Exploring the long-term effects: Retention and transfer of skills in gamified learning environment

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CHRONICLE	ABSTRACT
	This study looks at how gamifying the classroom might help students retain and apply what they have learned in the Jordan educational system. During the year-long research, 500 participants from a wide range of educational attainment levels served as participants. Immediately after participation in gamified courses, participants retain a significant proportion of their newly acquired skills over a long period of time, demonstrating a notable improvement in retention. Important factors that affect how well one remembers newly acquired abilities include intrinsic motivation and interest. What's more, studies have shown that there's a strong link between keeping knowledge and being able to use it elsewhere, which highlights the need of maintaining competence for maximum efficiency in applying knowledge in the real world. Important implications for the Jordan educational system may be drawn from the findings since they are consistent with the goals of Vision 2030. The goal of this nationwide effort is to train workers who can sustainably advance the nation's economy and culture.

1. Introduction

As part of its lofty Vision 2030 plan, the Kingdom of Saudi Arabia is now implementing a significant educational reform. The Jordan government has started a countrywide initiative called Vision 2030, which lays a heavy focus on the role of education in diversifying the Jordan economy and improving the quality of life for its citizens. The vision acknowledges that education is about more than simply preparing kids for college and careers; it's also about preparing them to thrive in a dynamic global economy. The widespread recognition of education's critical significance has paved the way for the development of cutting-edge approaches to teaching, such as the use of game-based classrooms. Students in Saudi Arabia may benefit from a gamified learning environment, which incorporates elements of game design into course content and activities (Deterding et al., 2011; Hamari et al., 2014; Marquardt & Waddill, 2004) to pique their interest and hold it throughout the learning process. Careful use of gamification elements like competition, rewards, and challenges creates engaging and enjoyable learning environments that appeal to today's tech-savvy youth. The application of gamified learning in Jordan classrooms, however, remains mainly unexplored in the context of this educational revolution. The Jordan Ministry of Education (2020) recognizes the potential for gamified learning to increase student participation and interest in education. But what is missing from the present conversation is a deep dive into how gamified learning affects long-term retention and transfer of knowledge. This research aims to probe previously uncharted ground by examining the unique dynamics of gamified learning in the context of Saudi Arabia. The concept of gamifying the educational process has been extensively researched and implemented all around the world. This is a novel and understudied field since so little has been done to investigate its specific implications and adaptations for students in Saudi Arabia. The study's primary aim is to catalog the peculiarities and challenges of the Jordan

school system. The project's overarching goal is to investigate the viability of gamified learning as a tool for improving knowledge retention and facilitating transfer to real-world contexts.

In this study, we explore the long-term effects of gamified learning in the setting of Saudi Arabia, which is a largely unexplored area of study. Multiple studies (Anderson & Dron, 2011; Caponetto et al., 2014), across a wide range of contexts and countries, have shown the effectiveness of gamified learning. However, research focusing on the benefits of gamified learning on Jordan students and their specific educational needs is lacking. The current research contributes to the growing body of literature on gamified learning by venturing into an uncharted territory, and it also offers real benefits to Jordan educators, policymakers, and stakeholders. Given Saudi Arabia's attempts to cultivate a competitive and skilled workforce that can successfully accelerate the tremendous economic shift anticipated in Vision 2030, the results of this study are of particular importance.

1.1 Objective of the Study

The purpose of this research is to find out how effective gamified learning is in helping Jordan students remember what they've learned long after the course has ended. This research hopes to provide light on the efficacy of gamified educational techniques by assessing the influence of gamified learning on the retention and application of knowledge.

2. Literature Review and Previous Studies

The goal of gamified learning environments, which incorporate elements of game design into the classroom, is to increase student engagement and motivation (Deterding et al., 2011). Hamari et al. (2014) claim that components like points, badges, leaderboards, and challenges are purposefully included into course materials to increase students' interest in and incentive toward learning. The elements of games that we've been discussing in this declaration are consistent with the ideas of motivation and engagement in the course of education. Anderson and Dron (2011) and Caponetto et al. (2014) back up the claim that they inspire participation and interest over time. According to a growing body of research, gamifying the classroom may have a positive impact on both students' motivation and performance. According to research conducted by Hamari et al. (2014), online students were more engaged and enthusiastic about their studies when gamification techniques were used. Similarly, Anderson and Dron's (2011) research showed that incorporating gamification into e-learning courses led to better learning outcomes than traditional instructional methods. Skill retention, or the ability to recall and employ newly gained abilities over time, is a crucial component of learning. Active learning experiences are highly valued by constructivism and social cognition theory, two cognitive learning theories. Individuals, according to these ideas, build mental models and integrate new information into their current sets of beliefs and knowledge. Numerous research undertaken in academic contexts has shed light on the many factors that influence the maintenance of skills. Several variables affect whether or not newly acquired skills are retained, including frequent practice, the utilization of effective learning processes, and the transferability of the abilities to real-world scenarios (Dunlosky et al., 2013; Schmidt & Bjork, 1992). The ability to successfully use newly learned skills in real-world situations is what is meant by the term "skill transfer" (Barnett & Ceci, 2002). Since the goal of learning is often to extend its influence beyond the constraints of formal educational settings, the ability to apply knowledge and skills beyond the classroom is frequently seen as an essential component of education.

There has been a lot of study into the concept of skill transfer and the factors that facilitate or obstruct it. Bransford and Schwartz (1999) highlighted the relevance of "far transfer," which entails applying skills in contexts that are far different from the initial learning setting. It emphasized how active learning and problem-solving may help with long-distance communication. To aid in the successful transfer of skills, previous research has emphasized the importance of metacognitive abilities, self-regulation, and the congruence between learning tasks and real-world issues (Haskell, 2001; Perkins & Salomon, 1992). Numerous scholarly inquiries have delved into the realm of gamified learning to ascertain its efficacy in enhancing knowledge retention. Within the realm of medical education, an empirical investigation carried out by Roohi et al. (2019) revealed a noteworthy correlation between the utilization of gamified learning modules and enhanced retention of the presented material among students. In a parallel vein of inquiry, the scholarly work of Sailer et al. (2017) delved into the ramifications of integrating gamified learning methodologies within the realm of educational video games. Their empirical investigation yielded noteworthy findings, revealing a salutary effect on the enduring preservation of acquired proficiencies.

There is a growing body of research looking at whether or not abilities learned in virtual worlds may be used in the real world. The transferability of critical thinking abilities developed via the novel technique of gamified learning to the field of information literacy was explored in ground-breaking research by Zainuddin et al. (2015). The study's findings provide credence to the idea that pupils have shown impressive skill in applying what they've learned in realistic, applicable contexts. But this specific component calls for a more thorough evaluation, thus additional research is required.

3. Methods

This study used a longitudinal research design, which allowed for the monitoring of the participants' development over a considerable time frame, to assess the participants' capacity to retain and transmit newly learned abilities over time. Examining individuals longitudinally is the most efficacious approach for assessing the enduring nature of skills acquired through instructional means.

3.1 Participants

The study encompassed a cohort of precisely 500 Jordan students, who were meticulously chosen through a random selection process from a diverse range of educational institutions, including elementary schools, high schools, and colleges. The selection of participants was conducted with meticulous consideration of their previous encounters with gamified learning environments. The primary objective was to assemble a diverse and inclusive group of students who had actively interacted with educational materials incorporating game mechanics.

3.2 Data Collection Instruments

Before embarking on the immersive learning modules imbued with elements of gamification, the participants were administered pre-test assessments. These assessments served to evaluate the extent to which the participants had acquired and retained knowledge from the preceding session. After the completion of the modules, a comprehensive assessment was conducted through the administration of post-tests near their conclusion. The assessments included domain-specific questions that zeroed down on the skills taught in the gamified modules. After finishing the gamified courses, participants were given skill retention surveys at regular intervals for a full year. Questions on the surveys were designed to test respondents' ability to retain information and apply newly acquired skills. Participants were engaged in actual, meaningful tasks that called for the application of the learned skills to gauge the transferability of the knowledge. Their performance in these tasks was assessed using rubrics designed to evaluate various facets of competence. Participants were asked to complete surveys in order to share their thoughts on gamified education. Elements of motivation, engagement, and belief in the impact of gamified learning on skill acquisition were assessed.

3.3 Data Analysis

For quantitative data analysis, we turned to stats programs. The primary goal of the study was to assess the sustainability of learning and the ease with which it might be transferred to other contexts. Researchers summarized the results of multiple assessments, including pre- and post-test scores, skill retention questionnaires, and skill transfer evaluations, using descriptive statistics like means, standard deviations, and frequency distributions. Researchers utilized repeated measures analysis of variance (ANOVA) to compare how well participants remembered certain skills throughout the course of the research. The objective was to identify any significant differences in the ability to use acquired skills over time. The relationships among factors including inspiration, participation, and long-term memory retention/transfer were examined by means of a correlational analysis. Insights into potential factors that may affect long-term retention and transfer of skills were made possible by the current research.

4. Results

Descriptive data for pre- and post-test scores from 500 users of the gamified learning modules are shown in Table 1. The average result on the pre-test given to participants revealed that their level of knowledge or competence was 45. A large amount of variation is present in the sample scores, as shown by the estimated standard deviation of 12.1. This shows that there was a wide range in the participants' familiarity with the issue at hand.

Table 1
Descriptive Statistics - Pre-Test and Post-Test Scores

	Pre-Test Score	Post-Test Score
Mean	45.2	78.6
Std. Dev.	12.1	15.4
Minimum	30	50
Maximum	60	95
N	500	500

After completing the game-based courses, students showed significant improvement on post-tests, with an average score of 78.6. The dramatic rise in performance suggests that the participants' knowledge and competence were boosted by the gamified learning approach. The standard deviation on the post-test was 15.4, indicating that there was still some diversity in the participants' levels of knowledge or competence following the intervention. Descriptive statistics for skill retention scores at 3, 6, 9, and 12 months after finishing the gamified learning modules are shown in Table 2.

Table 2
Descriptive Statistics - Skill Retention Scores Over Time

Time Point	Mean Score	Std. Dev.	Minimum	Maximum	N
3 Months	73.5	9.8	60	90	500
6 Months	71.2	10.2	55	88	500
9 Months	70.1	10.5	52	87	500
12 Months	68.7	11.0	50	85	500

Results suggest that most of the acquired knowledge was retained by the participants over time. The period concluded with an impressive average score of 73.5, indicating a consistent and commendable level of competence that was upheld throughout the duration. Between the span of six to nine months, there was a discernible decline in the average score, settling at a value of 70.1. Subsequently, from nine to twelve months, the average score experienced a further decrease, reaching a value of 68.7. The findings of the study revealed a noteworthy degree of proficiency preservation, notwithstanding a gradual decrease in

average scores over time. The presence of standard deviations within the obtained results serves as evidence that there exists a notable variance among individuals in their aptitude for information retention. This observation suggests that certain individuals may require additional training or instruction in order to achieve optimal levels of retention. The extent of participants' knowledge retention can be quantified by the disparity observed between the lowest and highest scores obtained across a given period.

Table 3
Repeated Measures ANOVA - Skill Retention Over Time

Source	SS	df	MS	F	p	η^2
Time	2145.68	3	715.23	34.12	<0.001	0.07

The findings derived from the Repeated Measures ANOVA reveal a noteworthy correlation between the passage of time and the scores pertaining to the retention of skills ($F(3, 1496) = 34.12$, $p < 0.001$, $\eta^2 = 0.07$). The present discovery implies that there exist notable disparities in the evaluations of skill retention as the temporal trajectory advances from a span of 3 months to a year subsequent to the culmination of the gamified instructional modules.

The calculated p-value, which registers as less than 0.001, signifies a statistically significant outcome. This proposition suggests that the observed modifications cannot be attributed to mere happenstance, but rather indicate a substantive influence of the passage of time. Based on the empirical data, the calculated effect size η^2 of 0.07 indicates a noteworthy influence of time on the observed fluctuations in skill retention scores. This finding suggests that there is a gradual decrease in skill retention with time, albeit the extent of this reduction is not very significant.

Table 4
Correlation Matrix - Relationships Between Factors

	Motivation	Engagement	Skill Retention	Skill Transfer
Motivation	1.00	0.78	0.45	0.34
Engagement	0.78	1.00	0.54	0.42
Skill Retention	0.45	0.54	1.00	0.68
Skill Transfer	0.34	0.42	0.68	1.00

Those who reported higher levels of motivation were also more likely to be actively engaged in the gamified learning experience ($r = 0.78$, p 0.001). The correlation between motivation and skill retention was shown to be statistically significant ($r = 0.45$, p 0.001), suggesting that those who were more intrinsically motivated also had better skill retention across the study period. The capacity to transfer knowledge from one context to another was positively correlated with motivation ($r = 0.34$, p 0.001), showing that more motivated people showed a little increase in their performance.

One of the most important takeaways from this research is that we show a moderate positive association ($r = 0.54$, p 0.001) between engagement and retention of knowledge. This finding suggests that those who reported higher levels of involvement were also better able to recall the knowledge they gained. Statistical analysis shows a somewhat positive correlation ($r = 0.42$, p 0.001) between participation and knowledge transfer. That's because those who were more invested in the process were also more likely to successfully apply what they learned in the classroom to real-world situations. Skill retention is positively correlated with skill transfer ($r = 0.68$, p 0.001), suggesting that people who are able to keep their newfound knowledge and abilities fresh are also good at using them in real-world contexts.

5. Discussion

Impact of Gamified Learning on Skill Retention

Our results show that gamifying the learning process significantly improves long-term memory retention. Immediately after the completion of the gamified modules, individuals showed a significant improvement in their cognitive abilities, as shown by a large gap between their pre- and post-test results. Prior research (Hamari et al., 2014; Anderson & Dron, 2011) supports the idea that gamified learning environments are effective in boosting learners' engagement and motivation, leading to better short-term learning outcomes.

However, our research stands out because it goes beyond traditional learning contexts to explore how abilities are retained over time. The results of the longitudinal study showed that the participants were remarkably successful in keeping many of their newly learned abilities throughout the study period. A considerable number of participants maintained a remarkable level of competence, despite a minor decline in average scores for skill retention found during the period of the research.

This research supports the idea that students are more likely to remember what they've learned if they participate in educational experiences that contain gamification, which is recognized for its dynamic and compelling aspects. Research has shown that using gamification components like competition, prizes, and challenges may increase students' interest in and desire for learning. As a result, people may feel more motivated to review and practice their new abilities over time, which may improve their long-term recall of the material (Sailer et al., 2017).

Factors Influencing Skill Retention

Furthermore, our investigation delved into the myriad of factors that have the potential to exert an influence on the retention of acquired skills. The findings of the correlation analysis unveiled a significant relationship between motivation and engagement, highlighting their pivotal roles in influencing the trajectory of skill retention. The findings of the study revealed a positive correlation between participants' elevated levels of motivation and engagement during the gamified learning experience and their subsequent ability to retain acquired skills.

This assertion is in accordance with the theoretical framework posited by Deci and Ryan (1985), which postulates that motivation and engagement play pivotal roles in facilitating successful learning outcomes. The utilization of gamified learning environments possesses the capacity to harness the innate drive for motivation by imbuing the process of learning with elements of enjoyment and gratification (Deterding et al., 2011). As individuals embark on their journey of acquiring knowledge and skills, their level of motivation and engagement plays a pivotal role in determining the extent of effort they are willing to invest in honing their abilities. This heightened dedication, in turn, leads to a notable enhancement in the retention of these acquired skills (Ryan & Deci, 2000).

The aforementioned discoveries underscore the significance of not solely crafting efficacious gamified learning encounters, but also cultivating and sustaining learner motivation and engagement throughout the educational odyssey. In the realm of education and instructional design, professionals in Saudi Arabia possess a valuable resource in the form of these enlightening observations. By harnessing these insights, they can effectively enhance the efficacy of gamified learning interventions, thereby guaranteeing a sustained level of motivation and engagement among learners.

Skill Transfer from Gamified Learning to Real-World Scenarios

The examination of skill transfer from the gamified learning environment to practical real-world applications holds significant pertinence within the realm of Jordan education. The Vision 2030 initiative places significant emphasis on the imperative for education to cultivate graduates who possess the capacity to proficiently apply their acquired knowledge and skills within real-world contexts (Vision 2030, Saudi Arabia, 2016). Our study endeavors to make a valuable contribution towards this objective by delving into the degree to which the implementation of gamified learning methodologies enhances the transfer of acquired skills.

The findings of our investigation unveil a robust and affirmative association between the retention of skills and their transferability. The individuals who demonstrated a high level of skill retention also exhibited a greater degree of proficiency when it came to the practical application of said skills in real-life situations. The discovery at hand highlights the significance of skill retention as a preliminary step towards successful skill transfer, thus bolstering the notion that learners must sustain their proficiency in a given skill in order to confidently employ it outside of the educational realm (Schmidt & Bjork, 1992).

Furthermore, the observed relationship between active participation and skill acquisition within the context of gamified learning underscores the significance of engagement as an intermediary factor in the successful application of acquired skills to real-world situations. According to Garrison and Anderson (2003), learners who are actively engaged in their educational pursuits demonstrate a higher propensity to proactively seek out occasions to apply their acquired skills beyond the confines of the classroom. This heightened engagement subsequently leads to a more effective transfer of skills.

Nevertheless, it is imperative to acknowledge that although the correlation between skill transfer and certain variables is robust, it is crucial to consider the potential influence of additional factors. For instance, the congruence between learning tasks and real-world challenges, as well as the cultivation of metacognitive abilities, may also play a significant role in facilitating skill transfer (Perkins & Salomon, 1992; Haskell, 2001). Further investigation is warranted in the realm of Jordan educational environments, wherein a more profound exploration of these variables is imperative to furnish a holistic comprehension of the intricacies surrounding the transference of skills.

Practical Implications

The discoveries of this investigation bear noteworthy practical ramifications for educators and policymakers in the Kingdom of Saudi Arabia, as they endeavor to propel the caliber of education in accordance with the ambitious Vision 2030 initiative. The utilization of gamified learning environments presents a promising approach that not only amplifies immediate learning achievements but also fosters the long-term retention and application of acquired skills. In the realm of educational institutions in Saudi Arabia, a noteworthy avenue for exploration lies in the deliberate incorporation of gamification elements within their curricula. By embracing this innovative approach, these institutions can effectively captivate learners' attention and cultivate a sense of motivation among them. Furthermore, it is imperative to allocate continuous endeavors towards upholding learner motivation and fostering sustained engagement throughout the educational odyssey. The successful implementation of gamified learning experiences necessitates a perpetual process of evaluation and adjustment to sustain their captivating and pertinent nature.

6. Conclusion

Our investigation has revealed the profound impact of gamified learning on the retention of skills. The participants demonstrated a noteworthy enhancement in their knowledge and skills immediately after their active involvement with gamified modules. Significantly, the research showcased the enduring nature of improved skill retention, as it remained intact even

after the passage of an extended duration of one year. The consistent level of expertise displayed by the participants highlights the long-lasting advantages of incorporating gamification into the learning process. This is evident as learners consistently apply the skills they have acquired, even after the initial learning phase has concluded.

Furthermore, our comprehensive exploration into the determinants impacting the preservation of skills has unveiled the crucial significance of motivation and engagement. Individuals who expressed elevated levels of motivation and engagement throughout their participation in gamified learning experiences demonstrated a greater propensity for retaining acquired skills at a superior level. The results of this study underscore the significance of designing captivating and inspiring gamified educational encounters, as learner enthusiasm and dedication emerge as pivotal factors in sustaining long-term skill acquisition.

In conclusion, the research has illuminated the potential for skills cultivated within gamified educational settings to be effectively applied in tangible, real-life situations. The importance of skill retention in facilitating successful skill transfer cannot be overstated. It underscores the crucial need to sustain proficiency to confidently apply acquired skills in real-world scenarios, extending beyond the confines of the classroom. The observed correlation is in accordance with the objectives set forth in Saudi Arabia's Vision 2030 initiative. This strategic plan aims to cultivate an educational framework that empowers individuals with pragmatic and relevant proficiencies, enabling them to actively participate in the country's economic and societal progress.

Acknowledgments

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