Learning Landscapes and Educational Breakout for the Development of Digital Skills of Teachers in Training.

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Abstract. The digital educational breakout, as well as gamification, has become a methodological strategy that provides a multitude of benefits. The following study is presented, incorporating a gamified practice through the educational Breakout in the university context with the purpose of verifying the perception of this methodological strategy, as well as analyzing if it is perceived as useful for teachers in training, the degree of motivation and level of satisfaction experienced in participating in the training experience through the TAM model (Technology Acceptance Model) with 968 participants, teachers in training. The results show that the proposal is suitable for university teaching, and all study subjects perceived this strategy as valuable for their training, highlighting dimensions related to ease of use in the classroom, integration, or transformation of interest in learning as the variables more significant and, in addition, the TAM and its level of acceptance are high.

Keywords: Breakout, gamification, digital competence, teacher training, active methodologies, validation.

1 Educational Digital Gamification: Breakout.

There is a clear agreement that the ambiguous and, on many occasions, erroneous use of the term gamification leads to its wrong implementation and, therefore, the development of didactic-curricular practices that manifest themselves through the achievement of unintended results [1]. For this reason, it is essential and interesting to review this concept, which is becoming so fashionable in the development of educational innovations.

Its origin can be documented in 2008, although it should be noted that it was popularized in 2010 by different digital media. Thus, in those early days, gamification was conceived as the use of different game elements applied to non-game environments with the purpose of motivating users -students- towards a certain point of interest. Thus, different authors [2, 3] consider it as an appropriate strategy to influence the behaviour or attitude of groups of people. Gamification makes its appearance in very diverse contexts and, one of the issues that most attracts the

attention of teachers and teaching professionals, is that it highlights the motivation towards the exercise of a particular action.

The Horizon Report [4] already alluded to gamification as one of its educational trends in Higher Education levels (and as it has been shown later, almost with greater boom in educational levels from kindergarten to secondary or high school), among other reasons due to the boom that mobile devices and games in portable format have reached among our students, which allows ubiquitous learning. This feature of learning increased by the Internet and its applications, make that through gamification we propose the use of game elements that act as a spiral of an activity, of a practice that has a clear final intentionality. That is to say, to establish a specific objective, which is the one to which attention must be paid in learning environments in order to be able to make proper use of gamification.

In the specific context of the educational world, there are many practices where gamification has already achieved great success, either because it has reached a high degree in its extrinsic motivation system (where rewards do their job very well to encourage the path), or because the simulated environment provided generates a sense of security to students. In the educational field, the goal of gamification lies in favoring students' learning, promoting their commitment to it and making them active participants in their learning process through playable activities that promote meaningful and lasting learning [5].

It should be noted that, although currently the technological and digital aspects prevail when carrying out these practices, it is true that gamification does not need them, since it can be put into practice from an analogical level without any problem. Among the characteristics of gamification, it is worth highlighting the voluntary nature of the interaction of the students with the gamified activities. This particular feature is part of a management mode called libertarian paternalism which aims to modify people's behavior through management processes in which they believe they are free but are subject to rules and monitoring. In this way, gamification generates competition and collaboration in unison so that users achieve certain goals or achievements set in advance [6]. On the other hand, it is important to note that another of the most significant characteristics of gamification is its use as a mechanism that enhances decision-making [7] following a playful and motivating thread and that, through the so-called game mechanics, favors the resolution of problems proposed by the person who implements gamification [8, 9]. Finally, we should not be confused when it is believed that the fact of using the game and its different elements as a teaching and learning strategy in the classroom, makes it a simple game without further ado. The gamification strategy has as a didactic objective the clear purpose of motivating to perform a certain action, develop skills or abilities and, therefore, does not have a win-lose context: it is a process through which the participant evolves, is empowered, and is offered the possibility to improve in order to achieve objectives.
Therefore, there are differences and similarities between game-based learning, gamification, and gamification alone (Table 1).

The game has been conceived, in all cultures, as a strategy that develops two fundamental areas, such as education and socialization, gamification offers a space where diversity of elements is possible, and where the educational objectives that can be developed can be part of any foundation of learning that is addressed, regardless of the educational level in which it is working.

Table 1. Differences and similarities between Gaming, Gamification and Game Based Learning.

Differences and similarities		
Game	Gamification	Game-based learning
It is free and voluntary without a specific purpose	It is not a game in itself, but it uses its dynamics	Game created or used for educational purposes
Losing or winning is part of the game	It involves a purposely created context	Achieving a learning objective
The context is implicit by the characteristic of the game.	Seeks to learn something from the action	Implies a targeted context

Speaking of gamification is referring to a methodology that uses elements of games in environments that are not playful a priori to increase the motivation of the participants. Some examples of gamification would be playful activities, reward systems, progress bars, achievements, or the feeling of 'agency' (student actions influence and have consequences). In addition, the advantages of ICT can be used to gamify the classroom.

In Game Based Learning (GBL) games are used, already created, or invented for the occasion, to learn through them. Thus, the game becomes a vehicle to strengthen concepts. This is the case, for example, of Trivial, and those designed to teach something specific, such as Risk to learn Geography. To these two options, a third could be added: create our own games to teach the content.

1.1 Benefits of Educational Breakout.

To highlight the most significant aspects of gamification, we can contemplate different research [10, 11, 12] through which the positive aspects that gamification brings to the teaching-learning process are highlighted, which can be summarized as follows: 1) tools for monitoring students according to the frequency of use and visits to places of interest in the gamified application; 2) rewards for students for their effort and interaction with the gamifying tool; 3) impartiality in the distribution of awards, as these depend exclusively on the fulfilment of goals or achievement of accomplishments; 4) evaluation possibilities different from the traditional ones that rely exclusively on the punitive; 5) classroom mechanics based on competition and cooperation; 6) automatic feedback in the interrelationships between students and student-teacher; 7) creation of a relaxed and playful classroom environment.

All this, in view of that a process will be carried out where planning takes on special relevance since it is essential that the design is structured around different phases, such as: 1) previously investigating the context of the students to design a

gamified activity with a high probability of success; 2) establishing clear learning objectives to give meaning to the implementation of the activity; 3) using game mechanics in which short and not excessively complex educational activities are proposed; 4) developing an evocative story, which captures the attention and is related to the interests of the learners; 5) clearly setting personal and collective goals; 6) designing the itineraries through which the students must circulate to achieve the proposed goals; 7) define how the activities performed by the student will be monitored and how they will receive the corresponding feedback; 8) plan the way in which the individual and collective activities will be developed; 9) specify the levels that the students must go through, taking into account that they must be of increasing difficulty; 10) determine the rewards and recognition that the students will obtain once the gamification is completed; 11) contemplate additional rewards for the individual and collective activities that increase the motivation of the students; 12) allow the students to repeat the activities.

1.2 Development of the Digital Competence of Teachers in Training.

Currently, the XXI century society is immersed in constant technological and methodological challenges, being forced to transform its educational practice. The adaptation of educational environments, according to these trends, the needs demanded by the system and the dizzying changes that have occurred, influence the way we communicate, learn and interact in the so-called information and communication society.

A hyper-technologized society, immersed in continuous and multiple changes, many of them produced by the use and implementation of digital technologies [13]. New communicational media that alphabetize practices, adding importance when interpreting the functioning of labor and recreational contexts of the knowledge community of the 21st century [14]. A new technological era, the result of accelerated changes, where information opens inscrutable paths promoted by the advances characterized using the so-called Information and Communication Technologies (ICT). The possibility of immediate access to each of the sectors that make up this cycle announces the essential ingredients that generate great added value to the economic and social development of the so-called knowledge society.

Technologizing information is the end that drives and generates new alterations in the organization of knowledge, practices and forms of organization, as well as in the molding of human cognition, without forgetting, and with it, the subject that concerns us; the field of education.

Despite this progression, the mere fact of incorporating technologies does not change learning environments. According to [15], in order to achieve this purpose, there must be leadership in the centers to increase the desire of teachers in training to use new teaching methods in relation to ICT, in order to acquire higher levels of competence in the use of ICT and generate the development of a collaborative culture that promotes the inclusion of ICT in the teaching and learning process (E-L).

This is where the term "E-Learning", established by the European Commission, becomes important. Virtual education would become one of the most powerful tools whose quality must be measured when designing training plans in this modality.

Therefore, it would be said that online education is a crucial tool for achieving

familiarization in technological contexts, achieving the increase of key competencies that allow the development and autonomy of good educational practices through virtual environments. We are talking about a type of virtual pedagogy that will encourage collaborative work, improve individualized tutoring and, in addition, will be able to include diversity in learning, improving the student's level of competence and the student's commitment.

To this end, the teachers in training must be able to develop dynamic and cooperative methodologies that focus on "learning by doing" as an infallible method to improve performance, applicability and motivation of student learning.

The importance of making use of ICT to facilitate our daily tasks, to enhance our professional development and as lifelong learning is a relevant and substantial aspect in order to perform any training program [16]. The considerable increase in this progression will mean that soon jobs will demand digital skills [17].

When we talk about including a competency model in a curriculum, we mean that learning activities should not be limited to a single subject, but that the contents, developed in it, seek to achieve the same competence that allows them to face any situation. We must be able to achieve a change of methodologies, moving from a reproductive methodology to a productive one. This is the only way to ensure that students can transfer the knowledge acquired in a problem-solving subject to different scenarios. The consolidation of competencies through productive strategies enhances, at the same time, different aspects of the teaching-learning process (E-L).

In this sense, with the main purpose of offering solutions to these alterities, new ways of interpreting educational environments are proposed, seeking a transformation that achieves a better didactic adaptation in this sector. These active methodologies make students acquire a dynamic role in their own learning, transforming rigid and memoristic conceptions.

There are several fields of application offered by gamification, the most researched being in the field of education [18], where it arises to implement it in e-learning environments, given its digital nature. This leads, that, in recent times, these gamifying practices are acquiring a relevant prominence [19].

This type of learning becomes optimal, due to the enjoyment in its realization and with it, a better acquisition of the contents [20]. It is understood that, in games, the challenges pose the need that the player possesses when it comes to exceeding his expectations, carrying this a great psychological burden, with the aim of influencing human behaviour [21].

Finally, it should be noted that, although many studies have investigated specific activities and practices that use gamification [22] not enough attention has been paid to the final result of the same, nor to the satisfaction of students or teachers in training who carry it out.

To analyse the degree of acceptance of the Breakout methodology in this study, one of the models that has acquired the greatest significance in explaining the degree of adoption that a person makes of a technology, both general and specific, is used. This model was originally called "Technology Acceptance Model" (TAM) [23]. Under its umbrella it is stated that the beliefs, attitudes or predispositions held about technologies will have an impact on the use made of it. To this end, it is determined by two variables: perceived usefulness and perceived ease of use. The TAM model proposes and empirically demonstrates that Perceived usefulness (PU) and Perceived

ease of use (PEU) are the most critical factors in the process of technology adoption and systems use [24].

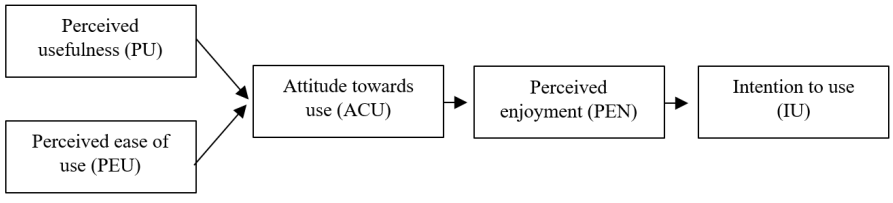

Fig. 1. Acceptance Model of Davis (1989).

The resulting model has the following dimensions according to [23]:

- Perceived usefulness (PU): the degree to which a person believes that using a particular system would enhance his/her job performance.
- Perceived ease of use (PEU): the degree to which a person believes that using a particular system would be free of effort.
- Perceived enjoyment (PEN): the degree to which the activity of using technology is perceived to be enjoyable in its own right apart from any performance consequences that may be anticipated.
- Attitude towards use (ACU): user's assessment of the desirability of using a specific information system application.
- Intention to use (IU): user's desire to use technology in the future.

Different studies have incorporated diverse transformations [25, 26, 27]. This has been done through the incorporation of new dimensions such as, for example, predictor dimensions (gender, degree of compulsory adoption of technology, experience, age, type of users...). These variables are used to predict the degree of acceptance.

The model itself emphasizes that it must be constructed for each situation of acceptance of the technologies to be investigated. For this reason, it is uniquely adapted to the presented study, contextualizing and locating in it the mediating variables considered from the researcher's point of view. In this sense, the model has evolved into other versions, such as TAM 2 [28] or the model for integrating technology acceptance and user satisfaction [29].

2 Methodology

This research presents the design of a training proposal aimed at teachers in training of Early Childhood and Primary Education. In this sense, the training process is developed and the degree of acceptance of the Breakout methodology by the students of the Degree in Early Childhood Education and the Degree in Primary Education of the University of Seville is evaluated. Therefore, the proposed objective is to study

the level of acceptance of the Breakout methodology of the trainee teachers involved in the training action: validation of the model of acceptance of the Breakout methodology (TAM) and analysis of the level of acceptance of this methodology.

This study uses two types of designs: scale validation and descriptive analysis. The first one tries to validate the acceptance scale of the Breakout methodology by adapting the TAM model. Subsequently, we proceed to provide the most significant data related to the acceptance of the Breakout methodology.

The 968 participants are students from the University of Seville, Spain. A total of 596 women and 372 men. These students are part of the University Degree in Early Childhood Education (442) and University Degree in Primary Education (526).

The University of Seville is an autonomous institution, with a social and public purpose; it teaches, carries out research with scientific-administrative freedom, and participates in the country's development plans. Specifically, this experience is carried out within the subject "Information and Communication Technologies applied to education".

In order to measure the degree of motivation, as well as the level of satisfaction experienced by the students when participating in the training experience and to be able to inquire about the technical, curricular and organizational difficulties that arise, the TAM model (Technology Acceptance Model) is administered. Its application is carried out telematically through a form created in Google Forms.

Before data analysis, it is verified that the data are not normally distributed through the study of skewness and kurtosis. The Kolmogorov-Smirnov goodness-of-fit test confirms this check, with significance (p-value) equal to .000 for all items (non-normal distribution).

To achieve the main objective, the acceptance model of the Breakout methodology (TAM-BREAK) is validated by means of reliability analysis (Cronbach's alpha and composite reliability), construct validity (AVE) and structural equation modelling (PLS). This is followed by descriptive and central tendency analyses.

The data obtained are analysed with the SPSS 27 statistical package (descriptive analysis and contrast) and SmartPLS 3 software (structural equation modelling).

3 Results

After having presented the training proposal, we proceed to study the level of acceptance of the Breakout methodology. In this case, an adaptation of the technology acceptance model (TAM) suggested by Davis (1988) is created for the Breakout methodology. For this reason, before describing the data, we proceed to validate the adaptation made.

First, the reliability and construct validity values are obtained. In the case of validity, the overall result after applying Cronbach's Alpha is 0.926. According to [30], this figure implies a high level of reliability. In conjunction, we proceed to calculate the reliability, composite reliability and construct validity indices by dimensions.

Table 2. Reliability and construct validity values by dimensions.

	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
PU	0.936	0.969	0.815
PEU	0.910	0.882	0.819
PEN	0.915	0.957	0.875
ACU	0.887	0.919	0.802
IU	0.895	0.997	0.849

As can be seen (Table 2), all the reliability results (Alpha and composite reliability) are higher than 0.7, which is the minimum adequate value according to Lévy (2006) to indicate acceptable levels. Therefore, it can be affirmed that the proposed model of acceptance of the Breakout methodology presents a good internal consistency in terms of its block of indicators. As for convergent validity, all the average variance extracted (AVE) indices are higher than 0.5. This value is taken as a reference by [31] to indicate that more than 50% of the construct variances are due to the indicators of the model. Therefore, it can be stated that the total amount of variance of the indicators is taken into consideration by the latent construct.

After this, the discriminant validity of the model is analysed to determine whether each dimension is different from the others. Two techniques are used for this purpose: the Fornell-Larcker criterion and cross-loading analysis.

The Fornell-Larcker criterion allows us to check whether the average variance extracted from a dimension is greater than the variance of the other dimensions.

Table 3. Fornell-Larcker Criterion Analysis for Checking Discriminant Validity.

	ACU	PEU	IU	PEN	PU
ACU	0.959				
PEU	0.319	0.887			
IU	0.776	0.282	0.959		
PEN	0.754	0.284	0.623	0.969	
PU	0.710	0.447	0.698	0.558	0.909

To interpret this table, it should be considered that the elements of the diagonal are the square root of the mean extracted variance, and the others are the correlations between dimensions. As can be seen, all the values to the left and below the values on the diagonal are less than the values on the diagonal. Therefore, the first criterion of discriminant validity is confirmed.

Next, an analysis of the cross-loadings of the model is performed. The results can be seen in Table 4.

Table 4. Cross Loading Model

	PU	PEU	PEN	ACU	IU
PU1	0.901				
PU2	0.801				
PU3	0.908				
PU4	0.915				
PEU1		0.811			
PEU2		0.854			
PEU3		0.929			
PEN1			0.967		
PEN2			0.918		
PEN3			0.885		
ACU1				0.996	
ACU2				0.919	
IU1					0.919
IU2					0.984

Results above 0.7 indicate high levels of correlation. Therefore, it is ensured that the items measure the construct to which they have been incorporated. After that, we proceed to present the formulated model by obtaining the standardized regression coefficients (path coefficients), the student's t-values and the R2 (R-squared) of the structural diagram. In terms of results, the model explains 72% of the variance in the "attitude towards use" dimension, 69% in the "intention to use" dimension, 39% in the "perceived enjoyment" dimension and 28% in the "perceived usefulness" dimension. All model relationships are significant at a 99% confidence level. Finally, the goodness of fit of the model is evaluated using the standardized root mean square (SRMR), Chi-square and normalized fit index (NFI). Figure 2 shows the resulting structural diagram correlation path. It shows the high correlation indices of the model (>0.7).

Table 5. Structural diagram correlation path.

	Path
ACU-PEN	0.825
PEU-ACU	0.802
PEN-IU	0.789
PU-ACU	0.785

Once the model has been validated, a description of the degree of acceptance is made. Table 6 shows the values obtained, as well as the reference values according to [32].

Table 6. Descriptive statistics of the level of acceptance of the Breakout methodology.

Item	Average	Standard deviation
The use of this methodology I believe could improve my learning in the classroom (PU1).	6,54	0,901
The use of this methodology during classes would make it easier for me to understand certain concepts (PU2).	6,64	0,665
I think this methodology is useful when learning (PU3).	6,59	0,568
The use of this methodology favors my learning (PU4).	6,42	0,745
I think the methodology is easy to use (PEU1).	5,99	0,825
Learning to use it and dealing with it has not been a problem for me (PEU2).	5,88	1,341
Learning to use it and dealing with this methodology has been clear and understandable to me (PEU3).	6,09	0,960
Using it has been fun for me (PEN1).	6,39	0,704
I enjoyed using this methodology (PEN2).	6,32	0,801
I believe that the methodology allows learning by playing (PEN3).	6,35	0,775
Using this methodology makes learning more interesting (ACU1).	6,44	0,680
I think its use in the classroom is a good idea (ACU2).	5,80	2,521
I would like to use this methodology in the future if I had the opportunity (IU1).	6,59	0,654
I would like to use this methodology to learn both the topics presented to me and with other topics (IU2).	6,60	0,525

All items are above 5.8 points. This implies that, in general, the level of acceptance of the Breakout methodology is high. Specifically, the following stand out: usefulness while learning (UP3), clarity of learning (FUP3), fun use and playful learning (PEN1, PEN3), interest in learning (ACU1) and future intention to use it to investigate other subjects (IU2).

To make the analysis more concrete, a descriptive analysis by dimensions is performed in Table 7.

Table 7. Descriptive statistics of the level of acceptance of the Breakout methodology (dimensions and total).

Dimension	Average	SD
Perceived Usefulness (PU)	6.51	0.721
Perceived ease of use (PEU)	5.98	1.012
Perceived enjoyment (PEN)	6.34	0.785
Attitude towards use (ACU)	5.28	1.694
Intention to use (IU)	6.54	0.648
Total	6.13	0.972

As can be seen, students highlight the intention to use (IU) and perceived usefulness (UP).

4 Discussion

Developing innovative methodologies through techniques such as digital educational breakout requires a knowledge of in-depth strategy, its benefits, difficulties, and educational possibilities. While it is true that this strategy is presented throughout studies and research as suitable to be incorporated in different areas and educational levels, it should also be considered that it is still necessary to continue implementing research that yields more data and results that help to complement and improve the lines that we currently have.

The characteristics of this didactic strategy, developed virtually, and the results obtained allow us to establish some conclusions, and that is, teachers in training perceive the digital Breakout in an adequate way, highlighting aspects such as usefulness while learning, clarity of learning, fun use and playful learning, interest in learning, or future intention to use it to investigate other topics.

All this is in line with previous studies, such as that of [33] when they stated that the satisfactory assessment with the training received online indicated not only a relevant adaptation of the resources to their needs, but also the acquisition of higher levels of maturity in the mastery of digital competencies. For this reason, considering the results obtained from the study presented here, we can confirm that the teachers in training who have participated in the learning experience express their satisfaction with it.

Likewise, and seeing that previous research has already been carried out successfully [34, 35], with the development of the study it has been possible to derive that the level of acceptance as far as the validation of the TAM model is concerned has been high and that it is also assigned an adequate internal consistency, all this regarding the blocks of indicators of the model. These results show that the model, which was initially proposed by [23], is significant insofar as the results are also in line with those obtained by [36, 37].

5 Conclusion

That is why, one of the conclusions we have been able to reach is that the TAM model used can serve as a predictor that explains the attitude towards the Breakout strategy and its incorporation in university education.

On the other hand, and as has happened with other strategies that incorporate ICT in their development, it is necessary and essential to propose and deepen the development of studies and research that provide methods, results and conclusions

that can expand the range of benefits that this strategy poses for its incorporation into university education. In this sense, one of the objectives of the study was to investigate the degree of importance of measuring the degree of acceptance of this strategy by the teaching staff. All this would make it possible to establish usefulness for future implementations and, despite its simplicity and high validity, it is true that the TAM model has several limitations: a) there is no positive relationship between use and performance; b) the model alludes to the prediction of use, but not to the increase in user performance; and finally, the variability of results if the sample is applied to teachers in training with high levels of competence.

Keeping in mind the need to establish new proposals in terms of traditional teaching and learning methodologies, it may be an option to propose these alternative methodologies that shape the development of everything that involves the dimensions of digital competence of university teachers in training [38]. This does not imply recognizing that the study presents limitations, around the possible specificity of the context where the training action is applied or the reduced sample, so it is raised as interesting a possible replication of the model in studies and research where the digital Breakout is also contemplated as a didactic strategy, or with tools and strategies that may have similar characteristics, such as the Flipped Classroom or the ScapeRoom, which are presented as emerging technologies with didactic validity and high educational potential [39, 40, 41].

Acknowledgements. This research was supported by the Vice-rectorade of Teaching of the University of Sevilla with the Project "Application of active innovation methodologies through digital breakout for the training of future teachers in university education". Reference: 23910. III Own Teaching Plan.

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