

Effects of Digital Badges on the Online Activity of University Students in a Blended Learning Model

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Abstract

This research aimed to determine the effects a digital badge program had on the academic performance and participation in online activities in the English I course. The research design was experimental with post-test and control group. The sample consisted of 18 students from the first semester, enrolled in a blended learning model in a private university in Lima. There were statistically significant differences between the control and experimental group, which favored the experimental group. In addition, an effect size of 4.56 was found, which was considered very large. Regarding academic performance, no statistically significant differences were found. However, the effect size was 0.60, considered moderate. In conclusion, the digital badge program encouraged participation in virtual academic activities; however, the results obtained in connection with academic performance are not entirely clear, which is why it is suggested to conduct research in courses of different areas, with a broader sample.

Keywords: digital badge, blended learning, university, academic performance

Efecto de las insignias digitales en la actividad virtual de universitarios en modalidad semipresencial

La presente investigación buscó determinar los efectos de un programa de insignias digitales sobre el desempeño académico en el curso Inglés I y la participación en las actividades virtuales. El diseño de investigación fue experimental con post-prueba y grupo control. La muestra estuvo conformada por 18 estudiantes del primer ciclo, matriculados en modalidad semipresencial en una universidad privada de Lima. Se encontraron diferencias estadísticamente significativas entre el grupo experimental y control, a favor del grupo experimental. Además, se halló un tamaño del efecto de 4.56, categorizado como muy grande. En el caso del rendimiento académico, no se encontraron diferencias estadísticamente significativas. Sin embargo, el tamaño del efecto fue 0.60, considerado como moderado. En conclusión, el programa de insignias digitales fomentó la participación en las actividades académicas virtuales; sin embargo, los resultados respecto del rendimiento académico no son totalmente claros, por lo que se sugiere realizar investigaciones en cursos de diferente área y con una muestra más amplia.

Palabras clave: Insignia digital, semipresencial, universidad, rendimiento académico

Efeito dos distintivos digitais na atividade virtual de universitários na modalidade semipresencial

Resumo

Esta pesquisa buscou determinar os efeitos de um programa de crachás digitais no desempenho acadêmico do curso de inglês I e na participação em atividades virtuais. O desenho da pesquisa foi experimental com pós-teste e grupo de controle. A amostra esteve composta por 18 estudantes do primeiro período, matriculados na modalidade semipresencial em uma universidade privada de Lima. Encontraram-se diferenças estatisticamente significativas entre o grupo experimental e de controle, a favor do grupo experimental. Outro achado foi um tamanho do efeito de 4,56, categorizado como muito grande. No caso do rendimento acadêmico, não se encontraram diferenças estatisticamente significativas. No entanto, o tamanho do efeito foi de 0.60, considerado como moderado. Em conclusão, o programa de distintivos digitais fomentou a participação nas atividades virtuais; porém, os resultados obtidos a respeito do rendimento acadêmico não são totalmente claros, motivo pelo qual recomenda-se realizar pesquisas em cursos de área diferente e com uma amostra mais ampla.

Palavras chave: emblemas digitais, semipresencial, universidade, rendimento acadêmico

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In recent years, many private universities have been offering educational programs for people with work experience (PQS. La voz de los emprendedores, 2016), using the blended model. These programs could even be completed in less time when compared to the regular model.

According to the National Institute of Statistics and Informatics (INEI), 25% of university students are 23 years old or older and have a job (INEI, 2010); thus, a significant segment of the population could benefit from a blended learning model. However, in the university environment, this modality presents some challenges, e.g., students' low level of motivation when it comes to performing virtual tasks (Sorbie, 2015), or the high level of distraction when performing those activities (La Roche & Flanigan, 2013). At the institution where this work was done, it was determined that 46% of students in the blended program participated in the virtual tasks, in the January 2018 semester (Dirección de Tecnologías para el Aprendizaje, 2018); this indicates that students don't perform a significant amount of

activities that would contribute to achieving the expected learning outcomes; consequently, they take part in on-site classes without having previously reviewed the online content. That is why it is necessary to identify and apply instructional strategies that increase students' motivation to complete virtual tasks. This is the case of digital badges, that are part of gamification strategies, which use game characteristics to promote learning (Kim, Song, Lockee, & Burton, 2018), for example, through rewards, feedback, and progress indicators (Observatorio de Innovación Educativa, 2016).

Recently, the use of digital badges has increased (Universidad de Deusto, 2017). For example, Reid, Paster, & Abramovich (2015) conducted a study with first-year students in a public university in the United States to analyze their attitudes towards the use of digital badges. It concluded that they have different effects depending on the characteristics of the student, whereby only students with high expectations regarding learning increased their levels of intrinsic motivation to

obtain badges. In addition, Iosup & Epema (2014) conducted research in a university in The Netherlands with 450 students in higher technical education, which sought to determine, among other gamification strategies, the effects of badges and status indicators on approval rates, level of satisfaction, class participation and completion of tasks. The results showed that more than 75% of students passed in their first attempt. Furthermore, a positive correlation was found between gamification and the number of students who passed, as well as the completion of voluntary activities and tasks.

Finally, Fajiculay, Parikh, Wright, & Heck Sheehan (2017) conducted research on students from a North American university, in which they described the perception and motivation of students pursuing a pharmacy career regarding digital badges. It was found that 53% of students felt that they could help them fully understand the content of the subject. In addition, 73% of the students who obtained at least one badge indicated that the badges had helped them improve their level of confidence in the content of the subject; 55% stated that they were able to focus on specific learning outcomes; 64% said that, since they started using badges, they acquired a broader understanding of the competencies of the subject; and, finally, 82% affirmed that digital badges served as a complement to traditional instructional strategies.

Other studies, such as the ones by Córdova Berona (2017), Abramovich, Schunn, & Higashi (2013), Glover and Latif (2013), and Palazón-Herrera (2015), also report on the effects of digital badges on the motivation and academic performance of high school and higher education students.

Digital Badges

Digital badges are used to represent mastery of a skill, as well as the compliance with or performance in an activity (Shields & Chugh, 2016). In addition, they can serve as motivational stimuli that direct student behavior towards a specific objective. They usually consist of a PNG image, information in the form of metadata, and a web page, where the evidence, criteria, and data of the issuer are stored (Borrás, 2017). The most representative part of the badges consists of metadata,

which also give them value. These refer to information about who delivered the badge, who won it, when it was obtained, what the conditions for obtaining it were, etc. (Masura, 2014). Furthermore, as an added value, the visual representation of the badge seeks to attract the student. That way, the image should provide information about the area or topic referred to, the institution, level of training, or about the description of the badge (Borrás, 2018).

Hickey (2012) mentions that badges can perform functions such as: (a) recognition of learning; thus, the possibility of accrediting informal learning is one of its great advantages (Hickey, 2012; The Mozilla Foundation and Peer 2 Peer University, 2012); (b) assessment of learning: the badges contribute to the summative assessment, which makes it possible to verify that learning took place; to the formative assessment, which sheds light on the aspects that need to be improved; and to the transformation assessment, which looks for changes in the identity of the learner (Baker, 2007; Davidson, 2011). (c) Motivation for learning can be used to increase the students' interest in a given subject, as well as to guide them to complete academic activities, so that the learner can recognize what processes he or she must follow to achieve a learning objective (Gibson, Ostashewski, Flintoff, Grant, & Knight, 2015).

However, it is important to recognize that there is currently no clarity regarding the real impact that digital badges have on learners' motivation (Zellner, 2015). To explain the way digital badges work, we can resort to the theory of motivational goals, which proposes three orientations that can be found in any educational situation: orientation towards results, towards avoidance and towards learning (Dweck & Elliot, 2005; Huertas & Montero, 2003). Current research shows that, within any given orientation, different goals can be put into play simultaneously (Huertas, 2009). It is assumed that in order for the student to try to obtain a particular badge, the reward associated to the badge must be aligned with the student's motivational orientation; otherwise, there would be a low probability that the student would make efforts to earn any badge.

The way digital badges operate can also be ex-

plained from behavior learning; in this case, from the operating conditioning (Robson, Plangger, Kitzmann, McCarthy, & Pitt, 2015), which consists of the contingent presentation of a stimulus to a certain response, generating an increase in the occurrence of this behavior (Leslie, 2005). One of the techniques derived from this learning principle is precisely the token economy. In this technique, tokens are only a set of neutral stimuli that, when presented repeatedly and in a contingent manner to the reinforcing stimulus, are transformed into reinforcing entities themselves (Doll, McLaughlin, & Barretto, 2013).

With what has been previously described, the present study seeks to identify the effects of a digital badge program on the participation in virtual activities and the academic performance of first-semester students at a private university under the blended modality. As a research hypothesis, it is proposed that the digital badge program will have a significant positive effect on the virtual activity of the first-semester students under a blended learning model at a private university, compared to a control group.

Method

Design.

The scope of this study is explanatory, while the design employed was quasi-experimental, with post-test and control group (Hernández, Fernández, & Baptista, 2014). Thus, when the manipulation of the independent variable was concluded, the levels of the dependent variables in both groups were measured.

Participants.

The participants were first-semester students from a private university in Lima, all of whom took English I course under the blended learning modality. With respect to the experimental group, 14 men and 4 women participated, for a total of 18 students. As to the control group, 13 men and 5 women participated, for a total of 18 students. The assignment of students in both groups was done through pairing, which is a method to make both groups equivalent starting from a certain variable (Hernández et al., 2014). In this case, the variable used to match the students was the level of English, choosing the same number of students, both for the control group and for the experimental group, with respect to the quartile in which this variable is located (see Table 1).

Data collection techniques.

The independent variables are academic performance and participation in virtual activities. In the first case, the measurement was done through the average of the grades obtained by students in two tests and a final assignment. Regarding participation in virtual activities, it was measured by counting the virtual tasks completed in each group.

The collection of the dependent variables was done through observation; specifically, using the measurement of permanent products. In other words, information on the results or traces of evidence of the displayed behavior was collected (McKay, 2008). One of the most outstanding advantages of this technique is the ease with which information can be collected, as well as the objectivity of the tangible products of the behavior.

Table 1

Student Classification According to Their Group and the Quartile in English Level

Group	Sex		Quartile		
	Men	Women	1	2	3
Control	13	5	6	8	12
Experimental	14	4	6	8	12
Total	27	9	12	16	24

Procedure.

First, the badge program was designed and then it was implemented in the *Canvas Learning Management System (LMS)* using the *Badgr* application. In addition, the student sample was obtained with the support of the English I course coordination. This course was chosen because of the high number of students enrolled in comparison to the other subjects. The students were then randomly matched to be assigned to both the control group and the experimental group, based on the quartile in which they were at their level of English. For this measurement, a test similar to the assessments given to students throughout the course was used. That way, 18 participants were chosen for the experimental group and the same number for the control group.

The course was held during the second semester of 2018 and lasted nine weeks for both groups. It's important to mention that the same professor was in charge of both the control and the experimental groups, which started classes in the same semester. At the beginning of the course, the students of both groups participated in a survey in order to obtain socio-demographic data. Throughout the classes, the data linked to the students' activity in LMS was collected by the evaluation and monitoring area of the institution.

For both groups, the professor followed a set of guidelines related to the use of the LMS, which included sending announcements, and participating in videoconferences and in a forum to clear doubts.

The badge program consisted in completing a set of virtual activities, for which the student was awarded a badge that could be seen in the LMS. Each of the badges represented the completion of a maximum of three virtual activities, which included the submission of comments in two forums, six submissions of exercises and six self-assessments, as can be seen in Table 2.

By earning three or four badges, each student was awarded an additional badge of a higher level, which they could exchange for a bonus point on the grade obtained in one of the graded tests. At the end of the course, the professor assigned that score in the grade record.

In a complementary manner, the professor sent out announcements through the LMS, including

a congratulatory message to students who had achieved some of the badges and a reminder about the badges that still had to be collected. It is important to mention that during on-site classes, the use of badges was reinforced through congratulations and motivational messages.

Results

Once the data collection was completed, IBM SPSS software, version 25, was used. With the data obtained, we proceeded to confirm with a parametric test whether the necessary requirements to carry out the comparison of independent samples had been fulfilled (Coolican, 2014). First, the assumption of normality in the score for participation in virtual activities was verified through the Shapiro-Wilks statistics test, which was used because the sample included less than fifty individuals, and the mean and variance of the population were unknown (Díaz, 2009). The results show that the participation scores of the experimental group are close to a normal distribution, whereas in the case of the control group the scores do not approach that distribution, as shown in Table 3.

Bearing this in mind, it was decided to use a non-parametric test: the Mann-Whitney U test. Based on these results, the null hypothesis is rejected, which indicates that the means of both sections are equal, since the probability is $<.001$, less than .05.

In addition, the effect size was identified, which is the size of the relationship or difference found in the research (Howitt & Cramer, 2017); it has also been defined as the measure of the strength of the difference in averages or other values (Creswell, 2013a; Alhija & Levy, 2009; Cortina, 2003, as cited in Hernández, et al., 2014). Since we worked with a control group in this research, the Glass formula (Castillo, 2014) was used, which allows us to state that the effect has a very large size because $d = 4.57$.

On the other hand, the number of badges obtained, which was 114, was also identified. When comparing this number to the total number of badges expected, a percentage of 45.24 participa-

Table 2

Distribution of Digital Badges

Semester Week	Activity Carried out by Students	Name of the Badge
1	Posting a comment on the presentation forum "Talking about me"	Me and you
	Completion of the first self-assessment.	Be nice
2	Submission of Assignment 2 – application sheet for the topic "Demonstrative Pronouns and Plural nouns"	People and things
	Completion of the second self-assessment.	
	Obtaining the following badges: <ul style="list-style-type: none"> • Me and you • Be nice • People and things 	In english, please I
3	Submission of Individual Assignment 3 – application sheet for the topic "Possessive adjectives"	My house is your house
4	Posting a comment in the forum "My family"	Happy family
	Completion of the third self-assessment.	
5	Submission of Assignment 5 – application sheet for the topic "There is -There are"	Out and about
	Completion of the fourth self-assessment	
	Obtaining the following badges: <ul style="list-style-type: none"> • My house is your house • Happy family • Out and about 	In english, please II
6	First submission of final assignment progress	Love life
	Completion of the fifth self-assessment	
7	Submission of Individual Assignment 7 - application sheet for the topic "Adverbs of frequency"	Work and play
8	Second submission of final assignment progress.	Yes, I can
	Completion of the sixth self-assessment	Close to the top
	Obtaining the following badges: <ul style="list-style-type: none"> • Love life • Work and play • Yes, I can • Close to the top 	In english, please III

Table 3

Statistics Regarding Participation in Virtual Activities

Group	M	Me	DE	Min	Max	SW	U	P _s
Experimental	9.22	9	2.34	5	14	p>.05	16.00**	4.57
Control	5.11	5	0.90	2	6	p<.05		

Note: M= mean; Me= median; SD= standard deviation; Min= minimum value; Max= maximum value; SW= Shapiro-Wilks; U: U of Mann-Whitney; Ps: Probability of superiority.

Table 4

Descriptive Statistics for the Number of Badges Obtained by the Experimental Group

Badges	<i>f</i>	Achieved Ratio	Remaining Ratio
Possible	252	45.24	55.76
Obtained	114		

Table 5

Statistics on Academic Performance

Group	<i>M</i>	<i>Me</i>	<i>DE</i>	<i>Min</i>	<i>Max</i>	<i>SW</i>	<i>U</i>	<i>P_s</i>
Experimental	17.39	17	1.19	15	19	<i>p</i> <.05	100.5	0.60
Control	14.61	17	4.63	1	20	<i>p</i> <.05		

Note: *M*= mean; *Me*= median; *SD*= standard deviation; *Min*= minimum value; *Max*= maximum value; *SW*= Shapiro-Wilks; *U*: *U* of Mann-Whitney; *Ps*: Probability of superiority.

tions is obtained. In addition, we also completed the comparison between the academic performance of both groups, also considering the use of the Mann-Whitney U-test (Coolican, 2014), given that the distribution of the samples was not normal, as shown in Table 5.

As can be seen, the experimental group's mean score does not differ significantly from the control group's mean score, with a significance of 5%. Nonetheless, a moderate effect size was found because *d*= 0.60. These results, seemingly discrepant, can be explained by the size of the sample, which decreases the probability of finding statistically significant differences.

Discussion

From the results obtained, a statistically significant effect on the participation in the virtual activities performed by the students in the experimental group could be verified, in comparison to the students in the control group; furthermore, the effect size is large.

These findings are partially consistent with the study conducted by Iosup & Epema (2014), where a correlation was found between the gamification program, with an increase in the percent-

age of students that passed, and their completion of complementary activities. It is also in line with other studies, such as the one undertaken by Abramovich, Schunn, & Higashi (2013), who suggest that badges have a positive effect on the students' motivation levels, which could translate into a greater completion of activities. Nevertheless, motivation has not been specifically assessed in this paper, which is the reason why it would be necessary to corroborate this point with further research.

This impact found on participation could be explained by the principles of behavioral learning, particularly, the respondent and operant conditioning (Robson et al., 2015). While digital badges initially have little or no value, they acquire the properties of reinforcers after being associated in a contingent manner. This way, getting a digital badge is a reinforcer for the student, increasing the likelihood of behaving the way it is needed to get them again.

On the other hand, no statistically significant differences were found in the academic performance of the students in the experimental and control groups. However, when analyzing the effect size, it can be stated that the size of the difference in means is moderate, so it can be inferred that the program had some impact on student performance, even though there is a high proba-

bility that this difference is due to chance. With the results obtained, it is not possible to establish with certainty a relationship between participation in graded activities and the grade obtained by students. That is why additional studies with larger sample sizes would be needed to corroborate whether, students would have greater practice of the subject contents with more virtual activities, which would be reflected in their grades.

With regards to the digital badges, on average, from the 252 possible badges, 114 were obtained, which is equivalent to 45.24%; consequently, 55.21% of badges were not obtained. This may have happened because not all virtual tasks have an impact on the final average, except for the bonus provided from the digital badges. Thus, a student who did not have the need to get such bonus would not be motivated to complete these virtual tasks.

This can be explained through the theory of motivational goals (Huertas, 2009). The prioritization of virtual activities varies according to the students' motivational goal: if students are oriented towards results and exclusively seek to pass, they would only need to carry out the minimum actions for that, and if they already had the necessary score, they wouldn't need to get any additional digital badges. It is inferred that, according to the goal that a student has regarding the subject, he or she would exhibit a different conduct aimed at achieving that goal, which is in line with what has been identified by Reid et al. (2015), who indicate that badges have different effects according to the characteristics of the student. Their study found a favorable perception of the badges in the English course for most students; however, the intrinsic motivational levels for obtaining the badges increased only for the learners who had high expectations regarding learning. Furthermore, these findings point towards a direction similar to the findings made by Glover and Latif (2013), who indicated that if many participants can acquire a certain badge, its effect may be diluted.

These results allow us to corroborate the effectiveness of digital badges as motivating elements in the participation of students in virtual academic activities under the blended learning modality, specifically for learning English. However, the research had some limitations; for example,

the evaluation of other relevant variables related to academic participation, such as motivation, was not carried out. Another limitation is related to the size of the sample, so the results obtained with regard to academic performance cannot be generalized.

It is recommended that research be conducted in courses from different areas to be able to generalize these results to the teaching of other types of content. In addition, it is important to expand the research sample in order to increase the probability of obtaining more consistent results.

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Appendices

Tabla 6

Digital Badges

Badge Name	Graphic representation
Me and you	
Be nice	
People and things	
In english, please I	
My house is your house	
Happy family	

Badge Name	Graphic representation
Out and about	
In english, please II	
Love life	
Work and play	
Yes, I can	
Close to the top	
In english, please III	