content tested in the game will make you complete the game faster, but this statement connects to Hanımoğlu (2018) explaining that students who have experienced forms of computation have a deeper logical thinking mechanism, which can be due to secondary school subjects

such as CAT and IT and to socio-economically advanced students having computers at home (Hanımoğlu, 2018). This alteration in background knowledge only benefited a few because 78.6% (Table 4) of the students had not taken CAT or IT in secondary school, and 84% (n=461) solved the functions and finished the escape room game successfully. The participants felt more confident in their ability to use the Microsoft Excel IF statements after playing the game, as 62.2% (n=340) agreed with the statement, as indicated in Figure 33 (Q13).

Figure 31: I was motivated to complete the escape room (Q16 - Survey)



With 72.7% (n=397) of the participants agreeing that they are likely to play an escape room game in the future, it is evident that most students enjoyed the game (Figure 30; Q14). P3 attributed their successful game experience to the timer, music, and the facilitator in the session announcing the time with the next song. Also, P5 stated that their eagerness to see who the murderer was greatly influenced their motivation to play the game. Continuous exposure to game-based learning and gamification integrated into traditional teaching can improve confidence, which leads to the likelihood of attempting such an experience again. Hamari and Koivisto (2019) state that factors that influence participants' attitudes towards educational games, as well as the intention to continue playing the game, can be influenced by the gaming elements, the

game environment, and the confidence level build-up throughout the game (Hamari & Koivisto, 2013). The participants felt motivated to complete the escape room, with 73.8% (n=401) agreeing with the statement, as indicated in Figure 34 (Q16).

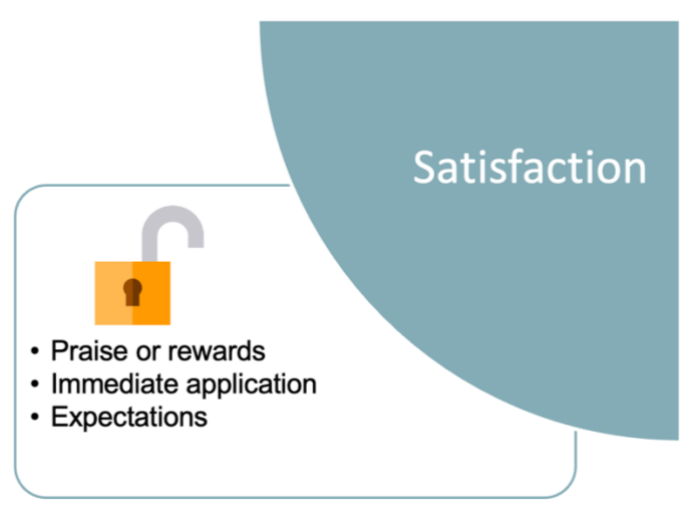
P1 felt the fact that they needed to solve all six puzzles to find out whom the murderer was kept them motivated to finish the game. P1 also mentioned that the game is set up so that one cannot skip a puzzle one needs to complete because it forms part of the next puzzle. P2 felt that the online session while playing the game motivated them to collaborate within the time limit. A few responses mentioned that the activity in the online session helped the students stay motivated. This can be attributed to the need for collaboration, since students were playing the game alone but virtually, so they were not alone because their classmates and facilitators were in the online session motivating them while they completed the puzzles.

Overcoming difficulties goes hand in hand with confidence in relation to believing one has the ability to complete a task (Norman & Hyland, 2003). An open-ended question in the survey was put forward as: Did you encounter any difficulties when attempting to escape the room? Where and why? (Q4). As mentioned earlier in Section 4.5.1, students who encountered issues mostly struggled with unlocking the guest list sheet, following the instructions, and compiling the IF statements in the Microsoft Excel workbook. Participants stated that they kept trying and did not give up when they encountered difficulties playing the game (Q4). The majority of the responses received in the semi-structured interview attributed their perseverance to trial and error. From the data, the participants found the elements and the game itself to be a confidence booster, based on the time limit, their ability to complete the game, their ability to do the IF statements, and their motivation to complete the game. The aspect of confidence was a driving factor for the participants' curiosity, motivating them to finish the escape-room game.

4.4.4 Satisfaction

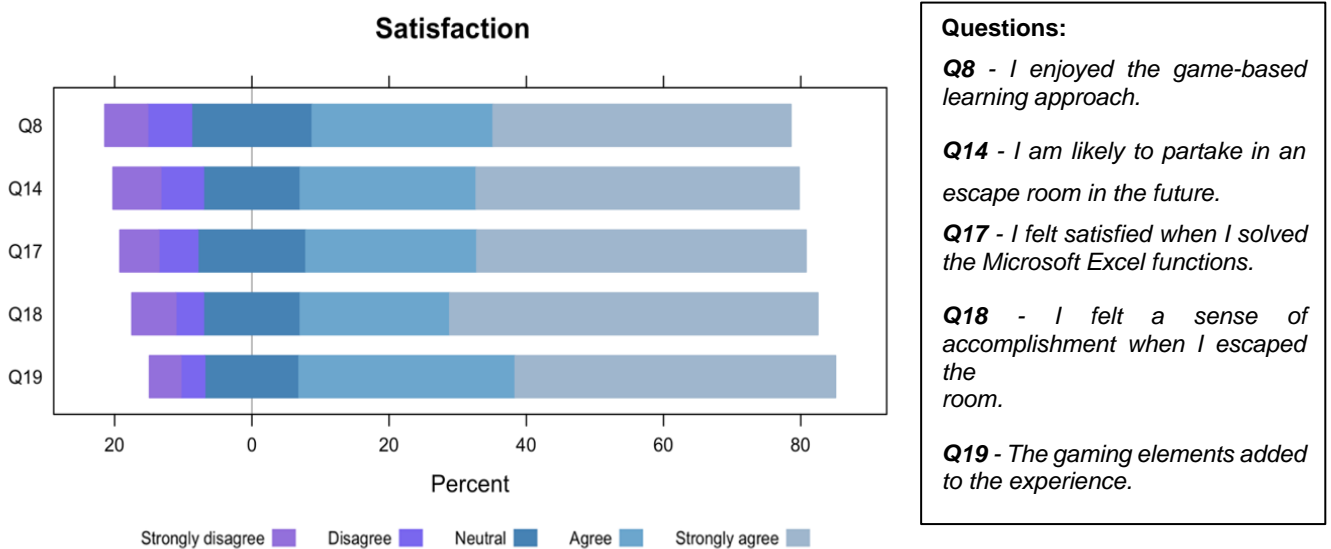
A feeling of satisfaction occurs when you accomplish or achieve a task you want or need to undertake (Formosa et al., 2022).

Figure 32: Satisfaction Features



In this study, satisfaction in game-based learning includes features such as enjoyment (Figure 22; Q8), future usefulness (Figure 30; Q14), satisfaction (Figure 37; Q17), accomplishment (Figure 38; Q18), and experience (Figure 39; Q19), as highlighted in Figure 35 (Yu et al., 2021).

Figure 33: Satisfaction

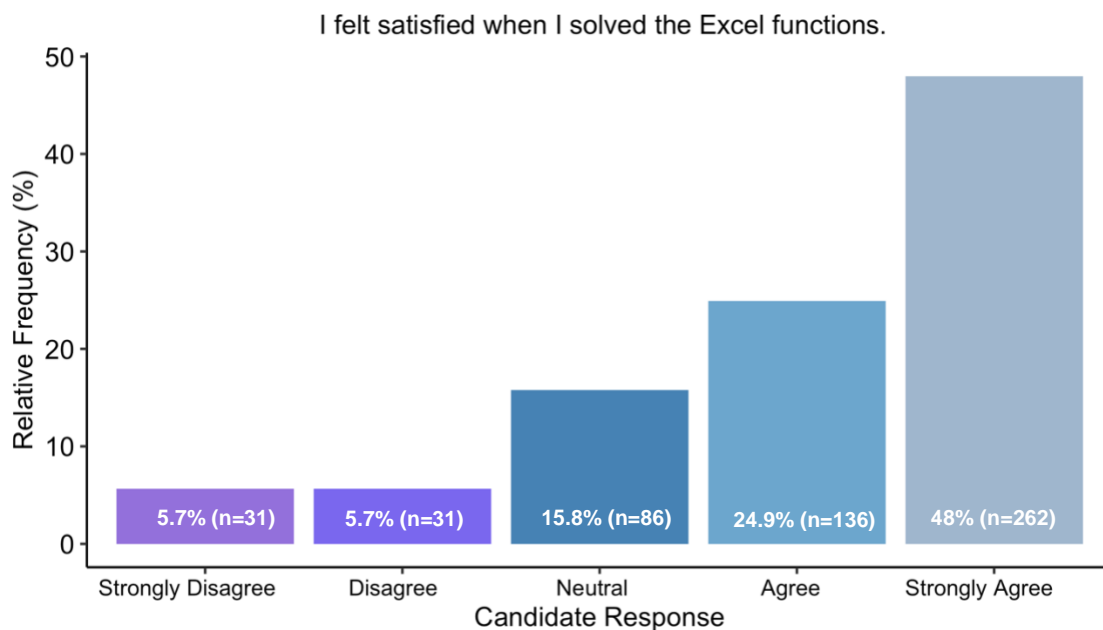


As illustrated in Figure 36, between 42.1% and 53.7% of the responses linked to the survey questions on satisfaction lean towards Strongly Agree, which is an indication that the virtual escape room created an experience that allowed the participants to feel satisfied with the game, the gaming elements, and drawing on the sense of

accomplishment, which is satisfaction, when participants finished the game and solved the murder

The gaming elements of puzzles and clues interlinked between the virtual escape room and the Microsoft Excel workbook grabbed the participants' attention, added to the relevance of the game, allowed the participants to build their confidence throughout the game and opened the possibility for a sense of satisfaction after problem-solving a puzzle, finding a clue and making the connection between the rooms in the game and the data in the Microsoft Excel workbook (Manzano-León et al., 2021). P1 felt very excited after solving a puzzle because it meant that they were one step closer to solving the murder. P2 stated that they felt super satisfied and proud of themselves for being able to play the game and pointed out that the experience was fun in terms of comparing their progress with that of their friends.

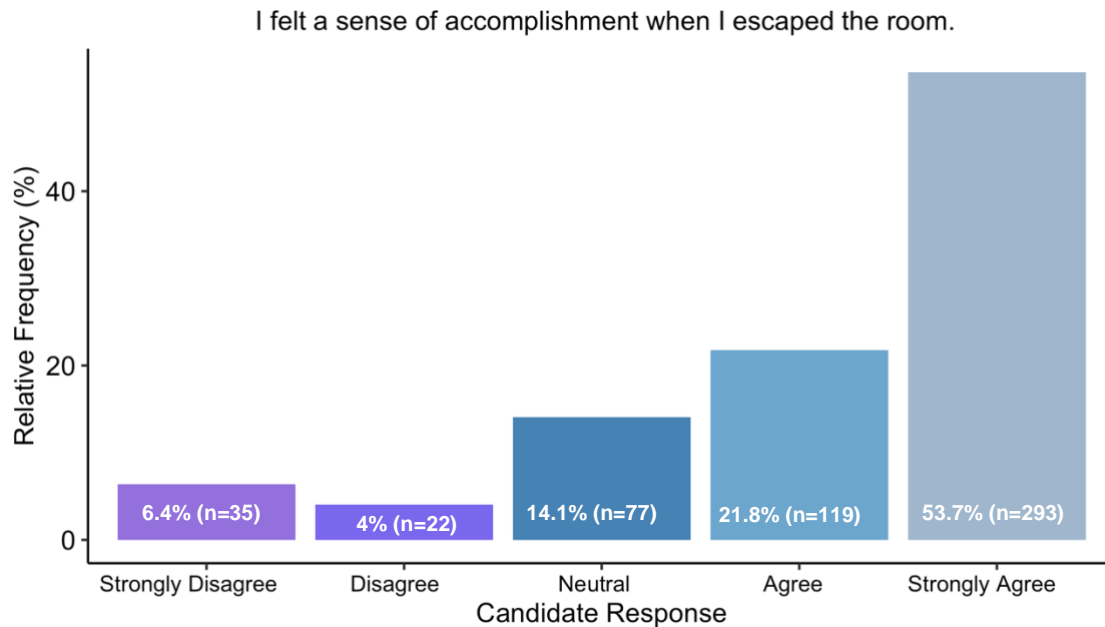
Figure 34: I felt satisfied when I solved the Microsoft Excel functions (Q17- Survey)



It is evident from the above-mentioned survey responses that the participants experienced satisfaction in task completion, with 72.9% (n=398) agreeing that they felt satisfied when they solved the Microsoft Excel functions (Figure 37; Q17). A sense of satisfaction accompanied by task completion is a direct result of incorporating the gaming elements correctly and connecting the game content and the puzzles to set up the opportunity for participants to build motivation during the game process and

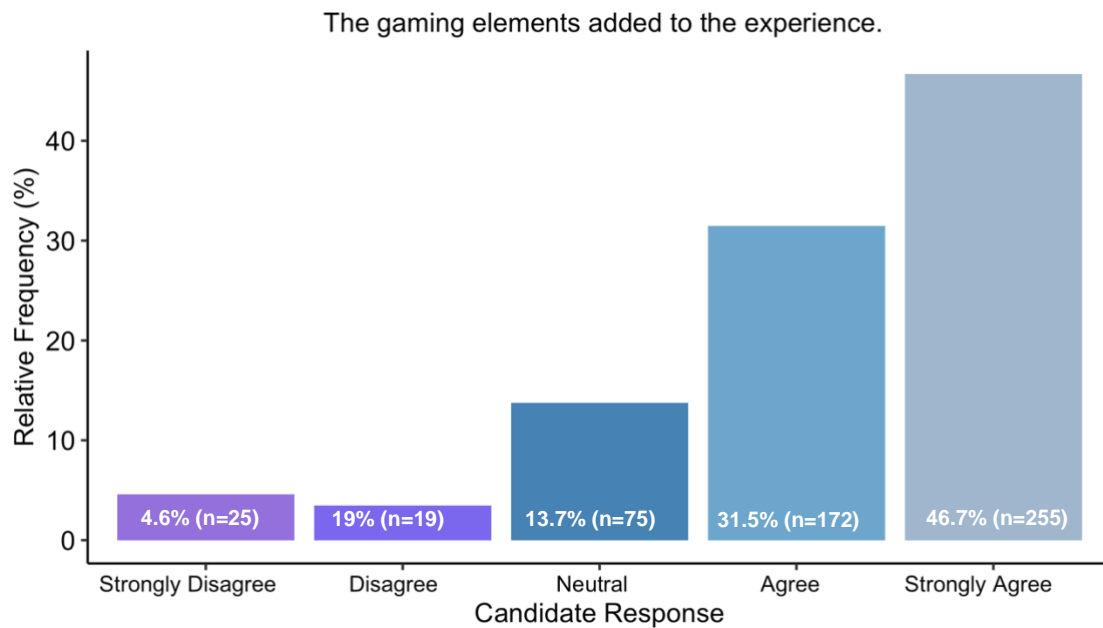
experience (da Silva et al., 2019). Hence Blair et al. (2016) believe that it is essential for an educator and game designer to understand the role of achievement in game-based learning.

Figure 35: I felt a sense of accomplishment when I escaped the room (Q18 - Survey)



The concept of achievement has been a part of games for players to see their points and progress, as well as having a scoreboard to see how players performed compared to others (Blair et al., 2016). Talbi and Ouared (2022) believe that educational games must be designed with a goal orientation because a participant's goal will affect how they experience and play the game. The orientation of the virtual escape room was learning-oriented, as the researcher's ultimate educational goal was for students to increase their competence level with the laid-out content of the game. The players felt a sense of accomplishment when they escaped the room, as stated by 75.5% (n=412) of the participants (Figure 38; Q18). This means that they completed puzzles, found all the clues, performed the Microsoft Excel functions and located the key to escape the room, indicating that they performed all the steps correctly to solve the murder.

Figure 36: The gaming elements added to the experience (Q19 - Survey)



As mentioned in the attention, relevance and confidence discussion earlier in the chapter, the gaming elements can be seen as an immense contribution towards the success of the virtual escape room. The participants enjoyed the gaming elements immensely, since 78.2% (n=427) stated that it added to their experience in undertaking the virtual escape room game (Figure 39: Q19). P3 felt that the game-based learning approach to Microsoft Excel was more fun than traditional methods and motivated them to improve. The other participants' responses supported this notion. All mentioned that such a learning activity aided their desire to continue learning, and that a game-based learning approach can be more relaxed than traditional assessment methods.

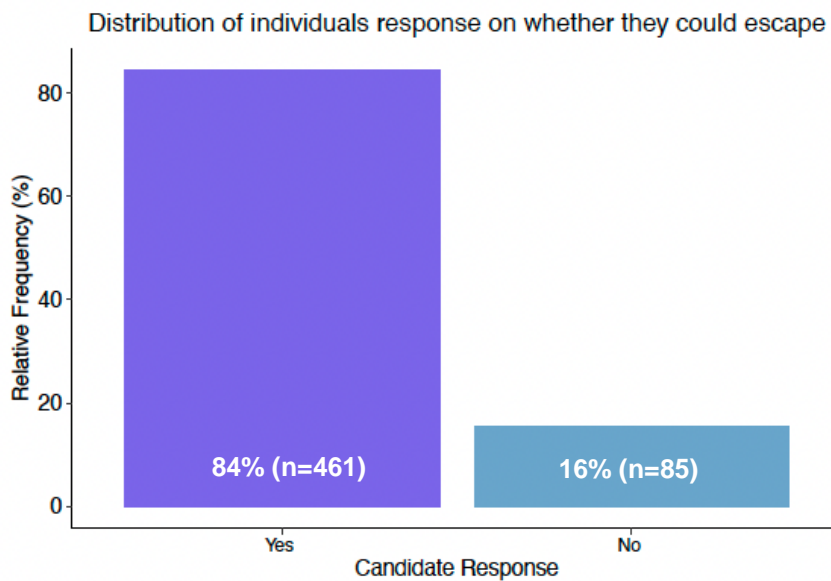
From the data, it was evident that the participants found the game elements, the game itself, the connection between the rooms and the Microsoft Excel workbook, and the integration between the puzzles and clues advantageous to the sense of satisfaction they felt during and after the game. The satisfaction quality was a forceful motivation aspect for the participants in the virtual escape-room experience.

4.5 Success of the Escape Room

The results revealed 84% of the participants successfully escaping the room, through solving the murder by completing the Microsoft Excel functions, and successfully

applying Microsoft Excel skills, as illustrated in Figure 17. It is apparent that the approach was successful since they persisted and finished the game. The game provided a sense of satisfaction because if participants completed a step, the instructions for the following step appeared, and the clues and puzzles followed each other. The findings revealed that the participants ultimately experienced confidence by escaping the room, solving the murder, and effectively applying Microsoft Excel skills. This is palpable in the response of P1: “I felt proud of myself for finishing the game” and P4’s response: “I was interested to see who the killer was, based on the things I learned in the Microsoft Excel modules. When I found the key and put it in my inventory, I was so excited to try to unlock the door”. The responses to Q1 are an indication that the use of the escape room as an educational game was successful. According to Vlachopoulos and Makri (2017), educational games can be a valuable tool in helping educators to identify what their students do not know.

Figure 37: Did you escape the room? (Q1- Survey)



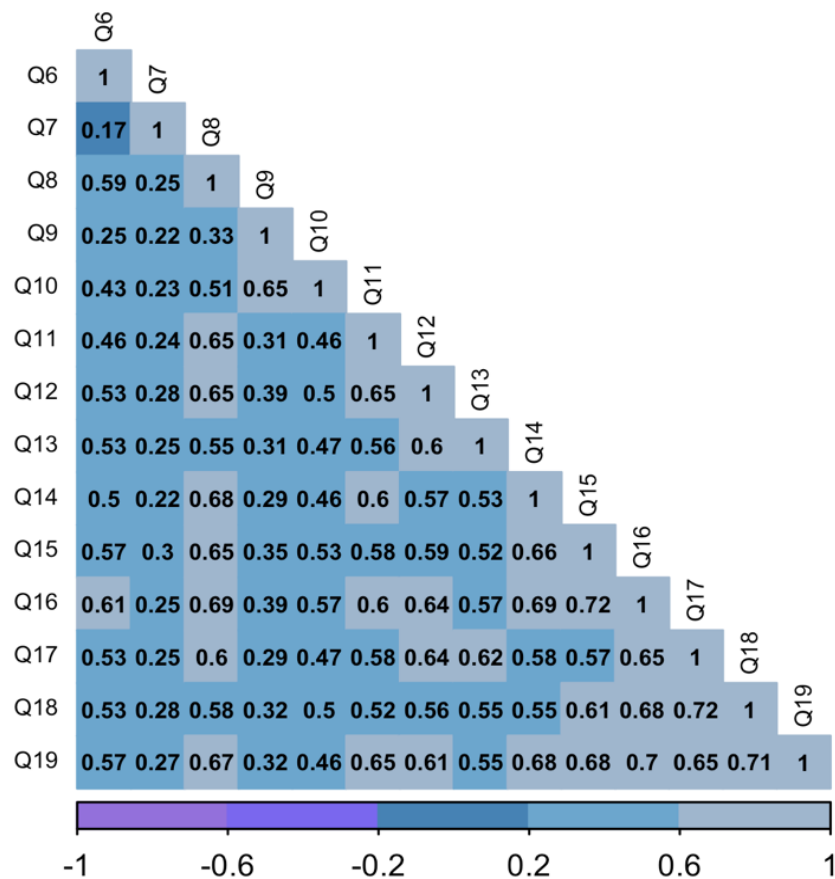
Question 1 in the survey was followed by an open-ended question for the 16% (n=85) who did not escape the room. It was discovered that the participants struggled to unprotect a Microsoft Excel sheet; carry out IF and AND functions; find the guest list; and some were unsure where to enter the answers to the puzzles. The findings revealed that most of the responses relate to the lack of content knowledge and to following instructions, on the part of the participants. A video explaining how the game

works or how to play the game could be helpful in terms of understanding what participants need to do beforehand. This video has the possibility to make the instructions easier to understand. From the responses gathered, the majority of the participants got stuck with the game itself and not with the instructions. This is similar to the findings of Vlachopoulos and Makri (2017). With the identification of knowledge gaps, the researcher can address these areas proactively through concise educational videos or small targeted focus sessions. These resources aim to bridge the gap by addressing specifically the outcomes that students were unable to apply in the game but learned during their lectures.

4.6 Correlation Analysis

An investigation was launched to determine whether a relationship exists between the responses recorded for the 19 Likert-scale survey questions (Appendix B: Survey) of interest in the quantitative data collection process. Since not all the variables were normally distributed, a nonparametric Spearman correlation analysis was performed to measure the degree of association between the two variables (see Figure 40). A stronger association is indicated when the values are closer to the outer bounds (-1 and 1). A significance test was included to determine whether the correlation differed significantly from 0. If this is not the case, then there is no significant association. The view in Figure 40 displays all the relationships, heatmapped to summarise whether the relationship is positive or negative. The heatmap in Figure 40 confirms a positive correlation in the relationship between the questions, as indicated by the values displayed in connection to the relationship of each question with the other.

Figure 38: Spearman Correlation Analysis



An X is usually used to indicate whether the correlation was significant. In this study, there is no X in the plot, since all of the correlations carried a significant connection which indicates that the relationship between the questions was positive. This indicates that the relationship between all the questions follows an adjective-aligned direction in terms of the answer pattern, meaning that participants had a positive as well as consistent experience with the game in terms of their answer selection, starting with a Likert-scale selection and following that pattern throughout all the survey questions. All correlations in this plot were significant at a 5% significance ($p < 0.05$).

The majority of the survey responses shadowed a uniform reply, which was expected owing to the motivational exploration by the researcher. This indicates that the game-based learning approach combined with the ARCS model was successful, as evident in the positive relation correlation in Figure 40. In this study, the ARCS model elements measure students' motivation, where motivation was evaluated using a virtual escape-room game with a game-based learning approach. The elements' connection tests how

attention, relevance, confidence, and satisfaction motivate participants throughout the gameplay. The relationship between the ARCS elements is prominent, as shown by the Spearman significance, resulting in a positive correlation between the Likert-scale questions (Appendix B: Survey). This indicates that the participants felt similarly about their responses which communicate that attention, relevance, confidence, and satisfaction were implemented successfully in the game and received positively by the payers. Therefore, with the use of a game-based learning approach, the game motivated students.

4.7 Summary

This chapter presented and discussed the findings based on the research results of the study. As part of a mixed-method approach to data collection, the data were collected using multiple methods. The data collection process was carried out through the use of a quantitative survey as well as through a qualitative semi-structured interview. This chapter was structured and analysed in accordance with the ARCS motivational model. There is no doubt in the mind of the researcher that attention, relevance, confidence, and satisfaction were achieved and obtained successfully by the participants in the virtual escape room in order to evaluate student motivation with the game-based learning approach of the virtual escape room. The subsequent chapter will lead us to the conclusion of our study.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

It is time to delve into the research conclusions and recommendations of this study. In this chapter, the researcher concludes the findings and thoroughly analyses the implications they have. To begin, a concise overview of the study conducted presented. A summary of the key findings that have been discovered to address the research questions are presented. A summary will be followed by a detailed reflection of the findings, focusing on the study's broader implications and the insights it can provide is discussed.

In addition, recommendations for future researchers is provided, highlighting areas that need more investigation and exploration. Furthermore, recommendations for virtual escape room designers is discussed, drawing on the research to provide guidance on how to create engaging and immersive experiences for participants. This chapter is the culmination of the research, providing valuable insights and recommendations that can help to inform and guide the development of virtual escape rooms.

5.2 Overview of the Study

The purpose of this study was to explore escape rooms as a game-based learning approach to promote student motivation. To adapt to the unique learning needs and preferences of Generation Z students, virtual escape rooms were used to engage these students actively in teaching and learning. To meet the digital demands of Generation Z to use tools in education, motivate them to be engaged and keep their interest in learning, the researcher wanted to learn more about how the implementation of a virtual escape room designed with game-based learning elements could promote students' motivation. Overall, this study makes an important contribution to education, educational gaming, and immersive educational innovations, providing valuable insights and recommendations to educators and researchers. A continuous drive for innovation in the classroom by leveraging the power of game-based learning and virtual escape rooms, engaging students, and promoting a love of learning will serve educators as well as learners.

The ARCS model was used to conduct the study and consists of four key components: attention, relevance, confidence, and satisfaction. These elements are critical in determining the effectiveness of a learning programme or activity. In particular, the ARCS model elements significantly impact the participants' overall experience in the context of a virtual escape room. When the link between the ARCS model elements and the virtual escape room were examined, it became clear that each of these elements is intricately intertwined with the gaming elements in the room (Wu & Santana, 2022). For example, attention is important in engaging and capturing the interest of participants from the start.

The virtual escape room must be designed to capture the attention of the participants, which can be accomplished by incorporating creative and immersive gaming elements such as clues, timers and a variety of activities that keep the participants engaged and focused. Relevance is also an important factor influencing the success of the virtual escape rooms. The game must be designed in a way that is relevant to the interests and needs of the participants. This means that the room's gaming elements must be tailored to the age, educational level, and other personal factors of the participants that influence their motivation to participate in the activity and to apply the intended learning outcomes to the content. Another important component of the ARCS model that is linked to the gaming elements of the virtual escape room is confidence. Participants must be confident in their ability to complete the task and to solve the game's puzzles. This can be accomplished by giving clear instructions, feedback, and assistance throughout the game. Finally, satisfaction is an important factor in determining the overall experience and motivation of participants to participate in future virtual escape rooms, since this forms part of their sense of accomplishment.

The group known as Generation Z, born between the mid-1990s and the mid-2010s, are digital natives who are extremely familiar with technology (Ang et al., 2021). They use technology for a variety of purposes, including learning. Game-based learning, which makes use of the engaging and immersive nature of games, using games as the primary instrument for teaching and learning, has been gaining popularity as an effective educational approach in recent years (Schöbel et al., 2021). Players in escape rooms, a popular game-based learning activity, are challenged to solve puzzles and riddles in order to escape from a closed room. These games are frequently used

for team building or as a fun approach to improve problem-solving skills. Motivation is an important aspect in game-based learning since it keeps players engaged and driven to keep playing. The ARCS model proposes that students are more motivated when they are engaged, believe the material is relevant to their goals, are confident in their ability to learn and succeed, and are satisfied with their progress and achievements. Game-based learning, escape rooms, and the ARCS model are all effective techniques for inspiring and engaging the tech-savvy Generation Z population.

Researchers, such as Schöbel et al. (2021), confirm that using game-based learning approaches increases student motivation and engagement in the classroom. Cheung and Ng (2021) investigated the effectiveness of a virtual escape room game as a game-based learning approach, with a focus on using Keller's ARCS model as a framework for evaluating student motivation (Keller, 2009). The virtual escape room game was created to provide students with a fun and challenging learning experience, in order to increase their motivation and engagement in the course material. The game was meticulously designed, with elements such as sound effects, graphics, and engaging narratives to capture students' attention and keep them engaged throughout the game (Clauson, et al., 2019). The game relevance was also emphasised, with the puzzles and tasks directly related to the course material. This ensured that students could connect what they learned in the game to what they had learned in the classroom. Furthermore, the game was created to give students a sense of accomplishment and satisfaction when they completed tasks and solved puzzles.

5.3 Summary of the Research Process

Where appropriate, including educational escape rooms in the curriculum has been shown to be a useful strategy for raising student motivation and engagement. However, it is crucial to make sure the escape room activities are in line with learning goals and are successfully incorporated into the overall teaching and learning strategy. To have the greatest possible influence on motivation and learning outcomes, escape room activities must clearly relate to the material being learned.

As a researcher, choosing the correct sample of participants for a study is critical, and in this study, the researcher focused on people who had escaped and people who had

not exited the room at various time intervals. The researcher collected rich qualitative data that provided great insights into the research issue by allowing participants to communicate their opinions and experiences freely. The researcher incorporated Qualtrics surveys as an optional final phase within the game, ensuring accessibility for all participants. This strategic approach facilitated the collection of quantitative data, offering a solid foundation for statistical analysis and reinforcing the conclusions drawn from the interviews. The researcher further enriched their understanding of the subject matter by engaging in semi-structured interviews with five participants, skilfully employing flexible, open-ended questions: thus, complementing the surveys.

Overall, using quantitative and qualitative methodologies resulted in a more thorough grasp of the research topic. This experience showed the benefit of using a range of research approaches to achieve a deeper knowledge of complicated phenomena and the importance of allowing participants to express their own experiences and viewpoints. In the survey, some participants stated that they struggled to move on to the next puzzle, but when the researcher interviewed the participants who did not escape the room, the researcher found that some did not understand that the Microsoft Excel workbook and the escape room needs to be used conjunctively to conceptualise the workings of the game.

The first sub-research question, to what extent does the attention, relevance, confidence, and satisfaction model (ARCS) influence the design of a virtual escape room? is addressed in section 5.3.1. Following that, in section 5.3.2, the second sub-research question, how do gaming elements support student motivation? is examined. Ultimately, in section 5.3.3, we conclude by addressing the main research question: How can educational escape rooms support the development of student motivation with a game-based learning approach? This sequential order of exploration demonstrates how the two sub-questions collectively fulfil and contribute to answering the overarching main research question.

5.3.1 ARCS Model Impact on a Virtual Escape Room and Design

The findings indicated that the four elements attention, relevance, confidence and satisfaction each uniquely contributed to different aspects of the participants'

motivation while playing the virtual escape room game. According to the findings, adding virtual escape room games into the classroom can increase student motivation and engagement effectively while delivering meaningful learning results. Designers should focus on providing visually engaging and immersive gameplay that corresponds with students' interests, topics of the content and learning preferences, while ensuring that the game content aligns with the curriculum objectives and reflects the subject matter accurately.

Keller's ARCS model provides designers with a useful foundation for improving the effectiveness of game-based learning (Tsai et al., 2022). This model highlights the significance of attention, relevance, confidence, and satisfaction in designing effective learning experiences (Laurens-Arredondo, 2022). In this study, providing clear instructions, personalised feedback, and instructional elements such as puzzles or hints proved instrumental in boosting participants' confidence levels and fostering the development of the necessary skills for achieving success (Susanti, 2022). Creating both tough and achievable gameplay and providing a sense of success upon completion boosted the participants' satisfaction and created a more enjoyable gaming experience.

In conclusion, this study's findings demonstrate that by incorporating the principles of the ARCS model into their design, game developers can create immersive and effective learning experiences that resonate with students and promote achievable learning outcomes. Virtual escape room games have significant potential for increasing student motivation and involvement in the classroom.

5.3.2 Gaming Elements Support Student Motivation

The findings show that incorporating attention-grabbing game aspects into the learning process can be quite beneficial in engaging students (Figure 26; Q12). The more interactive the game features, the more effectively they capture students' attention and encourage active engagement. Additionally, in the study, students enjoyed the connection between the Microsoft Excel document and the various rooms in the game, which contributed significantly to their overall engagement and motivation to continue playing (Figure 25; Q11). Furthermore, the game's aesthetics played an important role

in the students' level of interest and engagement (Figure 21; Q7). The students praised the game's set-up, which links to the game design, matched the theme of the scenario, and contributed to their immersive experience. Thus, incorporating effective game elements that are highly interactive, visually appealing, and directly related to the learning objectives can improve students' motivation and engagement in the learning process significantly.

These findings were consistent with those in the study of Strickland and Kaylor (2016), which demonstrated that a well-designed game could catalyse student motivation. Furthermore, the findings imply that game-based learning piques the interest of students in areas that they find difficult or boring. Similarly, the study by Plass et al. (2010) supports that game-based learning might improve student engagement with module material, resulting in increased learning motivation. Furthermore, the Plass et al. (2010) study found that game-based learning might motivate students to focus on more than just grades or answering questions, resulting in deeper learning outcomes.

5.3.3 Impact of Game-Based Learning in Virtual Escape Rooms on Student Motivation

The study's findings show that using educational virtual escape rooms with a game-based learning approach promotes the development of student motivation. As defined in Section 2.5 of Chapter 2, motivation is the ability to inspire individuals to achieve high levels of performance and to overcome obstacles to change (Tohidi & Jabbari, 2012). The participants reported increased levels of motivation and empowerment while navigating the game's obstacles, such as overcoming difficult steps to complete the game, as indicated by the results in Chapter 4.

Learning and gaming are two essential components of a game-based learning approach. In this case, the game's learning component included completing Microsoft Excel IF statements and solving critical thinking puzzles related to the Microsoft Excel content covered in the module. The participants found the connection of the game to Microsoft Excel and the puzzles connecting the clues in each room to perform a step in the Microsoft Excel document to be engaging and motivating (Figure 21; Q7, Figure 25; Q11, and Figure 39; Q19). Participants identified game elements, particularly the

timer and the clues, as the primary contributors to their motivation levels when using the game-based learning approach.

According to the semi-structured interviews, all of the participants attributed their increased motivation to game elements such as the timer, the game design, the puzzles, and the clues. As a result, the study found that the game-based learning approach increases student motivation while participating in the escape room. The findings of this study agree with those of Jääskä et al. (2022), who argue that participants' willingness to engage in a game can impact their motivation levels positively. Furthermore, Schrier (2018) emphasises the importance of two critical factors in the game-based learning approach: the desire to play the game and understanding its content. As observed in this study, the combination of a strong desire to engage and a comprehensive comprehension of Microsoft Excel statements acted as motivating factors for students, driving their participation and performance and ultimately leading to their motivation.

5.4 Reflection on Lessons Learned

After completing the data collection procedure, the researcher conducted a detailed evaluation of the information gathered. As a researcher, it is understood that reviewing all parts of the data thoroughly is essential to assure its relevance, accuracy, and trustworthiness. The researcher's attention to this extensive analytical method enabled them to draw important conclusions about the data and study topics.

As a result of the detailed game design using the ARCS motivational model, it was possible to design a virtual escape room that could improve student motivation. Incorporating aspects of the ARCS model effectively into the game design resulted in the students indicating higher motivation levels. These findings allowed for the development of successful learning design concepts, such as educational games with game-based learning that can be used in educational settings to boost student motivation.

The pragmatic mixed-method research methodology is particularly useful for analysing complex treatments or policies and for understanding both the effectiveness of the

intervention and the viewpoints of individuals affected by it. In this study, a combination of quantitative and qualitative data collection methods, including semi-structured interviews and surveys, was used to gain a comprehensive understanding of the research phenomenon. These approaches provided valuable insights into participants' experiences and perspectives that would not have been possible with only one method.

During the research study, the researcher recognised a preconceived bias, assuming that students without a background in computer applications technology would struggle more than their peers. However, it became evident that this assumption was unfounded. Students without prior experience in computer applications technology demonstrated similar proficiency and efficiency in navigating the game.

These findings underscore the importance of employing objective and inclusive methodologies to evaluate participants' capabilities and performance. Reflecting on this, future research endeavours will be approached with a heightened awareness of biases to ensure fairness and accuracy in data collection and analysis.

A significant takeaway from this research study is the value of involving students in the decision-making process. By seeking their input and feedback, educational experiences can be aligned with their preferences, fostering ownership and enhancing motivation and learning outcomes. Additionally, involving students in decision-making provides an opportunity for personal growth and reflection as an educator, enabling continuous improvement in teaching materials and methods.

The study aimed to achieve a more comprehensive and robust investigation of the research issue by using a pragmatic mixed-method approach. The combination of quantitative and qualitative techniques produced multidimensional knowledge, allowing for a more in-depth assessment of the phenomena under investigation and yielding substantial insights into the participants' experiences and perspectives.

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the students indicated higher motivation levels. These findings allowed for the development of successful learning design concepts, such as educational games with game-based learning that can be used in educational settings to boost student motivation.

5.5 Limitations

During the research study, the researcher recognised a preconceived bias, if students without a background in computer applications technology would struggle more than their peers. However, it became evident that this assumption was unfounded. Students without prior experience in computer applications technology demonstrated similar proficiency and efficiency in navigating the game. These findings underscore the importance of employing objective and inclusive methodologies to evaluate participants' capabilities and performance. Reflecting on this, future research endeavours will be approached with a heightened awareness of biases to ensure fairness and accuracy in data collection and analysis.

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It is essential to acknowledge that the researcher aimed to assess the participation within a group of 8,732 students. However, only 546 students voluntarily played the game and completed the Qualtrics survey, resulting in a response rate of 6.24%. Semi-structured interviews were conducted with five participants, representing 0.91% of the survey respondents. It is worth noting that the limited number of interview participants may have constrained the depth and breadth of qualitative data, and these findings primarily reflect their perspectives. Furthermore, these results offer insights into the willingness of students within that cohort to engage in research; however, due to the small sample size, generalizability to the larger population should be made with caution. This highlights the need for larger sample sizes and potential challenges and

opportunities for future data collection and analysis within the context of this educational study.

5.6 Recommendations

The results of this study lead to several recommendations. First, it's wise to consider implementing game-based learning approaches in educational settings, especially those involving virtual escape rooms. The study found that these techniques had a beneficial effect on students' motivation. Further investigation into such incentive tactics' viability and long-term consequences is also strongly encouraged. Investigating their adaptability to various age groups and educational settings might offer insightful information. Additionally, teacher training programmes should be developed to give educators the tools they need to construct successful and compelling learning experiences to ensure the success of game-based learning.

Additionally, with an emphasis on improving the whole educational experience, integrating technology that promotes game-based learning and virtual escape rooms should be considered. It is advised to use ongoing feedback channels to evaluate and improve these tactics. To make sure that these techniques fit their preferences and needs, it is crucial to involve students in designing and evaluating educational games. Finally, if appropriate, promoting legislative reforms that support cutting-edge instructional practises and technologically enhanced learning can advance the incorporation of incentive tactics into the academic curriculum. We can collectively promote an innovative and motivating educational culture by exchanging best practises and case studies in forums and publications.

This study aimed to achieve a more comprehensive and robust investigation of the research issue by using a pragmatic mixed-method approach. The combination of quantitative and qualitative techniques produced multidimensional knowledge, allowing for a more in-depth assessment of the phenomena under investigation and yielding substantial insights into the participants' experiences and perspectives, which is why the researcher would recommend a mixed-method approach for a similar study to view the experience from both sides.

5.7 Summary

The final chapter of this dissertation has given a succinct yet thorough summary of the subject issue, completing an extensive research project. The chapter also offers the researcher's conclusions on the technique used in the study, providing useful insights into the research process and its outcomes. Based on these findings, the researcher has developed specific recommendations that match the primary aims of the study, serving as a guide for future endeavours in this subject. Overall, this study makes an important contribution to education, educational gaming, and immersive educational innovations, providing valuable insights and recommendations to educators and researchers. A continuous drive for innovation in the classroom by leveraging the power of game-based learning and virtual escape rooms, engaging students, and promoting a love of learning will serve educators as well as learners.

The topic of investigation was summarised concisely in the concluding chapter of this dissertation, which was followed by the researcher's conclusions about the methodology used in the course of the study. On the basis of these conclusions, explicit recommendations were formulated that aligned with the principal objectives of the investigation. The unexpected dividend of the research project was the use of qualitative research methods to create an environment conducive to the induction and co-creation of new knowledge domains. This was accomplished by engaging with a diverse group of participants and eliciting their distinct perspectives and experiences through in-depth sharing, description, and exploration, resulting in a rich and multifaceted body of knowledge.

This inquiry has shown fascinating insights into the potential of this immersive and exhilarating teaching approach by exploring escape rooms as a game-based learning strategy to boost student motivation. The researcher's discoveries have opened up new vistas and have shed light on the fascinating possibilities provided by this novel technology. The synergistic integration of a virtual escape room game and an accompanying Microsoft Excel workbook, employing a captivating game-based learning approach, has unleashed an awe-inspiring surge in student motivation, permeating every facet of the study.

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APPENDICES

Appendix A: Interview schedule

Topic: Employing escape rooms as a game-based learning approach to promote student motivation.

Research question: ‘How can educational escape rooms support the development of student motivation with a game-based learning approach?’

Sub research questions:

- To what extent does the attention, relevance, confidence, and satisfaction model (ARCS) influence the design of a virtual escape room?
- How do gaming elements support student motivation?

Attention:

1. What aspects of the escape room held your attention?
2. What motivated you to escape the room?
3. How do you think that an educational escape room approach would benefit you more than traditional teaching approaches?
4. Which gaming elements kept your interest?

Relevance:

1. How was the content of the escape room relevant to this module?
2. How appropriate are virtual escape rooms for teaching computer literacy?
3. How relevant were the clues?

Confidence:

1. How did it make you feel when you completed the escape room?
2. How did the virtual escape room encourage competitiveness?
3. Which aspects of the escape room motivated you to continue paying?

Satisfaction:

1. How do you feel about the game-based learning approach?
2. Describe how satisfied you felt when solving a clue or puzzle.
3. How do you think an escape room with a game-based approach could help you feel good about your desire to continue learning?

Appendix B: Survey

Yes or No Question:

- Did you escape the room? (Q1)

Fill in Questions:

- If no, where did you get stuck? (Q2),
- Did you encounter any difficulties when attempting to escape the room? Where and why? (Q3)
- How did you overcome the difficulties that you encountered whilst playing this game? (Q4)

Multi-Select questions:

- Please select which of the following subjects you did in Secondary school: CA /RT, IT (Q5)

Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree Questions:

- The clues in each room helped me escape the room. (Q6)
- The set-up of this game surprised me. (Q7)
- I enjoyed the game-based learning approach. (Q8)
- The time limit made it competitive. (Q9)
- The time limit motivated me to escape the room. (Q10)
- Use of an escape room to learn more about Microsoft Excel was a new way of learning. (Q11)
- The various types of questions/Microsoft Excel functions kept my attention during the game. (Q12)
- After playing the escape room, I am confident that I can use if statements. (Q13)
- I am likely to participate in an escape room in the future. (Q14)
- The clues made me curious to solve the murder. (Q15)
- I was motivated to complete the escape room. (Q16)
- I felt satisfied when I solved the Microsoft Excel functions. (Q17)
- I felt a sense of accomplishment when I escaped the room. (Q18)
- The gaming elements added to the experience. (Q19)

Appendix C: Transcripts

Table 5: Interview 1

ARCS Model	Interviewer	Participant 1 (P1)
Attention	1. What aspects of the escape room held your attention?	I like that I had to search for things because I've never done an escape route. So, it was quite challenging for me personally. And I really wanted to beat that time limit.
	2. What motivated you to escape the room?	I wanted to show off to my friends and figure out who the murderer was. The timer also motivated me.
	3. How do you think an educational escape room approach would benefit you more than traditional teaching approaches?	Well, if I'm comparing it to that, it is more fun. Yes, I think so because I was more interested in the game than a normal document-based activity.
	4. Which gaming elements kept your interest?	The timer was fun and the puzzles and unlocking stuff in the room.
Relevance	1. How was the content of the escape room relevant to this module?	It was based on Microsoft Excel Modules 1 - 4.
	2. How appropriate are virtual escape rooms for teaching computer literacy?	Very, it is fun and innovative, and it also test[s] basic literacy skills that are not part of the content.
	3. How relevant were the clues?	The clues were intertwined, and you needed one thing from the document to unlock something in the room or vice versa.
Confidence	1. How did it make you feel when you completed the escape room?	I felt proud of myself for finishing the game.

	2. How did the virtual escape room encourage competitiveness?	I don't want to say that I am always competitive, but this game made we want to beat my friends in solving the murder before them.
	3. Which aspects of the escape room motivated you to continue playing?	The fact that I needed to solve all 6 puzzles to find out who the murder[er] was. The game is also set up in a way that you cannot skip a puzzle 1 needs to be completed because it forms part of 2.
Satisfaction	1. How do you feel about the game-based learning approach?	I enjoyed it; it was a nice change from the normal activities.
	2. Describe how satisfied you felt when solving a clue or puzzle.	I was very excited because that means I get to move onto the next step of the game, one step closer to solving the murder.
	3. How do you think an escape room with a game-based approach could help you feel good about your desire to continue learning?	I would like games to replace all my assessments, it is way more fun and less stressful.

Table 6: Interview 2

ARCS Model	Interviewer	Participant 2 (P2)
Attention	1. What aspects of the escape room held your attention?	I think it was the attention to details. The set-up, document and game were nicely planned, and it looked awesome with the red theme. The rooms in the game were a surprise as well. I like the couches and the notes on them.
	2. What motivated you to escape the room?	I wanted to know who the murder[er] was and my friends in previous session[s] mentioned they struggled so I wanted to see if I could do

		better than them in the time limit and by solving the puzzles with the help of the clues.
	3. How do you think an educational escape room approach would benefit you more than traditional teaching approaches?	Well, it's more fun. And when something is, you know, games and stuff and the games is part of learning, it just makes learning easier. And is more fun and easier to grasp information.
	4. Which gaming elements kept your interest?	Yes, they did. Watching the timer made me like, want to get things right. It motivated me to keep on trying till I solved a puzzle.
Relevance	1. How was the content of the escape room relevant to this module?	It was based on the Microsoft Excel content we covered the weeks before.
	2. How appropriate are virtual escape rooms for teaching computer literacy?	Okay, well, for starters, the escape room, I think it's an appropriate method, like to introduce games like, you know, for academics, and things like crossword puzzle.
	3. How relevant were the clues?	The clues were very important towards solving the puzzles and doing the functions.
Confidence	1. How did it make you feel when you completed the escape room?	It made me feel great. I've achieved what I wanted to achieve.
	2. How did the virtual escape room encourage competitiveness?	I was competitive especially when I saw that they put up a poll in the collaborate session to answer yes when you are done, and when
	3. Which aspects of the escape room motivated you to continue paying?	The time limit, doing it in the collaborate sessions at the same time as other students and I really wanted to know who the murder[er] was.

Satisfaction	1. How do you feel about the game-based learning approach?	I enjoyed it; it was a nice change compared to the normal document with steps. This game was so much fun and unexpected.
	2. Describe how satisfied you felt when solving a clue or puzzle.	Super satisfied, like wow I did this, and it was fun to compare with my friend and see where they are and wanting finish before them.
	3. How do you think an escape room with a game-based approach could help you feel good about your desire to continue learning?	I think it's very good for my desire to continue learning; it makes students you know; feel more relaxed about the module they are doing. It just makes things seem easier and fun. You know, it makes you feel more enthusiastic about the module and the content you're learning.

Table 7: Interview 3

ARCS Model	Interviewer	Participant 3 (P3)
Attention	1. What aspects of the escape room held your attention?	I think it was like the creativity of it all. It was very fun. And there were pictures, and it was like a very real-life experience.
	2. What motivated you to escape the room?	I think it was then like time the clock on the thing that motivated me to finish in time.
	3. How do you think an educational escape room approach would benefit you more than traditional teaching approaches?	I think like in the modern day, like the average student doesn't really have a very big attention span. So, I think, because it was very interactive, using Microsoft Excel and solving the puzzles it was a good learning opportunity, other than just like listening to theory the whole time you were doing it in that moment. I think that it was very beneficial.
	4. Which gaming elements kept your interest?	I liked how each puzzle has a clue connected to it so I looked in the Microsoft Excel document then searched in the escape room to connect it and solve it.

Relevance	1. How was the content of the escape room relevant to this module?	It was relevant because it is lectured and tested in this module.
	2. How appropriate is virtual escape rooms for teaching computer literacy?	Very appropriate especially now with COVID, online learning and the fourth industrial revolution. I think all modules need to make assessments more innovate, students are tired of the same things over and over.
	3. How relevant were the clues?	Very relevant to the game and Microsoft Excel, it was all connected so one could not be skipped you needed all the clues for the puzzles.
Confidence	1. How did it make you feel when you completed the escape room?	I think it was then like time the clock on the thing that motivated me to finish in time.
	2. How did the virtual escape room encourage competitiveness?	At first, I did not see the time limit until I saw comments about it in the chat box, then I got very stressed and competitive at the same time I wanted to finish before the time ran out.
	3. Which aspects of the escape room motivated you to continue paying?	The timer, the music that the lecturer was saying in the session, each time she said next song and this much time is left, I saw the polls also to indicate if you are done and I wanted to finish and see who the murderer was.
Satisfaction	1. How do you feel about the game-based learning approach?	I loved it, I did not expect it to be so interactive, at first, I thought it was only the Microsoft Excel file and I'll do the steps in there but then I saw it was connected to the escape room. It was such a surprise after weeks of doing boring Microsoft Excel files.
	2. Describe how satisfied you felt when solving a clue or puzzle?	I was so happy especially after the one about un hiding the column, it really got me stuck, but I did not want to give up, turn out I was right clicking at the wrong place.
	3. How do you think an escape room with a game-based approach could help you feel good about your desire to continue learning?	I think so. I think it can make them really motivated to do better and to do more fun learning.

Table 8: Interview 4

ARCS Model	Interviewer	Participant 4 (P4)
Attention	1. What aspects of the escape room held your attention?	I really enjoyed the escape room. It was fun testing out my Microsoft Excel knowledge to find the murderer.
	2. What motivated you to escape the room?	I was interested to see who the killer was based on the things I learned in the Microsoft Excel modules. When I found the key and put it in my inventory, I was so excited to try to unlock the door.
	3. How do you think an educational escape room approach would benefit you more than traditional teaching approaches?	Well, I think it's because you practise it yourself. So, what we were taught we got the chance to practise in the escape room to test if you know it.
	4. Which gaming elements kept your interest?	The way the game looked was awesome, I liked the red and all the icons and colours suited the murder theme. I also enjoyed how the puzzles and the clues must be used together to unclick or do the next step.
Relevance	1. How was the content of the escape room relevant to this module?	Well, we used the formulas we learned in class we used in the escape room. So, I think it's, it's relevant since it's based on content we did prior to the game.
	2. How appropriate is virtual escape rooms for teaching computer literacy?	Well, I think it's because the student would have to go on their computer, and they must sit there until they figure it out or get help. So, to get the game and finish it they need to learn how to use everything. So, I think it's a great learning approach. It's fun.
	3. How relevant were the clues?	Yeah, I think it was it, uh, it was easy enough to understand what I had to do.

Confidence	1. How did it make you feel when you completed the escape room?	I felt okay. It was a little shorter than I expected it to be. But for students who do not know Microsoft Excel it took longer. It was easy for, and I finished fast.
	2. How did the virtual escape room encourage competitiveness?	I am very competitive in games like 30 seconds so this was amazing, and I liked that I did not have to reply on another students I was in charge.
	3. Which aspects of the escape room motivated you to continue paying?	I wanted to finish before the others in my sessions and my friends who told me their times. I also really wanted to unlock the door and see who did the crime.
Satisfaction	1. How do you feel about the game-based learning approach?	It is a great way of learning. I wish more modules would incorporate games.
	2. Describe how satisfied you felt when solving a clue or puzzle?	It was awesome, I kept looking at the time to work out how much time I have for each puzzle.
	3. How do you think an escape room with a game-based approach could help you feel good about your desire to continue learning?	Yeah, I think it works because you can see it as a game. You also learn the work while you play the game. So, it's a fun way of learning. I was excited when I read about the escape room, like I wanted to do that immediately.

Table 9: Interview 5:

ARCS Model	Interviewer	Participant 5 (P5)
Attention	1. What aspects of the escape room held your attention?	Um, the set-up I wasn't expecting to see an actual living room. Because I've never done something like an escape room before, I have heard of the physical one never knew it could be online too.
	2. What motivated you to escape the room?	The excitement and encouraged from the lecturer in my session and the time limit. I also really wanted to finish when I unlocked the one safe and got a key for the door.

	3. How do you think that an educational escape room approach would benefit you more than traditional teaching approaches?	Yes, I would just actually drop all the other stuff and just say everyone just do these games it's way better.
	4. Which gaming elements kept your interest?	Yes, a lot, especially the pillows. I remember, there's one that I clicked on, it said Ha-ha, I liked that. Since I was my first-time using escape room, I went to the next room that check more pillows and realise it wasn't working. Then I went to the puzzles and figured it out. So, the way it related to the items in the room and each puzzle kept my interest.
Relevance	1. How was the content of the escape room relevant to this module?	Yes, it was, it really was. Because apart from it being fun you did, we did learn some stuff, and there are extra related, like how to that was my first time learning how to unprotect I remember, we were doing something like that, where you had to unprotect a file or something. sheet. So, um, so yeah, I'd see something like that.
	2. How appropriate is virtual escape rooms for teaching computer literacy?	Very. It incorporated all the skills that we need to know to be computer literate.
	3. How relevant were the clues?	Very relevant to the puzzles and getting to her next steps, which was one step closer to escaping the room.
Confidence	1. How did it make you feel when you completed the escape room?	I felt more and more confident in my ability to finish the game after solving each puzzle, once I unlocked something or moved onto the next step, I believed that I could finish the game and solve the murder and when I unlocked the safe that had the key in, I felt confident that I will escapee room.
	2. How did the virtual escape room encourage competitiveness?	I'm not very competitive but the timer made me nervous which made me want to solve the clues faster.

	3. Which aspects of the escape room motivated you to continue paying?	I wanted to use the key to get out of the room to see who the murderer was.
Satisfaction	1. How do you feel about the game-based learning approach?	I like it very much; it is better than the normal stuff we. I would rather do a game for marks then write a test.
	2. Describe how satisfied you felt when solving a clue or puzzle.	So happy because I was getting closer to escaping the room.
	3. How do you think an escape room with a game-based approach could help you feel good about your desire to continue learning?	I was sad when I found it was the only game, I loved this approach and which all my assessment was game or even escape rooms.

Appendix D: Letter of consent participants



Faculty of Education

Student

University of Pretoria

Dear student

INVITATION TO PARTICIPATE IN RESEARCH PROJECT –

Exploring escape rooms as a game-based learning approach to promote student motivation.

I am currently enrolled for a master's degree at the University of Pretoria. Part of the requirements for the awarding of this degree is the successful completion of a significant research project in the field of education.

The title of my approved research study is "**Exploring escape rooms as a game-based learning approach to promote student motivation**". The purpose of this study is to investigate to what extent a game-based learning approach can promote student motivation with the use of an educational escape room.

You are hereby invited to participate in this research project, which aims to understand:

To what extent does escape rooms, as a game-based learning approach promote student motivation?

Below is the scope and responsibility of your participation. To gather the information, I require for this research, I request permission to interview you as a student about the escape room and partaking in a survey on the learning management software regarding the escape room experience with relations to motivation. This interview should take no longer than 20 minutes and be conducted virtually. The interview, with your permission, will be audiotaped to ensure that accurate information is captured. The Survey will take no longer than 10 minutes and can be conducted on any device from home or at the university.

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Please understand that the decision for you to participate is entirely voluntary and that permission for your participation will also be protected by the Department of Higher Education and Training. Please also consider that everyone's participation in the study will be entirely voluntary and will in no way either advantage or disadvantage them. Each participant will be free, at any stage during the process up to and including the stage at which they authenticate the transcript of their interview, to withdraw their consent to participate, in which case their participation will end immediately without any negative consequences. All data collected from them up to that point in the study will then be discarded.

All the information obtained during the research study will be treated confidentially. Not even the Department of Higher Education and Training has access to the raw data obtained from the interviews. At no time will either you as an individual or your faculty be mentioned by name or indeed be allowed to be identified by any manner or means whatsoever in the research report.

This research study presents a unique opportunity for you to get involved in research aimed at investigating student motivation at Higher Education Institutions with escape rooms. If you decide to allow your school's participation, kindly complete the consent form at the end of this letter.

Thanking you for your consideration in this research study.

Yours in service of education,

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