Designing a Gamified Retirement Planning Application: Evidence from a Workplace Study of Millennial Employees

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https://doi.org/10.34190/ejel.24.3.4375

Abstract: The phenomenon of a global retirement crisis has gained increasing attention in recent years. A growing number of individuals struggle to secure sufficient financial resources to sustain themselves during retirement. Financial knowledge not only increases the tendency to save for retirement, but it also affects an individual's everyday money practices, including borrowing, saving, and investing decisions. Millennials are currently the largest cohort in the workforce and should be constantly made aware of the urgent need to save from the earliest age possible. The development and implementation of a unique gamified retirement planning application aimed at improving retirement preparedness was critically examined for its design rationale, user experiences, and observed successes and shortcomings. A randomised control experiment was conducted to observe any changes the gamified tool might have on the players' retirement preparedness. Participants, millennial employees at a higher education institution, aged between 24 and 43 were randomly divided into one of three groups (gamification group, education group, and control group), ranging between 29 and 34 participants. The gamified application created a platform where the gamification group could experience the long-term effects of their decisions in a low-risk setting by modelling real-life financial decisions, which helped them develop a more accurate grasp of retirement planning. The education group was only exposed to infographics on retirement planning, and the control group was not exposed to any intervention. Data were analysed and tested using a nonparametric ANCOVA. The gamified application tends to be more effective at improving basic financial literacy, promoting interest, fostering awareness, and building confidence. However, a decrease was observed in respondents' perceptions of how well they are prepared for retirement and whether they will achieve the income they need in retirement, which may reflect a "reality check" effect. The infographics appeared to be more effective at improving financial retirement literacy and resulted in a more positive perception of how well they are prepared for retirement, which may reflect overconfidence in their knowledge, leading them to believe they are better prepared than they actually are. Despite some content and technical limitations of the gamified application, it exhibits promise as a financial education tool, motivating individuals to take proactive steps toward retirement planning. Collectively, the evidence suggests that gamification enhances financial literacy and interest in retirement planning, prompts self-reflection, and serves as a "reality check" on respondents' perceived confidence in retirement preparedness. Consequently, e-learning environments for financial education interventions should not only consider gamification for motivation, but also balance engagement, knowledge development, and behavioural awareness, ensuring a meaningful and realistic development of financial proficiency and behaviour. The limitations of the study suggest that the sample size limits statistical power and restricts the generalisability of the findings, the self-reported measures may be subject to social desirability bias or overconfidence, particularly among participants exposed to educational material, and, lastly, due to the time limit of the study, long-term knowledge retention and sustained behavioural change could not be assessed.

Keywords: Financial education, Retirement planning, Gamification, Millennials

1. Introduction

The phenomenon of a global retirement crisis has attracted increasing attention in recent years as demographic shifts, economic factors, and social policy inadequacies converge. This crisis is characterised by the inability of an increasing number of individuals to secure sufficient financial resources to sustain themselves during retirement (Aegon, 2017). Population ageing is a global reality regarded as one of the main economic and social changes shaping the 21st century. People are living longer, and fewer children are born. A smaller number of people will be working to support an increasingly ageing population dependent on their government for financial support in retirement (Bodnár & Nerlich, 2022). Low levels of financial knowledge, combined with retirement unpreparedness, are perceived as a significant problem among millennials (Ndou, 2023). The traditional classroom setting may have worked for previous generations, but it only discourages millennials (McHaney, 2023). The conventional approach of seminars, workshops, and other educational programmes on financial

Cite this article: Grobbelaar, C. and Alsemgeest, L. 2026. "Designing a Gamified Retirement Planning Application: Evidence from a Workplace Study of Millennial Employees", *Electronic Journal of e-Learning*, 24(3), pp 1-15, https://doi.org/10.34190/ejel.24.3.4375

education has become insufficient to motivate millennial employees to save and plan for retirement (Sutton, 2019).

It has been argued that the focus of financial education should be on millennial employees (those younger than 43), given that they currently form the largest segment of the workforce and still have the potential to impact their retirement situation (Hill, 2017). In addition, experimentation and active participation are a great part of millennials' learning style. To gain their interest and attention, they must be constantly stimulated and challenged since they approach learning as a "plug-and-play" (effortless connection of devices to a computer system to operate) experience that allows them frequent, fast interaction with content. Although gamification has increasingly gained traction as a promising approach to financial education, the evidence remains fragmented (Yulianto et al., 2024).

Prior research suggests that gamification may increase engagement, motivation, and short-term interest in financial content, especially among younger learners. However, evidence of sustained gains in financial literacy and behavioural outcomes remains inconsistent. Such outcomes appear highly contingent on the quality of game design, the contextual relevance, and individual user characteristics. Much of the available literature is focused solely on the acquisition of basic financial knowledge (Ahmad et al., 2025), with comparably limited attention being paid to retirement planning specifically, especially among full-time working individuals. The literature indicates that current financial education initiatives do not necessarily enhance millennials' engagement in finances, and the retirement situation is becoming increasingly dire due to inadequate planning and saving for retirement (Yakoboski, Lusardi, & Sticha, 2024). This growing challenge puts the financial well-being of millions of young working adults at risk and calls for innovative educational approaches to address this problem. Accordingly, further context-specific research is needed to understand whether gamification supports retirement education and whether the development of the gamified application influences engagement and perceived preparedness. This study addresses this gap by examining a gamified retirement planning application for millennial employees. This study seeks to answer two questions:

Will a gamified retirement planning application enhance financial literacy, increase interest in retirement planning, and improve perceived retirement preparedness?

What are the potential strengths and weaknesses of such an application?

The article aims to critically examine the development and implementation of a gamified retirement planning application to enhance the retirement preparedness of full-time millennial employees (ages 24 to 43) based at a tertiary education institution in South Africa, with a particular focus on its design rationale, user experiences, and observed successes and shortcomings. This article will highlight the impact of the global retirement crisis, the future implications for millennials specifically, the need for financial literacy and retirement preparedness, and explore the use of gamification and digital financial education. It will also elaborate in detail on the design and implementation of the gamified application, focusing specifically on the theories, player types, design, content, and game elements applied. The successes, shortcomings, and lessons learned will be examined, after which concluding remarks will be made.

2. Literature Review

The literature review will provide an overview of the global retirement crisis, financial and retirement literacy, and the importance of targeting millennials specifically.

2.1 The Global Retirement Crisis

The global reality is that people are increasingly being forced to retire earlier than planned, are steadily growing older each year, and reach retirement with little to no savings, which places immense fiscal pressure on governments worldwide. Employed individuals will pay higher taxes, old-age support will be reduced to match current tax and saving rates, and people will have to work longer and retire later to accumulate more income (Bodnár & Nerlich, 2022; Natixis, 2022). Low-wage workers (ages 50 to 60) are likely to be the first to lose their jobs in times of economic downturn (for example, the COVID-19 pandemic), forcing them to retire sooner than planned with little to no savings. These households enter retirement with more debt than they had a decade ago. Pensions are eroded relentlessly and other avenues of retirement income become more unreliable due to fluctuating financial markets, creating a great inequality between economic classes as they age. Currently, half of American households have no retirement savings. The retirement crisis dooms one to observe the rapid increase in the number of elderly people becoming poorer, fruitlessly searching for jobs, and adding to the ranks of the unemployed (Ghilarducci, 2024).

2.2 Financial Literacy

The complex financial landscape today calls for financial sophistication to build sufficient wealth and increase the individuals' tendency to plan for retirement (OECD, 2023). Financially sophisticated individuals are more likely to be aware of and occupied with saving for retirement. Evidently, planning and preparing for retirement leads to more wealth in retirement. Financial knowledge also impacts an individual's everyday money practices, including borrowing, saving, and investing decisions (Bai, 2023). Young people are frequently advised to start saving as early as possible, but this can pose a daunting and challenging task, as the younger workforce may lack sufficient discretionary income to put away in savings accounts, and they might lack the necessary knowledge and skills, or perceive savings as unimportant while still young (Rappaport, 2019). Research has shown that a lack of financial literacy leads to the absence of retirement planning. A financially illiterate individual with low income is most vulnerable to poor financial decisions (Sundarasen, Rajagopalan, & Ibrahim, 2024). The most recent survey conducted by the Global Financial Literacy Excellence Centre (GFLEC) assessing the financial literacy levels of US citizens, shows no improvement in overall financial literacy. The results of the survey (percentage of questions answered correctly) for the last eight years (2017-2024) show a decrease of 1% (49% in 2017 and 48% in 2024) (Yakoboski et al., 2024). The most recent financial literacy survey conducted by the OECD, which included 40 countries (excluding the US), showed an overall financial literacy score of 60% (percentage of questions answered correctly) (OECD, 2023). Comparing it to the OECD financial literacy survey in 2015, the overall score for 30 countries was 63%, indicating a 3% decrease (2015: 63% to 2023: 60%) (OECD, 2023; 2016). The OECD/INFE has been actively working towards strengthening the financial literacy of adults globally through financial education initiatives, but the effect thereof on the financial literacy levels of individuals is not evident yet, at least not in the OECD and GFLEC scores (OECD, 2023; 2019; Yakoboski et al., 2024).

2.3 Millennials

Millennials are currently the largest cohort of employees in the workforce (born between the 1980s and the beginning of the 2000s). They should be constantly made aware of the urgent need to save from the earliest possible age. A millennial's most expensive mistake is delaying retirement savings (Hill, 2017; Sanlam, 2017). Compared to previous generations, millennials grew up in a more protective environment with unrealistic expectations for the future. Due to ongoing demographic, political, and macroeconomic factors, millennials seem oblivious to the less comfortable retirement awaiting them compared to what previous generations experienced. Their limited understanding of financial matters might stem from a lack of information about the stark reality they may encounter upon retirement, as well as from a general disinterest in financial matters (Bank of New York Mellon, 2015). Despite millennials being the most educated generation to date, they are also less involved in retirement planning and tend to focus on their immediate personal accomplishments, while saving and investing for retirement are put on the back burner. However, they firmly believe that they will not be able to retire comfortably and will be worse off than previous generations (De Lima, Nery, & Miranda, 2024). The millennials' delay in saving for retirement was also evident in the results from the National Institute for Retirement Survey in the United States, where 78% of millennials indicated that they would have to continue working past retirement age due to their financial insecurity (Doonan & Kenneally, 2021). Working past retirement age may not be an option given the looming retirement crisis and the high percentage of retirees entering retirement involuntarily (Ghilarducci, 2024). Millennials will face a deeply troubling retirement outlook as they are not saving nearly enough or not saving at all for retirement due to reasons such as depressed wages, high student debt, and the lack of access to employer retirement plans (Doonan & Kenneally, 2021). The literature indicates that young people entering the workforce need financial education and guidance from their employers to equip them with sufficient knowledge to manage their income and choose the best investment options for retirement (Michaud, 2021). Motivating millennials to take part in the learning process means engaging them with visuals and involving them in the process. Millennials are more likely to choose online (distance) learning formats due to their immersion in technology (McHaney, 2023). Millennials are in favour of free, easily accessible, and easy-to-understand online financial education resources, but this alone is not enough to gain their attention (Lusardi & Hasler, 2019). In addition, millennials prefer personalised ways to learn how to manage their money (Huang, Lassu, & Chan, 2018).

2.4 Gamification and Digital Financial Education

Gamification is defined as the use of game elements in non-game contexts to promote learning by adding a layer of interest to the task at hand, increasing engagement and motivating action (Kapp, 2012). Online gamification programmes are a convenient way that has proven to be successful to teach content, making learning engaging, relevant, personalised, and motivational for millennial employees (Kapp, 2012; Mazzo, 2015). Using gamification

as an educational tool can build confidence among millennials to take action to enhance their financial knowledge and start saving towards retirement (Grobbelaar & Alsemgeest, 2024). Furthermore, gamification can create a fictional setting where individuals can experiment without real-life consequences. This safe space allows individuals to strategise and learn from their mistakes through immediate feedback, which can foster sound behaviour in real life (Kapp, 2012). Difficult concepts can be explained in smaller sections of content to avoid the feeling of being overwhelmed. An essential benefit of gamification is the alleviation of psychological factors, such as fear and anxiety one experiences when managing finances. These psychological factors can be managed through gamification by creating smaller tasks and goals to achieve, rather than focusing on the end goal that may seem unachievable (Van Raaij, 2016). Gamification has gained significant attention across diverse fields – including education, health services, marketing, and personnel management (Rodrigues et al., 2018) – due to its ability to engage fundamental drivers of psychological motivation in addition to intrinsic and extrinsic incentives (Uppaluri, 2025). Uppaluri (2025) conducted a comparative analysis on users of gamified systems and non-gamified systems to investigate changes in users' engagement and saving behaviours. The results showed that after financial applications assimilated gamification, the daily active users increased by 191.67%, financial goals set by users increased by 180%, and the number of users meeting their financial goals increased by 85.71%. Thus, by incorporating game elements into financial applications, user activity increases, users are more motivated to set financial goals and objectives, and users are supported in meeting their set goals. The need to combine education and gamification into financial management platforms is essential to enhancing user performance and fostering financial stability. However, gamification must be applied responsibly to avoid the ethical dilemma of exploiting users instead of empowering them, while maintaining the integrity of financial guidance within these platforms (Uppaluri, 2025).

3. Methodology

The article aims to explore the design rationale, user experiences, and observed successes and shortcomings of a gamified retirement planning application developed and implemented to enhance financial literacy, increase interest in retirement planning, and improve perceived retirement preparedness of full-time millennial employees who fall between the ages of 24 and 43 at a tertiary education institution in South Africa. The best approach to determine changes in individuals' financial literacy levels, interest in the subject and perceptions, is for the researcher to be objective and independent of the research, which is also called a positivist philosophy. The primary aim of positivism is to draw conclusions through empirical research, namely observation and experimentation. Causal relationships between variables are established through causal laws and are connected to logical reasoning and linked with quantitative methods, where quantitative numerical data are statistically analysed (Collis & Hussey, 2014). Thus, an observation for successes and shortcomings was conducted through a randomised control experiment that focused on the cause-and-effect relationship between the independent variable (cause – financial education in retirement planning) and the dependent variable (effect – retirement preparedness).

The dependent variable was affected by offering financial education on retirement planning through a gamified application. The experiment involved three groups, ranging between 29 and 34 respondents per group (total respondents = 96), one group exposed to the gamified tool, one group exposed to educational infographics (also available in the gamified tool), and one control group. The recommended sample size for experimental research is 15 to 30 participants per group (Daniel, 2012; Gay, Mills, & Airasian, 2012). It is important to note that despite meeting the recommended minimum sample sizes for experimental designs, the relatively small group sizes limit the statistical power of the analyses and the generalisability of the findings beyond the specific context of the study.

The experiment used a pre-test, intervention, and post-test and lasted over a two-month period. The pre- and post-test data were collected through an online questionnaire that all three groups had to complete. The responses in the pre-test and post-test for the financial literacy and retirement preparedness questions were compared across the three experimental groups, and any differences among the groups' scores were linked to the intervention involved. Kapp (2012), however, cautioned that using a gamified application will not necessarily turn individuals into subject experts. Thus, an increase in the financial literacy score for a group exposed to an intervention exceeding that of the control group suggests a noteworthy impact, regardless of whether the difference is statistically significant. The difference can be traced back to the specific educational initiative involved.

All output data from the completed pre- and post-tests were extracted in the form of a Microsoft Excel report. The data collected were then imported, coded, and analysed using the statistical programme SPSS (Version:

29.0.0.0). The ANCOVA (analysis of covariance) test was applied to determine whether the pre- and post-test mean scores differed significantly across groups. In order to do a parametric ANCOVA test, two of the assumptions must be met, namely: the assumption of homogeneity of variance and the assumption of normality. For each assumption, there is a test to be conducted and if either one of the assumptions is not met, a non-parametric ANCOVA test must be performed. For either of the tests to be met, the desired p-value should be more than 0.05 (Field, 2018). The results of both the homogeneity test and the normality test indicated that some variables' p-values were greater than 0.05 and others were less. Thus, none of the assumptions were met, and a non-parametric ANCOVA test was performed. The non-parametric ANCOVA test used to analyse the data will be discussed later on. Internal and external validity were retained throughout the experiment and protected against history threats (influence by outside events), maturation threats (development of participants), and repeated testing and instrumentation threats, through the use of a randomised pre-test-post-test control group and experimental group design and being conducted in a real-life setting (Babbie, 2016). The development and implementation of the gamified application was part of a larger PhD study.

4. Design and Implementation

The design of the gamified application was based on the determinants of retirement planning, including financial literacy, retirement goals, and future time perspective (Anuar, Ismail, & Samad, 2023). Financial literacy is the ability to allocate financial resources more effectively by analysing financial data and making informed decisions when saving and building wealth over a lifetime (Ifeanyi, Rena, & Prinsloo, 2019). Yong, Yew, and Wee (2018) described it as the ability to apply financial skills such as personal financial management, budgeting, and saving that enable individuals to make sound financial decisions. A retirement goal is a long-term objective that provides a clear direction of the preferred living standard and quality in retirement to be achieved and serves as a driving force that inspires one to start planning (Jiun, Satar, & Ishak, 2021). Future time perspective refers to the extent to which an individual considers the future, anticipates potential outcomes, and plans before taking any actions (Kooij et al., 2018).

The purpose of the gamified retirement planning application was to provide players with a gameful experience of real-world financial matters related to retirement planning, what being prepared for retirement entails, and to raise awareness of the need to plan and save for retirement. Players were tasked with making decisions on everyday financial and retirement matters and viewed the impact of their decisions and overall performance through immediate, constant feedback. In reality, the impact of a financial decision can only be experienced after a certain time has elapsed (Jain & Dutta, 2019). The expectation was that after playing the game, players would show an increase in their financial literacy levels, and that their perception of how well they are prepared for retirement would be more accurate in terms of attitudes and behaviours towards retirement planning.

Taking into account the determinants of retirement planning and the intended goal to be achieved through a gamified retirement planning application, several theories relevant to gamification, including both learning and motivational theories, were explored to act as the foundation for the development of the gamified application. These theories inform how individuals acquire knowledge and skills, how to influence attitudes, and change behaviours. It also serves as guidance for educators in designing effective gamified learning environments by incorporating appropriate game elements (Kapp, 2012). Identifying the appropriate type of player within the gamified retirement planning application environment can also contribute to the development of the application. The type of player can also indicate which game elements to incorporate into the gamified application (Marczewski, 2018). The following section explores the relevant theories and player types that support the intended outcomes of the gamified application.

4.1 Theories

The design and implementation of the gamified application were built on four gamification theories. The first is the theory of gamified learning (Landers et al., 2019), which specifies that game elements can be used in psychological processes to affect learning. During the development of the gamified application, specific game elements were incorporated to influence players' behaviours and attitudes towards retirement planning and retirement preparedness. Goals were incorporated to enhance players' understanding of how retirement planning can help them achieve their retirement goals. Narrative elements created an environment that players could relate to and change their attitude towards planning and preparing for retirement. The social learning theory allows players to observe a model's desired behaviour, process it internally, and afterwards exhibit the learned behaviour (Kapp, 2012). Through participation in the gamified application, players observe and practice the process required to prepare for retirement and, ultimately, reach the retirement goal. The play environment was safe and secure, allowing the participants to make financial decisions and learn from their mistakes without

experiencing the consequences in real life. Distributed practice allows for the educational content within the gamified application to be spread across manageable portions at the relevant stage in the application, to prevent information overload, and develop long-term information retention abilities (Kapp, 2012). The self-determination theory focuses on the fundamental purpose of human motivation to perform a task by fulfilling one's psychological needs (autonomy, competence, and relatedness). Players had control (autonomy) over their financial decisions through immediate feedback, effort was required to achieve the retirement goal (competence), and a narrative of everyday financial matters and unexpected life events allowed them to connect with the gamified environment (relatedness) (Richter, Raban, & Rafaeli, 2015).

4.2 Player Types

Marczewski (2018) developed six types of players for gamified applications: socialisers, free spirits, achievers, philanthropists, disrupters, and players. The type of player depends on intrinsic motivational factors and behaviours that players are expected to develop when engaging with the gamified application. Planning for retirement is solely the individual's responsibility (Iwry et al., 2021). Keeping this in mind, the gamified application was developed for a single player to engage with the gamified content without competition or cooperation with other players. Thus, the types of players suited for such an application were the achiever and the free spirit. The definition of each player guided the specific game element to incorporate into the application.

Achievers are driven by mastery, by improving themselves, and overcoming challenges is their strength. Achieving their desired retirement goal will motivate them to engage with the gamified content until they succeed. Free spirits want to be in control and choose their own path. Their strength lies in their ability to create wealth within the gamified application and have total control over their finances. Game elements that are identified by these two types of players are challenges, rewards, new skills, levels, choosing their own path, unlocking content, avatars, and resources (virtual currency) (Marczewski, 2018).

4.3 Design

Kapp (2012) suggested a development framework used to document the gamified application. A detailed discussion of the framework employed is provided as follows:

4.3.1 Overview of the gamified retirement planning application

The gamified application was developed to teach individuals the essence of being financially prepared for retirement. It depicted a real-life scenario of an employee over a 35-year period, in which players had to make general financial and savings decisions to reach their chosen retirement goal. At the start of the application, the players chose the retirement goal they wanted to achieve. Construct play allowed players to use their income earned within the gamified application to gather assets, pay expenses, and save towards retirement, ultimately reaching the chosen retirement goal. Infographics were provided to help them make informed decisions when faced with financial events (e.g., deciding whether to buy or rent a house).

4.3.2 Instructional objectives

Instructions were clear and guided the user to reach their retirement goal. The intended outcome of participating in the gamified application was for players to improve their financial literacy and change their financial attitudes and behaviours.

4.3.3 Character description

Players could choose an avatar to play the role of a lecturer at a higher education institution, which closely resonated with their real-world employment environment at the time. Employment started from the age of 26 until 60 years. At the time the gamified application was introduced, the institution's mandatory retirement age was 60. The player earned a salary and contributed to the employer's sponsored retirement fund. Disposable income was the resource available to the player for making financial choices and dealing with unexpected life events.

4.3.4 Gamified environment and gameplay

The gamified application was a web-based, fixed-screen application that displayed the avatar and tabs for the monthly budget, financial ledger, and assets and liabilities. On the same screen, a window displayed the financial choice and the event the player faced. Once the player made a financial decision by clicking the preferred option from the available options, the effect of the decision was immediately shown in the monthly budget and other financial feedback statements.

4.3.5 Reward structure

Rewards are received in the form of retirement savings within the gamified application. Sound financial decisions will increase retirement savings, and adverse financial decisions will deplete or restrain retirement savings growth. Whatever financial decisions were made eventually affected their retirement savings at the end of the application, which then determined whether they reached their retirement goal.

4.3.6 Look and feel of the gamified application

The gamified application had basic aesthetics without any special features or sound. The application was in the form of a click-and-play, single-player setting.

4.3.7 Technical aspects

The gamified application was entirely web-based, and no software needed to be downloaded. The application was compatible with laptops and computers with internet access.

4.4 Content

Players faced day-to-day and unexpected financial events that required them to make financial decisions. The content of these financial events incorporated into the gamified application was gained from literature on the phases of life during employment, financial literacy, retirement planning, and retirement preparedness. The financial topics included the following:

- Salaries and key deductions.
- Retirement funds – rules, regulations, calculations, taxation, life and living annuities, and income replacement rates.
- Medical health products.
- Accommodation – buying or renting: pros and cons, and the costs involved.
- Financial products – various insurance products, investment properties, equity shares, portfolio diversification, and investment risk.
- Debt – personal loans, mortgage loans, and vehicle finance.
- Time value of money.
- Budgets.

4.5 Game Elements Applied

A gamified application does not necessarily use all available game elements; it uses only those that are needed based on the theories and the type of players that form part of the development process. The elements of gamification are divided into three categories: dynamic, mechanics, and components. Game dynamics outline the goal to be achieved with the gamified application – the big picture. Game mechanics are the basic processes that drive movement in the action and player engagement. Game components are the visible indicators of game dynamics and mechanics. The game elements are interlinked and do not necessarily have a specific approach for use in the development of the gamified application. The main dynamics applied within the application included the narrative, emotions, constraints (rules and boundaries), and progression (Werbach & Hunter, 2020).

4.5.1 Narrative

The narrative of the gamified application was based on life as a newly employed worker at a higher education institution. The employee began their virtual life at age 26 and continued until age 60. The players faced life events that were directly aligned with their employment, aiming to create an authentic experience. The flow and sequence of the financial life events acted as curves of interest to hold the players' attention (Kapp, 2012). Due to resource constraints, players could only choose between a male or a female character. The aim was not to link the image (avatar) of the player within the gamified application to a specific ethnic group; they could, however, choose between a green or purple avatar. As the avatar progressed from one level to the next, it grew older to illustrate the approach of retirement and that time is running out to save towards their retirement goal within the application. The ageing avatar was specifically designed based on the finding that participants who observed their avatar growing older seemed more inclined towards changing their saving behaviour (see Figure 1) (Ersner-Hershfield et al., 2009).

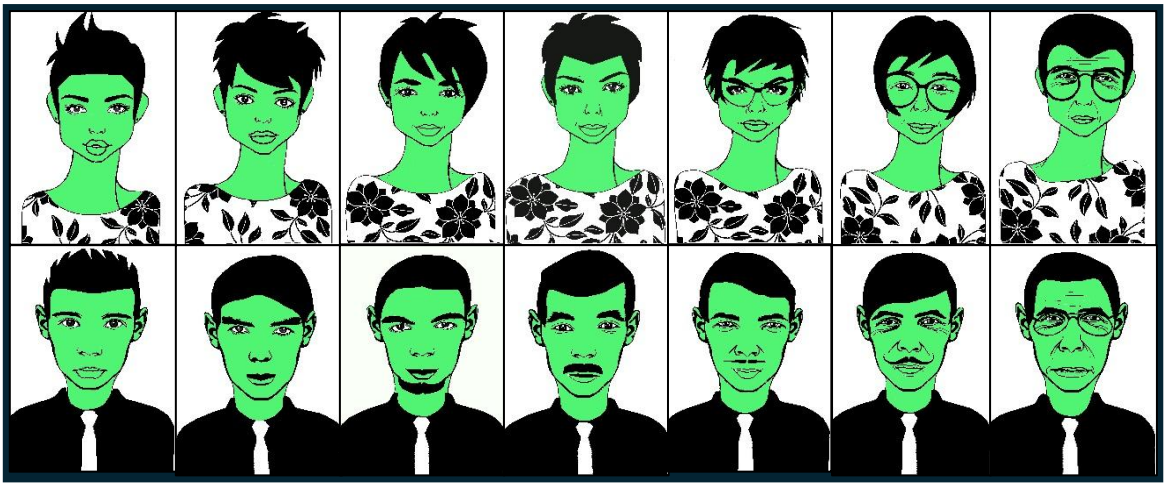

Figure 1: The avatar within the gamified application that grew older each level

4.5.2 Emotions

Game aesthetics served as the emotional element in the gamified application. Due to cost constraints, only basic aesthetics were applied (see Figure 2). Visual elements were kept to a minimum, with the focus on the financial decisions the players had to make. The essential elements incorporated to contribute towards the emotions and the look and feel of the gamified application included the ageing avatar, feedback panes (budget, financial ledger, and assets and liabilities), and the life event pane. All of the aesthetics portrayed the importance of preparing for retirement, which was the ultimate purpose of the gamified application.

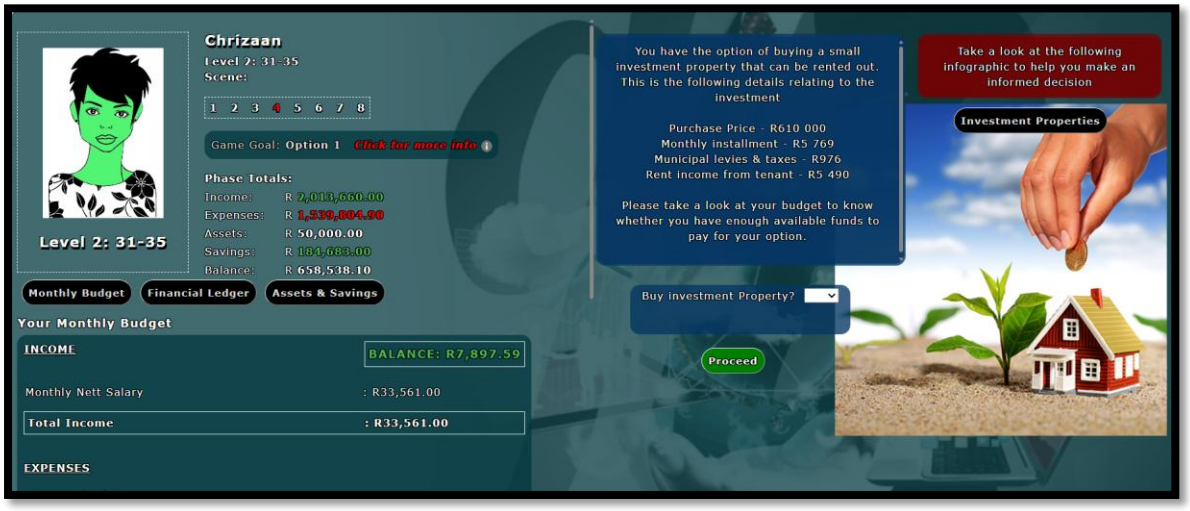

Figure 2: The interface of the Gamified Retirement Planning Application (https://game.go4software.co.za/login/)

4.5.3 Constraints (rules and boundaries)

Constraint elements incorporated in the gamified application included levels, time constraints, infinite gameplay, and transactions. The application's fixed-screen format prevented participants from exploring the gamified environment. The players faced a series of choices in sequential order, representing different phases of life and general life events. Due to time constraints, levels were created, each representing a lifespan of five years, totaling seven levels (starting at age 26 and ending at age 60). The time constraint served as a warning to players that the time they have in real life should be used efficiently to save for retirement. The first level presented players with general financial decisions, including medical aid, accommodation, transport, income protection, and savings. Players were allowed to make changes to their general financial choices at the beginning of each subsequent level. From Level 2 onward, investment properties were introduced as another avenue for saving for retirement. If a player encountered budgeting problems due to costly financial decisions made in previous levels, they could reset the application to the level where they want to change their previous decision.

However, players were not allowed to move to the next level or skip levels if they had not completed the series of financial events in the current level. The levels differed in the types of life events they faced, but not in terms of difficulty. If adverse decisions were made at earlier levels, it would become increasingly difficult in later levels to achieve their retirement goal set at the start of the gamified application. The players were allowed infinite gameplay by resetting the gamified application as many times as they wished and choosing different retirement goals. With each financial decision, a transaction occured that automatically updated their budget, financial ledger, and assets and savings. Rules for calculations in the gamified application were programmed to account for inflation, increases in asset values, compound interest, fixed interest rates, depreciation of vehicles, buying and selling of assets, the type of financing allowed for specific transactions, and different debt pay-off periods. The final retirement savings at the end of all seven levels consisted of retirement fund savings, personal savings, bank account balance, rent income from investment properties, and a deduction for any mortgage loan balance. The total accumulated retirement savings was compared to the retirement goal chosen at the start of the application to determine whether the goal was achieved.

4.5.4 Progression

Goal-focused challenges, resources, cascading information, feedback, and rewards embodied the progression elements employed in the gamified application. Only one goal-focused challenge was incorporated into the application – to achieve the retirement goal chosen at the start of the gamified application. To achieve their chosen goal, players had to complete all seven levels and make appropriate financial decisions. Players could choose from six different retirement goals. The easiest of the retirement goals (goal number one) reflected a retirement with insufficient savings that does not even cover the most basic needs. The better the retirement outlook (with more benefits and luxury), the higher the required retirement savings needed to achieve the goal. Thus, goal number six was the most difficult and nearly impossible to achieve within the gamified application. Players collected resources in the form of a salary. The disposable income left after compulsory deductions (retirement fund contributions and taxes) was available to the player to use when making financial decisions with each life event. More income could be collected if the player decided to buy investment property. Players were also allowed to put aside additional savings that earned interest. In the event of unexpected life events with a financial impact, the money in their bank account or savings account could be utilised. If no funds were available or the player did not want to use their savings or bank account, they could obtain a personal loan, which would have cost them more, as interest was charged at a very high rate. Through cascading, players were exposed to information about the financial event they faced at that specific stage. The information was provided to help players make better-informed decisions. To avoid information overload, the information was given in chunks rather than all at once. The element of unlocking content as the player progressed through the gamified application also meant they did not know what lay ahead in the coming levels. If adverse financial decisions were made, such as declining to obtain income protection, this decision could cost them later due to unexpected life events (e.g. loss of income due to a medical condition). The most crucial game element used in the gamified application was feedback. The impact of every financial decision made by a player is immediately reflected on the budget, financial ledger, and asset and savings statements. The asset statements reported the values of the properties and the vehicle, total employer pension fund savings, the bank account balance, and the mortgage loans balances. Feedback provided the player with information about the impact of the decision they made. In reality, the impact of financial decisions is only discovered in the long term, by which time it may be too late to rectify their financial situation. Thus, players could learn from their mistakes within the gamified application and transfer this knowledge to their real-life (Aegon, 2021; Bell, 2018; Kapp, 2012). During the gamified application, players were rewarded when making sound financial decisions by avoiding the costs of unexpected life events. They could avoid medical costs if they had the appropriate medical aid plan, avoid accident costs if they had car insurance, or avoid income loss if they had income protection. When players reached the end of the gamified application, a message indicated whether they achieved their goal. Reaching the retirement goal set for oneself was the reward in the gamified application. If a player did not reach their retirement goal, the application indicated the type of retirement they could afford based on the amount of retirement savings they accumulated. The result could give the players an idea of how realistic their retirement goal was.

5. Results

The dependent variable, retirement preparedness, was measured in terms of basic financial literacy, retirement financial literacy, interest in retirement planning, and their perception of how well they think they are prepared for retirement (attitudes and behaviours towards their retirement). Basic financial literacy assessed understanding of time value of money, interest rates, compound interest, a safe investment, investment risk,

investment diversity, inflation, and prime rates. Retirement financial literacy measured knowledge of pension fund rules (retirement age, withdrawals, and transfers), tax-related matters, differences between funds, percentage of salary allocated to retirement, and scenarios impacting retirement savings.

This article focused on overall improvements in participants' financial literacy and retirement preparedness, emphasising the general trends observed from the gamified application rather than definitive causal conclusions. The gamification group also provided feedback on Likert-scale statements about the application (1 = strongly disagree; 5 = strongly agree) and answered open-ended questions about what they liked and disliked, as well as suggestions for improvement. The data gathered from the pre- and post-test were analysed in SPSS (Version: 29.0.0.0) using a Quade non-parametric ANCOVA to assess differences between groups attributable to the interventions. A p-value below 0.05 indicates a statistically significant change in post-test results. Although the intervention groups showed greater increases in financial literacy scores than the control group, these findings should be interpreted as preliminary trends reflecting the exploratory nature of the study, rather than conclusive evidence. Table 1 illustrates the financial literacy scores before and after the interventions between the groups.

Table 1: Basic financial literacy (BFL) and financial retirement literacy (FRL) scores

Variable tested:	Gamification	Education	Control	Total	P-value
Overall basic financial literacy score					0.383
Pre-test: Average BFL score	73.9%	71.7%	76.5%	74.1%	
Post-test: Average BFL score	81.2%	78.1%	79.7%	79.6%	
Overall increase in BFL score	7.3%	6.4%	3.3%	5.6%	
Overall financial retirement literacy score					*0.001
Pre-test: Average FRL score	63.2%	59.3%	68.1%	63.6%	
Pre-test: Average FRL score	66.1%	72.2%	68.1%	68.9%	
Increase in FRL score	2.9%	12.9%	0.0%	5.3%	
*p-value <0.05 **p-value <0.001					

Both interventions were associated with improvements when compared to the control group. The gamified application appeared more effective at improving basic financial literacy, whereas a focused study of the infographics produced greater gains in retirement financial literacy. This difference may be attributed to the education group's exclusive focus on core retirement concepts. In contrast, the gamification group divided attention between gameplay and supplementary infographic content, with limited engagement with the embedded links.

Table 2 illustrates the participants' interest in retirement planning before and after the interventions (Likert scale of 1 to 5, where 1 indicates low interest and 5 indicates high interest).

Table 2: Interest in retirement planning

Variable tested:	Gamification	Education	Control	Total	P-value
Interest in retirement planning					0.278
Pre-test - mean	4.48	4.55	4.62	4.55	
Post-test - mean	4.62	4.42	4.44	4.49	
Change in mean score	0.14	-0.13	-0.18	-0.06	
% increase/-decrease	3%	-3%	-4%	-1%	
*p-value <0.05 **p-value <0.001					

Participation in the gamified application was associated with a slight increase in interest, whereas the education and control groups experienced decreases. These trends suggest that interactive, engaging experiences may promote short-term motivation to engage with retirement planning, consistent with Self-Determination Theory, which posits that autonomy, mastery, and feedback increase intrinsic motivation. Table 3 provides the

percentage changes of each group for the variables tested, indicating how well the participants think they are prepared for retirement before and after the interventions.

Table 3: Perception of how well a participant thinks they are prepared for retirement

Variable tested:	Gamification	Education	Control	Total	P-value
1. Personal responsibility					0.564
% increase/-decrease	-1%	2%	-1%	0%	
2. Level of awareness					0.204
% increase/-decrease	7%	12%	1%	7%	
3. Understanding of financial matters					0.299
% increase/-decrease	5%	18%	13%	12%	
4. Personal retirement plan					0.277
% increase/-decrease	-2%	11%	3%	4%	
5. Saving enough					*0.012
% increase/-decrease	1%	20%	-2%	6%	
6. Confidence towards retirement					0.104
% increase/-decrease	8%	13%	4%	8%	
7. Gross income replacement					1.000
% increase/-decrease	-1%	4%	8%	3%	
8. Achieve income required					0.633
% increase/-decrease	-4%	15%	0%	3%	
*p-value <0.05 **p-value <0.001					

The gamified application was associated with increased awareness and confidence, but a decrease in their perception of how well they think their personal retirement plan was developed. This was also the case for the question on whether the gamification group thinks they would achieve the income needed in retirement. Their response decreased after participating in the game. This may reflect a "reality check" effect, where experiential learning exposes participants to the real-life challenges of retirement, prompting more realistic self-evaluations. In contrast, the education group, after being exposed to the infographics, was, overall, more positive in their perception of how well they are prepared for retirement. This result is consistent with the cognitive bias literature, suggesting that individuals who study limited but targeted information may overestimate preparedness. In addition, over-confident individuals are no more likely to be better prepared than those who are less confident (Angrisani & Casanova, 2019).

Table 4 presents the feedback from the gamification group on the Likert scale statements, rated on a scale from 1 (strongly disagree) to 5 (strongly agree).

Table 4: Feedback from the gamification group on the gamified application

Statements	Agree/Strongly Agree	Mean
I know more about retirement planning after participating in the gamified application.	68.9%	3.8
All my concerns regarding retirement planning were covered in the gamified application.	44.8%	3.2
The gamified application was engaging, fun, and highly interactive.	86.2%	4.2
The gamified application motivated me to be more involved in my retirement planning and be prepared for retirement.	82.7%	4.4
I would recommend the gamified application to other employees.	79.3%	4.1
Average mean		4.0

The first and second responses in Table 4 might have appeared more positive if the players actually consulted the infographics in the gamified application, even though it was not a requirement. They were mainly tasked with a retirement goal, playing all the levels in the application (making financial decisions throughout), and trying to achieve their initial retirement goal. The average mean of 4 indicated that the gamification group found the gamified application useful.

Responses to the open-ended questions were predominantly positive, although some negative experiences were also reported. Respondents described the gamified application as practical, realistic, and informative due to real-life scenarios and actual figures incorporated into it. Many indicated that the application made financial planning more engaging and helped place financial decisions and their consequences for retirement savings into a clearer perspective. Many thought the unexpected life events were a meaningful and thought-provoking experience. The feedback statements were particularly well received, as participants could immediately observe the consequences of their financial decisions. This real-time feedback encouraged reflection on personal retirement planning and promoted a more realistic assessment of retirement preparedness. Several participants also reported increased motivation to save for retirement. As one participant commented: "I am more aware of the need to plan sufficiently for my retirement", which was an objective of the gamified application.

Despite the generally positive feedback, participants identified several limitations. Some respondents indicated that the instructions provided at the start of the application could have been clearer. Others noted the absence of additional saving and payment options, as well as the limitation that certain financial choices, such as selecting car insurance or deciding to have children, could only be made once. The budgeting structure allowed participants to spend only available funds, with no option to simulate overdraft or debt, which some felt restricted their ability to explore the consequences of unwise financial decisions. In addition, a small number of participants reported feelings of anxiety when engaging with retirement-related content, while technical issues experienced during gameplay contributed to frustration.

6. Limitations of the study

Several limitations should be acknowledged when interpreting the findings of this study.

First, although the sample size of 29–34 participants per group meets recommended thresholds for exploratory experimental research, it may have constrained statistical power. It restricts the generalisability of the findings beyond the study context. Second, the study relied primarily on self-reported measures of financial literacy, interest, and perceived retirement preparedness. Such measures may be subject to social desirability bias or overconfidence, particularly among participants who have been exposed to educational material. Third, the intervention was evaluated over a two-month period, providing insight into short-term changes only. Long-term knowledge retention and sustained behavioural change could not be assessed. Finally, while open-ended responses were thematically categorised, a more in-depth qualitative approach (such as interviews or focus groups) could provide richer insight into participants' decision-making processes and behavioural responses.

7. Discussion

The findings suggest that gamification can positively influence basic financial literacy and stimulate interest in retirement planning, supporting prior research indicating that interactive and experiential learning environments enhance engagement with complex financial topics (Kapp, 2012; Uppalari, 2025). The increase in interest observed in the gamification group aligns with studies showing that game elements such as feedback, progression, and simulated decision-making can enhance intrinsic motivation among adult learners. The results also indicated a more nuanced outcome. Participation in the gamified application was associated with a decline in participants' perceived retirement preparedness. Rather than suggesting a negative effect, the result may reflect a constructive "reality check", whereby exposure to realistic financial scenarios could prompt participants to reassess their previous, more optimistic perception of their retirement situation. This finding extends the gamification literature by demonstrating that increased engagement does not necessarily lead to greater confidence and may, in some cases, reduce perceived preparedness as participants become more aware of the complexity of retirement planning.

This outcome contrasts with the education group, where exposure to infographics resulted in increased financial retirement literacy, as well as confidence in preparedness. While increased financial literacy is essential, behavioural finance literacy cautions that greater knowledge can also contribute to overconfidence bias, in which individuals overestimate their readiness despite limited practical application (Angrisani & Casanova, 2019). The contrasting results across the two intervention groups suggest a gap between perceived competence

and actual preparedness, underscoring the importance of integrating knowledge-based education with experiential learning approaches, such as gamification.

The way forward may be to expand the gamified application with a more comprehensive approach, including a wider range of financial decisions (investment and payment options) and retirement concerns. Players should be allowed to enter their real salaries and expenses to manipulate the starting conditions in a gamified application. The automatic update of calculations prevented participants from being educated on how to perform basic financial calculations which would have contributed to their understanding of financial matters. Providing educational material through a clickable link to assist players with their financial decisions was not successful. A different approach must be followed to address this issue. Scaffolding, as one of many ways, can be applied to compel players to first complete knowledge quizzes or tasks before they can unlock the next level.

Overall, the findings contribute context-specific insight into how gamification influences not only financial literacy and interest but also self-perception and confidence in retirement preparedness. Gamification may extend beyond motivation by acting as a reflective process that challenges assumptions and supports more realistic self-perceptions. This nuanced outcome contributes to existing research by emphasising the need for financial education interventions that balance engagement, knowledge development, and behavioural awareness.

8. Conclusion

The gamified retirement planning application successfully illustrated how interactive learning can promote financial literacy and retirement preparedness. Players experienced the long-term effects of their decisions in a low-risk setting by modelling real-life financial decisions, which helped them develop a more accurate understanding of retirement planning. Participants' self-assessment of their retirement readiness became more realistic as a result of this interactive tool's ability to challenge their prejudices and expand their knowledge. The limitations of the gamified application were a need for clearer instructions, more financial possibilities, and the ability to customise income and expenses to better suit unique situations. Participants also indicated a desire to see the consequences of poor financial decisions, which could be included to enhance the educational impact. These observations imply that, despite its effectiveness, the application might need some improvements to be more relatable and adaptable, possibly including scaffolding strategies to encourage slower learning. In the end, this gamified method exhibits promise as a financial education tool, motivating people to take proactive steps toward retirement planning.

AI Statement: No AI tool has been used in the development of this paper.

Ethics Statement: All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the rules of the University of the Free State, South Africa. The protocol was approved by the General Human Research Ethics Committee (GHREC) with the Ethical Clearance Number of UFS-HSD2019/0023/21/22.

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