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Towards the development of motivation through gamification

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ABSTRACT

The application of gamification was able to adapt to the learning style of the current generation allows to increase concentration, effort and motivation, the latter being a key aspect in the learning achievement of students. This study is a quantitative approach, experimental design, pre-experimental level and aims to evaluate the effect of the application of gamification tools on students' motivation, as well as to determine whether the level of motivation in the dimensions attention, relevance, confidence and satisfaction is influenced by the use of gamification tools. A probability sample of 209 secondary school students in Peru was used and an instrument adapted from the Instructional Materials Motivation Survey (IMMS) based on the ARCS model approach was employed. The results of the study revealed that 69.2% of students have a high motivational level. In addition, it was found in the comparison of the pre-test and post-test results that the four dimensions of Keller's motivational design: confidence, attention, satisfaction and relevance achieved a high level of development, being the dimensions satisfaction and relevance the ones that reached the highest level of development with 79.4% in the high level.

Keywords: *gamification tools; motivation; IMMS; ARCS; Keller model; learners*

Hacia el desarrollo de la motivación a través de la gamificación

RESUMEN

La aplicación de la gamificación lograda adaptarse al estilo de aprendizaje de la generación actual permite incrementar la concentración, el esfuerzo y la motivación, siendo este último un aspecto clave en el logro de aprendizaje de los estudiantes. Este estudio es de enfoque cuantitativo, diseño experimental, nivel preexperimental y tiene como objetivo evaluar el efecto de la aplicación de herramientas de gamificación en la motivación de los estudiantes, así como determinar si el nivel de motivación en las dimensiones atención, relevancia, confianza y la satisfacción está influenciada por el uso de herramientas de gamificación. Se utilizó una muestra probabilística de 209 estudiantes de secundaria en Perú y se empleó un instrumento adaptado de la Encuesta de Motivación por Materiales Instruccionales (IMMS) basado en el enfoque del modelo ARCS. Los resultados del estudio revelaron que el 69,2% de los estudiantes tienen un nivel de motivación alto. Además, se encontró en la comparación de los resultados del pretest y posttest que las cuatro dimensiones del diseño motivacional de Keller: confianza, atención, satisfacción y relevancia lograron un alto nivel de desarrollo, siendo las dimensiones satisfacción y relevancia las que alcanzó el nivel más alto de desarrollo con un 79,4% en el nivel alto.

Palabras clave: herramientas de gamificación; motivación; IMMS; ARCOS; modelo Keller; aprendices

INTRODUCTION

The current context as influenced by the Covid-19 pandemic has resulted in students having difficulty self-regulating their learning activities due to the lack of extrinsic reinforcement, further impairing intrinsic motivation (Christopoulos & Sprangers, 2021). Motivation plays a key role in students' learning achievement so teachers use it as a factor to help students learn better. (Li & Keller, 2018) in this sense it is necessary to identify how to motivate in order to have resources, strategies, teaching materials and procedures being in this scenario the motivational design model ARCS who gives importance to attention, relevance, confidence and satisfaction (Keller, 1987) promoting the continuous desire to learn, a need that has increased due to the current situation. (Herianto & Wilujeng, 2021). This context poses challenges to teachers as it has caused them to play roles such as designing and managing information to carry out a learning activity, being the management of games a catalyst for learning. (Romero Rodrigo & López Marí, 2021)The management of games is a catalyst to increase student motivation. (Asiri, 2019).

Recent research indicates that the use of gamification in the classroom has allowed to increase motivation, raise the participation process, provide emotional security and feedback (Bahauddin & Setyaningrum, 2019; de Soto García, 2018; Hanafiah et al., 2019; Jedel & Palmquist, 2021; Kasinathan et al., 2018; Romero Rodrigo & López Marí, 2021) as well as favoring cooperation and learning achievement. (Alajaji & Alshwiah, 2021; Colomo-Magaña et al., 2020; de Soto García, 2018; Gómez-Carrasco et al., 2019; Hanafiah et al., 2019; Malkawi et al., 2021; Romero Rodrigo & López Marí, 2021; Salvador-García, 2021; Sánchez-Mena & Martí-Parreño, 2017). In this scenario, several studies have considered the use of gamification tools such as quizizz, kahoot, and socrative for their simple language and dynamic interface. Studies such as Quispe Maraza et al. (2019), Lestari (2019), Basuki & Hidayati (2019) y Mendoza Batista (2020) concluded that quizizz and kahoot are attractive and motivate learning achievement; Quizziz being more effective than Kahoot; however, Orhan Göksün & Gürsoy (2019) showed that there was no significant difference between the application of these two tools and the conventional method of instruction on academic achievement. On the other hand, Fuertes et al. (2016) y Vallet - Bellmunt et al. (2019) found that the use of Kahoot and Socrative is positively valued and also improves attendance and academic performance. On the other hand

Sainz de Abajo et al. (2019) evaluated the perception of students of the mentioned tools and google forms finding a score in a very similar way, so it could not decide which one is more convenient. These results are due to the temporal situation in which the research was conducted since several authors have pointed out that Quizizz provides a space of activity to answer questions at the student's pace, while kahoot requires a screen and projector for its use generating distraction, however, this feature changed in times of pandemic COVID-19 allowing the three tools mentioned to create asynchronous activities in addition to synchronous.

On the contrary, studies by Mee Mee et al. (2020), Yasar et al. (2020), Aras and Ciftci (2021) and Villarroel et al. (2021) pointed out that gamification is not significantly related to improve motivation, because its use could increase anxiety and jealousy among students, besides teachers are just using some digital tools in a forced way due to the context of the COVID-19 pandemic.

On the other hand, studies related to the ARCS motivational design such as those of Turel & Ozer Sanal (2018) determine that the use of a digital learning material based on Keller's model helps to improve academic performance and motivation level showing a significant difference in the experimental and control group of 1100.487, $p < .01$; on the other hand Khan et al. (2019) showed the increase of students' learning motivation after using augmented reality mobile application also determined that attention, confidence and satisfaction increased based on the percentage differences while the relevance factor decreased, coinciding with the positive result of using ARCS motivational model, on the other hand Hsu (2020) showed in his quasi-experimental study that learning motivation through virtual reality improved by 7.30 in all aspects where it increased 0.25 in "Attention", 0.16 in "Relevance", 0.16 in "Confidence" and 0.34 in "Satisfaction". On the other hand Herianto & Wilujeng (2021) indicates that the use of interactive multimedia learning can significantly improve students' learning motivation, particularly attention which increased by 10.83%, confidence with an increase of 13.60%, and satisfaction with an increase of 9.54%; however, the relevance aspect of students' learning motivation did not increase significantly as it only increased by 1.45%.

As it can be evidenced there is controversy about the use of gamification tools, resources and didactic materials as well as different perspectives and results about their effect on motivation, although there are recent studies, the context of the pandemic has generated

updates in several applications and virtual tools even in the mentioned gamification tools; as teachers we face several challenges in the context of crisis, therefore the present study aims to evaluate the effect of the application of gamification tools on students' motivation, in order to discover if technological innovations have a significant impact on fostering motivation as well as their relationship with students' attention, relevance, confidence and satisfaction to encourage their widespread use by teachers in virtual education.

GAMIFICATION

The main objective of gamification is to influence behavior as it produces and creates experiences that generate feelings of mastery and autonomy in students resulting in a considerable change in behavior (Sánchez i Peris, 2015) because it is a learning technique that transfers the mechanics of games to the educational environment in order to achieve better results by increasing motivation with the use of incentives, gains, points and challenges (Díaz Cruzado & Troyano Rodríguez, 2013).

Gamification considers the student as one of the most important actors in the learning process since it is he who has to choose between learning routes and compete with each other to reach higher levels depending on his motivation which could be intrinsic or extrinsic (Dichev et al., 2020) so it is the teacher's responsibility to encourage a higher level of participation in the learning process (Sánchez-Pacheco et al., 2020) and to use gamification to dynamize learning sessions (Villalustre Martínez & Del Moral Pérez, 2015) by psychologically predisposing the student to participate in the problem-solving oriented game that involves overcoming obstacles and using corrective feedback by the teacher.

The gamification tools used in the research are of online characteristics and allow the creation of synchronous and asynchronous activities so they respond to the learning needs in times of Covid-19 pandemic.

KAHOOT TOOL

It is a system of answers with which you can create online questionnaires, it seeks an active pedagogy by the student who becomes the protagonist of their learning (Prieto et al., 2014). In order to use this tool it is necessary to enter the following internet address <https://kahoot.com>, where the teacher registers as administrator to create the resources and design the activity with a code that will be used by students through the internet

address <https://kahoot.it> (UNID, 2017) allowing their involvement in learning from the game (motivation) and fix in memory contents through a playful experience.

QUIZIZZ TOOL

It is an online tool that allows online quizzes with playful elements generating student participation, it can be used for feedbacks, evaluations through quizzes, increasing the motivation and participation of students. In order to use this tool, it is required to enter the following address <https://quizizz.com> where the teacher registers as an administrator for access to the different functions and design an activity that generates a code to be used by students at the following internet address <https://quizizz.com/join> (Trejo González, 2019).

SOCRATIVE TOOL

It is an online tool that allows to dynamize competitions of multiple choice, true/false and short answer questions (Mayoral et al., 2019).

To enter the tool is accessed through the address <https://www.socrative.com> where the teacher registers to create the questionnaire and then create a code or PIN that is provided to the students to join the room through the address <https://b.socrative.com/login/student/>

ARCS MOTIVATIONAL DESIGN

Motivation plays a key role in students' learning achievement so teachers use it as a factor to help them learn better (Li & Keller, 2018) in this sense it is necessary to identify how to motivate in order to have resources, strategies, didactic materials and procedures being in this scenario the ARCS motivational design model who gives importance to attention, relevance, confidence and satisfaction (Keller, 1987) promoting the continuous desire to learn.

The ARCS model of motivation is based solely on the design of teaching based on four factors which are attention, relevance, confidence and satisfaction.

- **Attention:** It is linked to stimulation and seeks to maintain the curiosity and interest of students, it can be activated with perception or inquiry (Keller, 1987) so teachers should use different materials and teaching environments that involves attracting attention, so the sources of information, materials and tools should be striking, unexpected, surprising, attractive and pleasing to the eye of the students.

- **Relevance:** It is linked to the personal learning needs, motivation and beliefs that students have about the learning experience (Keller, 1987). The learner needs to link the purpose of learning with their needs, as well as perceive the resources, materials and sources of information necessary to understand various problematic and important to achieve success in a learning activity, another aspect linked to the recognition of relevance is the use and meaning of what has been learned (Turel & Ozer Sanal, 2018).
- **Confidence:** This is linked to students' expectations of achievement and success that drive a continued desire to learn by feeling satisfied with the outcomes of a learning experience (Herianto & Wilujeng, 2021). Learners must understand and have the impression that they will achieve the purpose of a learning activity by understanding the sources of information, materials, and tools they use, which will build their confidence to achieve the development of evidence.
- **Satisfaction:** It is linked to the state of well-being achieved by the student when receiving rewards in the development of a learning activity, which generates a sense of achievement and enjoyment that is related to feedback and the opportunity to use what they have learned in various environments (Khan et al., 2019).

METHODOLOGY

The research used the quantitative experimental design approach at the pre-experimental research level to achieve the objectives of evaluating the effect of the application of gamification tools on student motivation, as well as to determine whether the level of motivation in the dimensions attention, relevance, confidence and satisfaction is influenced by the use of gamification tools.

This research was developed in a population of 457 students in the fourth grade of secondary education of public educational institutions of regular school day (JER) of the Alto Selva Alegre district of the Arequipa region in Peru, and a probabilistic sample of 209 students. The experiment took place during the 2021 school year in the learning experience N°8 proposed by Aprendo en Casa, which is a distance education strategy that proposes learning experiences aligned to the Peruvian national curriculum in times of pandemic. (MINEDU, 2021) It lasted one month and consisted of 8 virtual learning sessions where they interacted with gamification tools.

To execute the intervention based on the use of gamification tools kahoot, quizizz and socrative, permission to conduct the research was requested from the principals of the educational institutions involved, then proceeded to distribute the google forms links on the questionnaires for students was also distributed in Word and PDF format. The researchers collected the pre-test and post-test data to analyze the effect on motivation. For the instrument used, an adaptation of the standardized questionnaire of the Keller (2010) For the instrument used, an adaptation of the standardized ARCS model questionnaire was made, based on the ARCS model approach, consisting of 36 questions with a five-point likert scale. Cronbach's alpha 0.971 was used to measure the reliability of the instrument, as well as the review by experts from the main local universities.

RESULTS

The normality tests show that the analyzed results of the motivation variable in its pre-test and post-test level, as well as its analyzed dimensions of confidence, attention, satisfaction, relevance; show values lower than the significance ($p < 0.05$) showing that the distribution of the data are normal and parametric.

Table 1. Normality tests

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistician	gl	Sig.	Statistician	gl	Sig.
Pre-test confidence	,107		,000	,974		,001
Attention pre-test	,083		,001	,978		,002
Pre-test satisfaction	,108		,000	,950		,000
Pre-test relevance	,075		,006	,971	209	,000
Pre-test motivation	,049		,002	,982		,001
Post-test confidence	,169		,000	,890		,000
Attention post test	,144		,000	,896	209	,000
Post-test satisfaction	,175		,000	,830		,000
Post-test relevance	,163	209	,000	,875		,000
Post-test motivation	,129		,000	,868		,000

The hypothesis testing shows that the results found in the analysis according to the Student's t-statistic show that the motivation variable presents differences in its pre-test

stage as well as in its post-test level, implying that there are differences between the beginning and the end of the variable and according to the Student's t-statistic show a positive evolution since the value found is 13.1999 which is a value greater than the limit parameter (1.645) and with this it is proved that there are evolutionary differences between the two stages. $H_0 = p > 0.05$, p-value found = 0.00 > 0.05, the null hypothesis is rejected and it is demonstrated that there is an improvement in the motivation of the students. $H_1 = p < 0.05$, p-value found = 0.00 < 0.05, the alternative hypothesis is accepted and it is shown that there is an improvement in student motivation.

Table 2. Paired Samples Test

Paired samples test								
	Matched Differences					t	gl	Sig. (bilateral)
	Media	Deviation Deviation	Avg. error	95% confidence interval of the difference				
				Lower	Top			
Pre-test motivation - post-test motivation	38,03828	39,28102	2,71712	32,68164	43,39491	13,999	208	,000

Table 3. Hypothesis testing

Degrees of freedom	0.25	0.1	0.05	0.025	0.01
	1,063	1,323	1.6924	2,080	2,518
208	1,061	1,321	1.6451	2,074	2,518
	1,060	1,319	1.6696	2,069	2,518

Regarding the comparison of the results of the pre-test and post-test of the motivation variable, a substantial change was found when using the gamification tools (kahoot, quizz and socrative), because when applying the pretest 44% of the students had a low level of motivation, while 37.8% were at a regular level and only 18.2% stated a high motivational level. With the application of gamification tools, motivation was considerably transformed since 69.2% reported a high motivational level, while 16.7% reported a regular level and 13.9% a low level of motivation, so that the use of Quizziz, Kahoot and socrative is totally effective for students to achieve a higher level of motivation.

Regarding the comparison of the results of the pre-test and post-test of the motivation variable by ARCS dimensions, significant changes were found after using the gamification tools, the four dimensions confidence, attention, satisfaction and relevance achieved a good development being at the high level which shows the positive and effective impact of gamification tools (quizizz, kahoot and socrative) in motivation, being the dimensions satisfaction and relevance the ones with the highest level of development 79.4% at the high level consolidating the pleasure of learning, while the dimensions of attention and confidence achieve 73.7% at the high level.

DISCUSSION

Regarding the hypothesis testing, the results found in the analysis according to the Student's t-statistic show that the motivation variable presented differences in its pre-test stage as well as in its post-test level, showing a positive evolution with a value of 13.1999. As for the objective of evaluating the effect of the application of gamification tools in the motivation of students, the results concerning the comparison showed that the motivation was transformed considerably because of the 209 students surveyed 69.2% reported a high motivational level, 16.7% indicated a regular level and 13.9% a low level of motivation so that the gamification tools are totally effective in motivation. As for the objective of determining whether the level of motivation in the dimensions attention, relevance, confidence and satisfaction is influenced by the use of gamification tools, the result was a substantial change in the four dimensions confidence, attention, satisfaction and relevance which developed a high level evidencing the positive impact of gamification tools (quizizz, kahoot and socrative) in motivation, being the dimensions satisfaction and relevance those that achieved the highest level of development, 79.4% at the high level.

The aforementioned in the previous paragraph is corroborated by the study de Soto García (2018) who in his pre-experimental research done in Spain pointed out that gamification tools create a fun environment in classrooms fostering motivation, also concluded that students prefer the use of gamification tools with computer support as they consider that their learning is greater with them, similarly Kasinathan et al. (2018) in his research in Malaysia concluded that gamification is a new approach in education to motivate students to learn while playing; we agree with both studies because the playful environment of gamification tools used in the research were characterized by developing

virtually with synchronous or asynchronous activities meeting the need of the context of Covid-19 so the positive result of 69.2% of students in a high motivational level encourages us as teachers to promote their use in educational environments. Also Bahauddin & Setyaningrum (2019) in his qualitative study with teachers in Indonesia determined that students need learning media close to the technology that provide learning pleasure so it can be used as an alternative solution, in that framework the pre-experimental study we conducted allowed us to show that the autonomy and motivation of the student was influenced extrinsically and intrinsically by gamification tools allowing the dynamization of learning sessions. Likewise Hanafiah et al. (2019) in his study conducted in Malaysia found that gamification as an educational tool allows students to perform learning tasks to acquire mastery at their own pace accompanied by fun and enjoyment, similarly the results of this research coincide with the studies of Quispe Maraza et al. (2019), Lestari (2019), Basuki & Hidayati (2019), Mendoza Batista (2020) who concluded that gamification tools are attractive and motivate the achievement of learning, the positive effects mentioned are related to the results in the dimensions of motivation ARCS where satisfaction and relevance achieved 79.4% at the high level, while the dimensions of attention and confidence achieved 73.7% at the high level. On the other hand Sainz de Abajo et al. (2019) in its comparative analysis carried out in Spain pointed out that the game is a social process that improves motivation and promotes learning, being the incentives that improve motivation, participation, high acceptance and satisfaction among students. In the case of the study presented, the positive and effective impact on motivation is evidenced because the tools used such as kahoot, quizizz and socrative allow the student to participate in the game oriented to problem solving that involves overcoming obstacles and using corrective feedback from the teacher, thus involving the motivational design ARCS of Keller.

On the other hand the inquiry of Mee Mee et al. (2020) quantitative study conducted in Malaysia and those of Yaşar et al. (2020) found frequent problems such as increased anxiety and setbacks in those who failed to receive rewards, as supported by their quasi-experimental study Aras & Çiftçi (2021) in their quasi-experiental study in Turkey who used the Instructional Materials Motivation Scale (IMMS) developed by Keller to measure students' motivation in relation to the materials used in teaching, they found a mean IMMS score of 126.28 ± 16.88 so they determined that there was no statistically

significant difference between the groups where conventional instruction and gamified instruction was used furthermore they found in all the sub-dimensions ($p > 0.05$) determining that there was no statistically significant relationship; in this picture Villarroel et al. (2021) in a correlational study with students in Peru found that the results indicated that there was a very low, significant relationship of 0.025 ($p \text{ value} = 0.0694 > 0.05$) so I conclude that gamification is not significantly related to improving student motivation. A factor for the mentioned results is that the teachers were just using some digital tools in a forced way by the context of the COVID-19 pandemic, although these positions have their support in the mentioned studies, the results of this study allow to support that the update of the gamification tools, as well as the context can influence the development of the motivation of the students because after carrying out the intervention the motivation was transformed considerably achieving a 69.2% in the high motivational level, also the satisfaction dimension achieved 79.4% in the high level and the confidence dimension achieved 73.7% in the high level.

Continuing the inquiry regarding the motivational design ARCS, Turel & Ozer Sanal (2018) in their mixed design study done in Turkey found a significant difference in the level of motivation of 1100.487, $p < .01$, in this regard Khan et al. (2019) In his research in South Africa, he determined that after using an augmented reality mobile application, the ARCS learning motivation of the students increased. Coinciding in turn Hsu (2020) who in his quasi-experimental study with students from Taiwan evidenced the impact of virtual reality on ARCS motivation finding an increase of 0.25 in Attention, 0.16 in Relevance, 0.16 in Confidence and 0.34 in Satisfaction in this aspect agree with Herianto & Wilujeng (2021) who with their study in Indonesia with the use of interactive multimedia were able to significantly improve students' learning motivation, particularly attention with an increase of 10.83%, confidence with an increase of 13.60%, and satisfaction with an increase of 9.54%; however, the relevance aspect of students' learning motivation did not increase significantly as it only increased by 1.45%. All these results support the effects found in this study as the use of gamification tools significantly influenced ARCS motivation.

Overall, the research is consistent with previous studies that showed a positive impact on students' learning motivation as the results show that the use of gamification tools such as kahoot, quizizz and socrative significantly influence motivation as well as the different

dimensions of the motivational design ARCS attention, relevance, confidence and satisfaction.

A limitation of this study is that because it was pre-experimental it did not have a control group. The results of this research study are vital for further investigation of factors that may influence ARCS motivation.

CONCLUSIONS

In the study conducted to evaluate the effect of the application of gamification tools in the motivation of students, the comparison of the results of the pre-test and post-test of the motivation variable was executed obtaining 69.2% in high motivational level, while 16.7% indicated a regular level and 13.9% a low level of motivation so that the gamification tools are totally effective to achieve a higher level of motivation.

With regard to the objective of determining whether the level of motivation in the dimensions attention, relevance, confidence and satisfaction is influenced by the use of gamification tools, it was found in the comparison of the results of the pre-test and post-test of the variable motivation by ARCS dimensions a substantial change that is obtained after using the gamification tools, the four dimensions confidence, attention, satisfaction and relevance achieve a good development in the high level being the dimensions satisfaction and relevance those with the highest level of development 79.4% in the high level evidencing in terms of satisfaction that the gamification tools allowed students to have a sense of achievement when successfully completing a gamified activity generating that they enjoy learning in addition to feeling rewarded by the form of feedback, while in relation to the relevance students found a sense in the development of gamified activities and learning activities as they were related to the purposes also the sources of information were related to the subject matter addressed aimed at meaningful learning linked to success in gamified activities.

Finally, we propose the development of future studies with an experimental design, quasi-experimental level that will provide the scientific knowledge necessary to analyze whether pedagogical innovation mediated by gamification tools influences motivational models, one of which is the ARCS model.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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