

# The Implications on Innovative Gamification Approach: Station Rotation Gamification (SRG) to Increase Student's Motivation

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**Abstract:** Engaging student in learning is a very challenging process. This problem will lead to reducing in students' interest and motivation in learning. According to Yang and Newman (2019), station rotational gamification aims to boost students' motivation, engagement, and academic success. Station Rotational is a component of blended learning, which combines in-person and online instruction. As a proposed solution to this issue, gamification will be incorporated into rotational blended learning using different stations in this study. This will allow students to learn transferrable abilities and then use them at stations that are optimised for the particular talent. Although gamification has been the subject of prior studies, relatively few have offered it in blended learning and e-learning in higher education in an organised fashion. As a result, the implementation of Station Rotation Gamification in collaborative environments will provide an alternative solution to the engagement issue both inside and outside of the classroom. The suggested approach that was applied in this study is a quasi-experimental to gauge how motivated students are when employing Station Rotation Gamification in a group setting. Following a structured interview with the researcher, 33 motivating questionnaires will be given to the students to complete. The use of Talentlms.com was made to evaluate the validity of gamification in education. The next step is to calculate the means for each construct for the three phases of pre-intervention, interim intervention, and post-intervention. Throughout contrast, Perceived Competence and Perceived Choice show an increase from pre-intervention to interim intervention but both constructs decline during post-intervention. These 2 constructs, effort and value, are gradually increasing throughout these 3 stages. The suggested approach works better at boosting pupils' motivation. This study's key contribution is to normalise the contrast variation and remove lighting variation. Conclusion: Using the suggested strategy effectively and efficiently resulted in an increase in the motivation of the students.

**Keywords:** gamification, blended learning, motivation, game-based learning, station rotation

## 1. Introduction

The traditional teaching method, which is exam-focused, instructor-centered, and lacks flexibility, is still being used by teachers in Malaysia (Chuzairy, 2013). Additionally, it was found that instructors were taking a boring and uninteresting approach. Increased student tiredness is a result of one-way communication courses' frequent use of slides. Students feel left out in class as a result, and they are less likely to participate. It is important for

students to participate and engage in class; otherwise, their lack of drive will cause them to lose focus on their academics. An earlier study found that instructors' teaching strategies don't always take all students' learning preferences into account (Gomes & Mendes, 2007).

Depending on a student's desired learning style, the learning environment does not change to fit a particular learning scenario. The characteristics of the students are not considered by many instructional materials and tactics, which use the same framework for all tasks. As a result, they are reluctant to participate in the educational activity, which interferes with their ability to learn (Sleeman, 1986). To increase student participation, the instructor must adopt a novel teaching approach. In Malaysia, the majority of instructors use digital technologies extensively. Our contemporary technical breakthroughs have produced a continually evolving digital culture. According to (Longmore, Grant, & Golnaraghi, 2018), the labour market needs flexible, creative people who can continually reinvent themselves and participate actively in their own lifelong learning. Recently, gamification has been included into an instructor's teaching technique based on past research. Gamification is defined as the use of game elements in the different situation other than game itself (Deterding, n.d.). The use of gamification in Information Technology is able to facilitate voluntary continuous practicing (Dicheva, Irwin, Dichev, & Talasila, 2015). It can increase student motivation and engagement during their learning activities. Gamification allows students to assess their efficiency and promote non-compulsory persistent practicing, thus improving student engagement and motivation in class activities. By improving the personal limits of the student (through constant feedback, mini challenges and positive increase), students are believed to be able to achieve better engagement (Sinha, 2012). Despite these benefits, some prior academics, however, have questioned whether gamification is beneficial in enhancing student achievement, engagement and motivation. Students' investment in a PC-assisted synergistic learning environment during the educating and learning process can also serve as a benchmark for the level of collaboration and association among students during the learning process (Fischer & Dillenbourg, 2007). Therefore, academics had suggested an improvised kind of gamification to address the issue of low motivation, engagement, and achievement. However, in this article researcher's focus are only in the domain of motivation.

### Literature Review

According to previous researchers, low self-efficacy students are found to be less involved in class activity (Ohno, Yamasaki, & Tokiwa, 2013). An experimental study conducted on 205 educational science students by (Sailer & Sailer, 2021) supported this finding. The study infused game elements such as team leaderboards and points into in-class gamified activities, while non-gamified in-class activities involved exercises. By showing that gamification has a favorable impact on application-based knowledge that is influenced by learning process performance, the findings lend support to the idea of gamified learning. Additionally, the results demonstrate how intrinsic motivation and social connectedness are enhanced by gamified in-class activities. However, a self-determination theory claims that there is no discernible impact on the satisfaction of competence needs. In their research, (Nousiainen et al., 2021) examined game aspects and game elements. The study's objectives were to investigate participant opinions on the inclusion of game elements and to look at the group's user demographics. This was done to see if user types might be used to create gamification solutions for people who are training to be teachers. Each of the three key game elements was seen to have somewhat increased the students' motivation, therefore the results of the individual game parts were consistent with the overall preference (Nousiainen et al., 2021). In other studies, the use of gamified digital tools is preferred by 81.03% of students, and this practice has been shown to increase motivation to learn a second language by 82.76% (Harvey Arce & Cuadros Valdivia, 2020). Contrary to Zaric's assertion, Lukarov & Schroeder (2020) discovered that while gamification has an effect on student engagement, this effect does not apply to all students equally. According to the findings, gamification elements like badges, leaderboards, and experience points were beneficial to students with reflective, global, visual, and intuitive learning styles but detrimental to those with sensory learning types. A combined research strategy based on quantitative and qualitative methodologies was used to attain the goals. It is evident in finding that students who play apart in a gamified formative activity achieved higher mark on the aspect of commitment, activation, teamwork and motivation, whereby it is proven that there is no negative effect detected in gamification when compared to traditional methods (López-Belmonte, Segura-Robles, Fuentes-

Cabrera, & Parra-González, 2020). Similar findings were found by Alshammari (2020) and the ones mentioned above. This study uses a controlled experiment with 58 elementary school children taking an Arabic language course to look into the learning impact of gamification. The results demonstrate that gamification enhances students' motivation to learn and learning outcomes. In contrast, Buchem, Vorwerg, Stamm, Hildebrand, and Bialek's study from 2021 focuses on the effects of gamification integration on academic achievement standards, student satisfaction, and the development of skills necessary for the digital society of the 21st-century workplace. The study's findings, which are statistically significant, show that creating innovative and successful game-based experiences that encourage students to create value in active learning environments, does not have a negative influence on academic achievement. These opportunities also assist students in developing a variety of abilities necessary for success in the twenty-first century. This is in line with a study by Duggal, Gupta, and Singh (2021), whose main goal was to address the problem of student withdrawal through the creation and application of a gamified framework that improved student engagement, motivation, and enticement among a group of 120 higher education students. The findings show that students who utilised the suggested intelligent gamified system demonstrated better levels of participation compared to the control group, indicating the model's success (Duggal, Gupta, & Singh, 2021). The findings of a recent study suggest that incorporating gamified activities during the face-to-face phase of flipped learning can increase motivation, instructor-student interaction, and student-student interaction. In recent years, there has been a growing body of literature on enhancing gamification by combining Collaborative Learning, Problem Based Learning, and Blended Learning. This trend is reflected in a study conducted by (Ropero-Padilla et al., 2021).

### Research Gap

In conclusion, based on the review, the approach of using technology especially in gamification should be improvised so that it becomes more structured and organized. There is large volume of published studies explaining the successful of gamification in education. However, researchers have found several gaps while integrating gamification in learning. There is a crucial need of improvising gamification due to several negative implications in previous studies. In addition, it was clear that the efficacy of gamification was lacking due to tactical weaknesses in the nature of the analysis (Sailer, Hense, Mayr, & Mandl, 2017). Previous studies often either utilized a class intervention without conducting a pre-test, or conducted a two-class comparison study that did not involve comparing students from the same course (Çakıroğlu, Başbüyük, Güler, Atabay, & Yılmaz Memiş, 2017). Based on the review, most of the researchers do not have a structured design of gamification. The investigations performed by infusing minimal activity related to gamification which means that the games have been used as part of the lesson and not integrating the whole and structures gamifications. On the other hand, from the point of view of students, unstructured lesson of gamifications will lead them to loss not knowing which one is relevant to syllabus and which one is not. Hence, in this paper the main contribution is to improvise the framework of Gamification by introducing Station Rotation Gamification (SRG). This framework has been designed by infusing structured and systematic gamification design elements that has been combined with blended learning. Moreover, the need to produce structured guideline on teaching Information Technology in innovative way seems to be very important and compulsory. The initiative of providing platform of gamification for learning Information Technology is significant and will be a proper guidance to instructor and also student in learning Information Technology in a creative way. Therefore, the reason for this investigation is to give a learning environment that emphasizes on interaction and combined with blended learning approaches through gamification learning environments. Station Rotational is intended to increase students' engagement and also increase student's achievement in learning (Yang & Newman, 2019). Station Rotational is part of blended learning that integrate face to face and online learning. As a proposed solution to this challenge, gamification will be included into rotational blended learning with numerous stations in the framework; it allows students to learn transferrable skills and then apply them at stations that are optimised for the individual talent. The SRG is based on gamification that has been improved in the context of structure and method. The proposed method allowing the environment of study to be infused with gamification in systematic way which is in Blended learning environment. The quasi-experimental method is used to test the effectiveness of the SRG in the aspect of engagement, motivation and achievement. The outline of this work follows; section II explains the literature

review, the proposed method was explained in section III, the resulting performance listed in section IV, the discussion of the finding study was explained in section V and finally section VI elaborated the conclusion of this work. We compare the outcome from Control group and experimental group. Finally, section V presents the conclusion.

## 2. Methodology

**Blended Learning:** A learning strategy known as blended learning integrates many instructional modalities, including live e-learning, self-paced learning, and in-person classroom experiences. It makes use of a number of different teaching strategies, including as conventional instructor-led training, synchronous online conferencing or training, asynchronous self-paced study, and structured on-the-job training from an expert employee or mentor. This definition is consistent with that offered by Singh, 2021. Online learning and traditional classroom instruction are both included in blended learning. The exercises could include group projects, independent study, or even teacher-led teaching. Other definitions place more emphasis on blending traditional in-person instruction with online instruction using a variety of delivery strategies. These definitions correspond to those offered in numerous research, including references. (Garrison & Kanuka, 2004; Driscoll, 2002; Bonk, 2006; Akkoyunlu & Yilmaz-Soylu, 2008). Depending on the programme or course, the precise proportion of online and offline components may vary, but the objective is to offer a more flexible and personalised learning experience that may satisfy the demands of various learner types. Online tools and resources can be used in a blended learning setting to improve the in-person learning experience, give students and teachers access to more learning resources, and encourage communication and teamwork. The Station Rotation is one of the popular models of Blended Learning where students rotate through all the learning modalities. In this model, students rotate on a fixed schedule between different stations, either online or face-to-face with the instructor. This model is more commonly used in primary schools, with 80% of primary schools in California adopting blended learning using the rotation model, as they are already structured to have students move between stations (Watson et al., 2015).

### Gamification

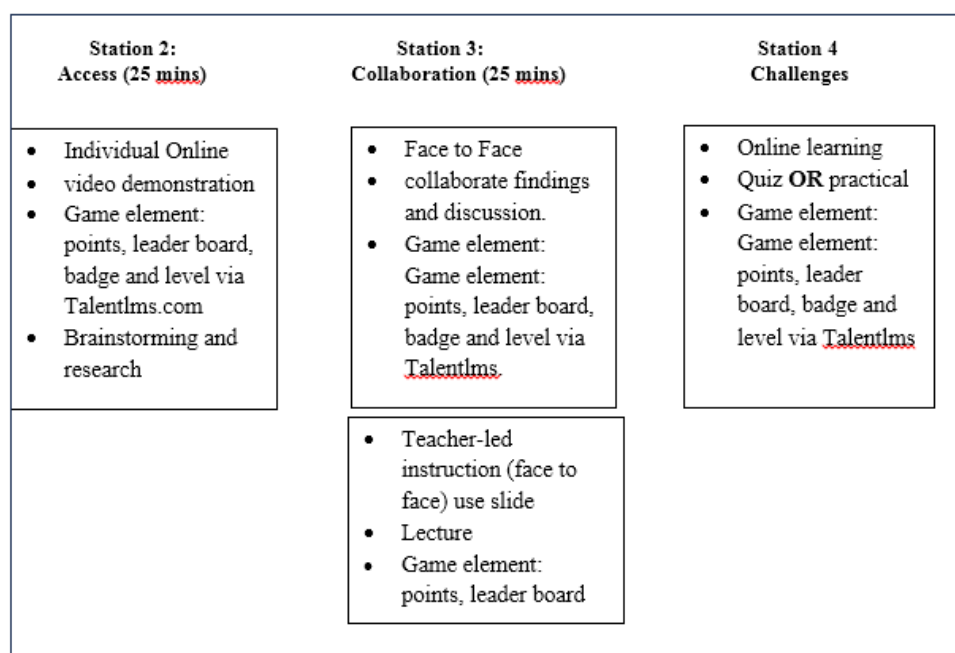
Gamification is considered as one of innovative education trends (Rincon-flores, Gallardo, María, & Fuente, 2018). Gamification gain popularity recently and the strategy have been integrated into learning to make class more enjoyable. The fundamental reason for gamification is to draw in and persuade students (Tsai, Huang, Hou, Hsu, & Chiou, 2016) into learning by adapting gaming elements into non-game context. According to Lee & Hammer(2011) gamification allow user to experiment with rules, emotion and social roles. Furthermore, various skills can be developed such as creativity, collaboration and self-regulated learning (Caponetto, Earp, & Ott, 2014). The rising popularity of gamification is due to the capability to support user's engagement through playful experiences. Seaborn & Fels (2015) in their research stress that gamification is expeditiously increasing in many areas such as in Information technology, education, business and health. Gamification is the emerging trend that generate playful experience to reinforce the user's engagement (Huotari & Hamari, 2012). Several studies conducted by researchers has produced positive result on user engagement (Hamari, Koivisto, & Sarsa, 2014), however the effectiveness is sometimes contradicted, but usually mixed and varies among individuals (Seaborn & Fels, 2015; Hamari et al., 2014)). This can be suggested that different people are motivated differently by taking account different values, personalities, motivations and needs (Codish & Ravid, 2014; Mcadams, 1995; Klock, Gasparini, Pimenta, & De Oliveira, 2015). Existing investigations additionally recommend that taking care of the issues of the decrease of commitment after some time and the loss of enthusiasm for challenges which are seen excessively basic, saw in standard gamification ideas, require versatile methodologies that can progressively reconnect users (Thiebes, Lins, & Basten, 2014; Böckle, Novak, & Bick, 2017). By integrating gamification into station rotation blended learning, it is hope that the decrease of commitment and loss of enthusiasm for challenges can solve or at least reduce because blended learning allow students to improve via different type of learning activities, applying divergent learning styles and approaches, thus promoting versatile methodologies.

### Station Rotation Gamification

Talentlms.com was used and the materials of the subject Information Technology was design at Kolej MARA Banting to be used in Station Rotation Gamification. There are two groups with different pedagogy, experimental group used Talentlms.com for the gamified learning with blended-collaborative environment whereby control group used traditional technological learning such as using slide to lecture and forming group for discussion. Both groups used the standardized allocation of period for the subject with the same instructors conducted both control and experimental groups. The period lasted for 3 weeks. The pilot study was carried out to identify the reliability of the Talent.lms, the flow in the process of SRG and the questionnaires. For control group they used non-gamified learning module which is mass lecture, individual and group activities via Google Classroom. Station Rotation Gamification Model is the combinations of Station Rotation Model in gamification which comprises four stations which are Station 1 Goal, Station 2 Access, Station 3 Collaboration and Station 4 Challenges.

The process involved in SRG as per described below:

#### Station 1: Goal (25 mins)



**Figure 1: Activities in Station Rotation Gamification**

The stations concept has the advantage of allowing students in groups to rotate through a range of learning activities. Students can proceed via a variety of activities by rotating stations, which cater to various learning styles and techniques. Students will rotate through stations and participate in learning activities that provide enough chances for consultation and cooperation with instructors, tutors, and peers. This can include interactions with digital gadgets, face-to-face dialogues, or tangible items or instruments. For some of the station's gamification will be integrated as part of activities and assessment in boosting up their engagement and motivation. In Science Computer, hands on activities are very crucial. This can be done individually or in group work. Students will rotate among stations and take part in learning activities that allow them to consult and collaborate with instructors, tutors, and classmates. Interactions with digital devices, face-to-face conversations, and tactile goods or instruments are all examples of this. This also provides for a problem-solving or project development strategy based on communal thinking. Collaborative work can be done online, although it may be best done in person. That is, after all, the objective of mixed learning models: to use diverse virtual and physical places to achieve the best results.

## Participants

The sample of the participants were chosen based on purposive sampling method (Creswell, 2012). Purposive sampling, sometimes referred to as judgmental, selective, or subjective sampling, is a non-probability sampling technique where researchers choose survey participants from the broader population based on their own judgement. There were 103 students of Kolej MARA Banting registered in the Information Technology course however, only 68 students (male and female) aged 17-19 has been selected for this study. There were 2 classes of experimental with the total number of 35 students, and two classes for control groups with 33 number of students. Experimental groups implement gamified learning whereby control group used non-gamified learning. Before the implementation of pilot study, researcher has conducted preliminary need analysis based on students' experience pertaining the use ICT, game experience and subject matter. Students has been assigned with pretest for the topics of Networking and Database before start the lesson and end with the posttest after implementing the learning. Material has been prepared to be implemented in the online learning platform which is Talentlms.com. Experimental and control groups lasted for 10 weeks on the topic Networking and Database under the subject of Information Technology. The selected topics were based on preliminary study conducted earlier on the previous batch that has completed the syllabus before. For experimental groups, current instructors of the subject had brief students on the process involved in the pilot study. These are all the material needed by the instructor pertaining the pilot study.

- 1) Less  
on plan is provided by the instructor: These lesson plan has been improvised by the researcher in agreement with the instructors due to the need in infusing gamification elements.
- 2) Min  
i module created by researcher explaining how to conduct class using Station Rotation Gamification.
- 3) Acc  
ess to talentlms.com by the instructors and students. Talentlms.com is the web-based learning site with gamification features. The features include games element such points, leaderboard, level and badges.
- 4) Intri  
nsic Motivation Inventory to be distributed by the instructors before started the lesson, in the middle of teaching the relevant topic and at the end of the syllabus. The purpose of this questionnaire was to check the level of students' motivation.

For the control group's instructor started the lesson by applying normal teaching methods such as lecture, group discussion, group presentation and other activities. At the beginning of the lesson all students took pre-test related to the topic to check their prior knowledge, and post-test has been assigned too at the end of the lesson. Intrinsic Motivation Inventory has been distributed before started the lesson, in the middle and at the end of topic syllabus. The proposed Station Rotation Gamification (SRG) were evaluated in Multimedia lab with 35 units of personal computers. 35 students in one class accessed the lab according to preassign group. There were 4 main stations involved. The SRG method were design for 1-hour and 30 minutes lesson. The division of stations are as follows: Station 1 – Goal (25 minutes), Station 2– Access (25 minutes), Station 3 – Challenges (25 minutes), Station 4 -Collaboration (20 minutes). This study was approved by the Head of Units of Information Technology.

## Instruments

The implementation of the research has been started by creating the materials for Gamified and Non-gamified learning. Instructor is provided with module contained the procedure of conducting learning that is infused with Station Rotation Gamification (SRG). Inside SRG there were activities designed to be used in Talentlms.com. Talentlms.com is a platform of online learning with gamification features such as game elements. There are different types of game elements such as points, badges, levels, rewards and leaderboard. We apply all of the above game elements due to maturity level apparent in many research (Garcia, Linaza, Gutierrez, & Garcia, 2019; Paravizo et al., 2018; Koivisto & Hamari, 2019). Before starting the class, all students are required to answer pretest questions on the selected topics. Topics selected are based on need analysis that has been

conducted before. The pretest is derived from the standard semester exam paper and is aligned to the standard of the syllabus of Information Technology. There are 5 open ended questions with different level of Bloom's Taxonomy. At the end of the topic syllabus students were given post test questions with 5 open ended questions too. Finally, students answered questionnaire on Intrinsic Motivation that comprises of 5 main construct which is Effort, Interest, Perceived Competence, Perceived Choice, Pressure and Value

### 3. Result and Discussion

| Construct            | Pre-Intervention | Interim-Intervention | Post-Intervention |
|----------------------|------------------|----------------------|-------------------|
| Effort               | 3.7143           | 3.9714               | 4.0457            |
| Interest             | 3.9347           | 4.4286               | 4.2367            |
| Perceived Competence | 3.1714           | 3.8000               | 3.7000            |
| Perceived Choice     | 3.4122           | 3.8286               | 3.1918            |
| Pressure             | 2.9714           | 2.0629               | 2.0114            |
| Value                | 4.4952           | 4.6286               | 4.6381            |
| Valid N (listwise)   | 35               | 35                   | 35                |

Table 1: Mean score for all constructs for the Experimental Group during pre-intervention, interim-intervention, and post-intervention.

Based on the above table, construct Effort and Value shows increment from pre-intervention, interim-intervention, and post-intervention. The reason behind these figures has been analysed using the outcome of the student's interview. Students focus on effort more because of the element of gamification that exist in TalentLMS.com. In the interview, students feel that they have to struggle to gain more points, badges, good rankings, and certificates of completion for the course. This drives their motivation to increase their effort in finishing the task via TalentLMS.com. Meanwhile, Interest, Perceived Competence and Perceived Choice show an increment from pre-intervention to Interim Intervention however these constructs drop during post-intervention. From the interview conducted to the students of experimental group some of the arguments by the students are, to the lower end group of students (in term of ranking and points) they do not feel competence anymore when they are not in the top rank or have less points collected. Some of them feel that it impossible to be at the top three of the ranking thus giving up. Construct Perceived Choice is also slightly declining at the end of the post intervention. In this structure gamification, students were given choice of choosing which station to start with (except for station 1), students are expected that this intervention allow them to have more choices in term of selecting which tasks to be solved, however students did mention that they are happy because they have freedom of accessing TalentLMS.com at their own convenient time. Construct Pressure constantly declining from the beginning of pre-intervention, pre-intervention and post intervention. For majority of participants, playing games promote and connect them with the words "relaxing", "excitement", "healing" and "release tension". During the process of learning whenever teacher infusing gamification in learning, students feel the aura of feeling relax, thus reducing their level of pressure. For them playing game make them feel fun, enjoy and feel the excitement. However when compare to Control group, this experimental group shows far more better result and it is proven that this innovation approach Station Rotation Gamification is effective in increasing students' motivation in learning.

#### 4. Conclusion

According to the findings of this study, gamification has been shown to be a significant factor in enhancing students' motivation. The study has introduced an innovative approach aimed at structuring the implementation of gamification to make it more systematic. The main contribution of this work is the development of a structured gamification approach that enhances its effectiveness during implementation. The approach is called Station Rotation Gamification (SRG) that is based on Blended Learning. Although, there is some decrement in the motivation in the interim stage of data gathering, the mean of motivation has been increased tremendously when compared to control group. The main result of finding study was summarized in table 1. In the meantime, the proposed method is effective for to increase student's motivation. In future study, it is suggested more data to be collected for different construct to understand more on students' motivational level by using Station Rotation gamification.

#### 5. References

- [1] Akkoyunlu, B., & Yilmaz-Soylu, M. (2008). Development of a scale on learners' views on blended learning and its implementation process. *Internet and Higher Education*, 11(1), 26–32. <https://doi.org/10.1016/j.iheduc.2007.12.006>
- [2] Alshammari, M. T. (2020). Evaluation of gamification in e-learning systems for elementary school students. *TEM Journal*, 9(2), 806–813. <https://doi.org/10.18421/TEM92-51>
- [3] Böckle, M., Novak, J., & Bick, M. (2017). Association for Information Systems AIS Electronic Library (AISeL) TOWARDS ADAPTIVE GAMIFICATION: A SYNTHESIS OF CURRENT DEVELOPMENTS. Retrieved from [http://aisel.aisnet.org/ecis2017\\_rp/11](http://aisel.aisnet.org/ecis2017_rp/11)
- [4] Çakıroğlu, Ü., Başbüyük, B., Güler, M., Atabay, M., & Yılmaz Memiş, B. (2017). Gamifying an ICT course: Influences on engagement and academic performance. *Computers in Human Behavior*, 69, 98–107. <https://doi.org/10.1016/j.chb.2016.12.018>
- [5] Caponetto, I., Earp, J., & Ott, M. (2014). Gamification and Education: A Literature Review. *Computers in Human Behavior*, 3(4), 1–4. <https://doi.org/10.1006/ceps.1999.1020>
- [6] Codish, D., & Ravid, G. (2014). Academic Course Gamification: The Art of Perceived Playfulness. *Interdisciplinary Journal of E-Skills and Lifelong Learning*, 10, 131–151. <https://doi.org/10.28945/2066>
- [7] Deterding, S. (n.d.). Gamification: Designing for Motivation. 14–17.
- [8] Dicheva, D., Irwin, K., Dichev, C., & Talasila, S. (2015). A course gamification platform supporting student motivation and engagement. 2014 International Conference on Web and Open Access to Learning, ICWOAL 2014, (January). <https://doi.org/10.1109/ICWOAL.2014.7009214>
- [9] Driscoll, M. (2002). Blended learning: Let's get beyond the hype. *E-Learning*, 54. Retrieved from [http://www-07.ibm.com/services/pdf/blended\\_learning.pdf](http://www-07.ibm.com/services/pdf/blended_learning.pdf)
- [10] Duggal, K., Gupta, L. R., & Singh, P. (2021). Gamification and Machine Learning Inspired Approach for Classroom Engagement and Learning. *Mathematical Problems in Engineering*, 2021. <https://doi.org/10.1155/2021/9922775>
- [11] Garcia, A., Linaza, M. T., Gutierrez, A., & Garcia, E. (2019). Gamified mobile experiences: smart technologies for tourism destinations. *Tourism Review*, 74(1), 30–49. <https://doi.org/10.1108/TR-08-2017-0131>
- [12] Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet and Higher Education*, 7(2), 95–105. <https://doi.org/10.1016/j.iheduc.2004.02.001>
- [13] Gomes, A., & Mendes, A. J. N. (2007). Learning to program - difficulties and solutions. *ICEE - International Conference on Engineering Education*, (May), 411. <https://doi.org/10.1007/s002449900368>
- [14] Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? - A literature review of empirical studies on gamification. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 3025–3034. <https://doi.org/10.1109/HICSS.2014.377>
- [15] Harvey Arce, N. P., & Cuadros Valdivia, A. M. (2020). Adapting Competitiveness and Gamification to

- a Digital Platform for Foreign Language Learning. *International Journal of Emerging Technologies in Learning*, 15(20), 194–209. <https://doi.org/10.3991/ijet.v15i20.16135>
- [16] Huotari, K., & Hamari, J. (2012). Defining gamification - A service marketing perspective. *Proceedings of the 16th International Academic MindTrek Conference 2012: "Envisioning Future Media Environments"*, MindTrek 2012, 17–22. <https://doi.org/10.1145/2393132.2393137>
- [17] Klock, A. C. T., Gasparini, I., Pimenta, M. S., & De Oliveira, J. P. M. (2015). "Everybody is playing the game, but nobody's rules are the same": Towards adaptation of gamification based on users' characteristics. *Bulletin of the Technical Committee on Learning Technology*, 17(4), 22–25.
- [18] Koivisto, J., & Hamari, J. (2019). The rise of motivational information systems: A review of gamification research. *International Journal of Information Management*, 45(June 2017), 191–210. <https://doi.org/10.1016/j.ijinfomgt.2018.10.013>
- [19] Longmore, A. L., Grant, G., & Golnaraghi, G. (2018). Closing the 21st-Century Knowledge Gap: Reconceptualizing Teaching and Learning to Transform Business Education. *Journal of Transformative Education*, 16(3), 197–219. <https://doi.org/10.1177/1541344617738514>
- [20] López-Belmonte, J., Segura-Robles, A., Fuentes-Cabrera, A., & Parra-González, M. E. (2020). Evaluating activation and absence of negative effect: Gamification and escape rooms for learning. *International Journal of Environmental Research and Public Health*, 17(7). <https://doi.org/10.3390/ijerph17072224>
- [21] McAdams, D. P. (1995). C RIME & P UNISHMENT S URVEY The survey asks participants to read several scenarios briefly described in a few sentences . Participants are then asked to determine if a crime has been committed and , if so , to rank order those scenarios according to how. *Journal of Personality*, 63(September 1995), 3. Retrieved from <https://static1.squarespace.com/static/5abc0743710699dd7ac56a81/t/5c34ea86758d464573059751/1546971784449/McAdams%2C+1995.pdf>
- [22] Nousiainen, T., Vesisenaho, M., Ahlström, E., Peltonen, M., Fort, S., & Gómez, S. (2020). (2021). Gamifying Teacher Students' Learning Platform: Information and Communication Technology in Teacher Education courses. *Proceedings of the Eighth International Conference on Technological Ecosystems for Enhancing Multiculturality* (Pp. 688-693). ACM. <https://doi.org/10.1145/3434780.3436659>, 60(2), 420–453.
- [23] Ohno, A., Yamasaki, T., & Tokiwa, K. I. (2013). A discussion on introducing half-anonymity and gamification to improve students' motivation and engagement in classroom lectures. *2013 IEEE Region 10 Humanitarian Technology Conference, R10-HTC 2013*, 215–220. <https://doi.org/10.1109/R10-HTC.2013.6669044>
- [24] Paravizo, E., Chaim, O. C., Braatz, D., Muschard, B., Federal, U., Carlos, D. S., ... Wernke, R. (2018). ScienceDirect ScienceDirect innovation Spain and sustainability Exploring gamification to support manufacturing education on Costing models for capacity optimization between used capacity and operational efficiency. *Procedia Manufacturing*, 21, 438–445. <https://doi.org/10.1016/j.promfg.2018.02.142>
- [25] Rincon-flores, E. G., Gallardo, K., María, J., & Fuente, D. (2018). Strengthening an Educational Innovation Strategy: Processes to Improve Gamification in Calculus Course through Performance Assessment and Meta-evaluation. *Iejme – Mathematics Education*, 13(1), 1–11. <https://doi.org/10.1016/j.ijporl.2007.09.012>
- [26] Ropero-Padilla, C., Rodríguez-Arrastia, M., Martínez-Ortigosa, A., Salas-Medina, P., Folch Ayora, A., & Roman, P. (2021). A gameful blended-learning experience in nursing: A qualitative focus group study. *Nurse Education Today*, 106(August), 105109. <https://doi.org/10.1016/j.nedt.2021.105109>
- [27] Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*, 69, 371–380. <https://doi.org/10.1016/j.chb.2016.12.033>
- [28] Sailer, M., & Sailer, M. (2021). Gamification of in-class activities in flipped classroom lectures. *British Journal of Educational Technology*, 52(1). <https://doi.org/10.1111/bjet.12948>

- [29] Seaborn, K., & Fels, D. I. (2015a). Gamification in theory and action: A survey. *International Journal of Human Computer Studies*, 74, 14–31. <https://doi.org/10.1016/j.ijhcs.2014.09.006>
- [30] Seaborn, K., & Fels, D. I. (2015b). Gamification in theory and action: A survey. *International Journal of Human Computer Studies*, 74, 14–31. <https://doi.org/10.1016/j.ijhcs.2014.09.006>
- [31] Singh, H. (2021). Building Effective Blended Learning Programs. 43(6), 15–23. <https://doi.org/10.4018/978-1-7998-7607-6.ch002>
- [32] Sleeman, D. (1986). The challenges of teaching computer programming. *Communications of the ACM*, 29(9), 840–841. <https://doi.org/10.1145/6592.214913>
- [33] Thiebes, S., Lins, S., & Basten, D. (2014). Gamifying information systems – a synthesis of gamification importance of user motivation for IS success. *Twenty Second European Conference on Information Systems*, 1–17. Retrieved from <https://pdfs.semanticscholar.org/7b5d/41781a96d46acf34127258780299cafe3c66.pdf>
- [34] Tsai, M. J., Huang, L. J., Hou, H. T., Hsu, C. Y., & Chiou, G. L. (2016). Visual behavior, flow and achievement in game-based learning. In *Computers and Education* (Vol. 98). <https://doi.org/10.1016/j.compedu.2016.03.011>
- [35] Watson, J., Powell, A., Staley, P., Patrick, S., Horn, M., Fetzter, L., ... Verma, S. (2015). Teacher education and K-12 online learning. *The International Association for K–12 Online Learning*, (July), 1–20. Retrieved from <http://files.eric.ed.gov/fulltext/ED560788.pdf>
- [36] Yang, S., & Newman, R. (2019). Rotational Blended Learning in Computer System Engineering Courses. *IEEE Transactions on Education*, (January), 1. <https://doi.org/10.1109/TE.2019.2899095>