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Psychometrics of the Brief Scale of Autonomous Learning in University Students

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ABSTRACT

Aims The use of WhatsApp can develop autonomous learning, however, there are still no tools that can measure it. This study was performed with the aim to analyze the psychometric properties of the Abbreviated Scale of Autonomous Learning with the use of WhatsApp in Peruvian university students.

Materials & Methods In this instrumental study, in a non-probabilistic sample (n=411) of students, An exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and reliability were estimated.

Findings The statistics report that the AFE are acceptable and significant KMO (0.816) and Bartlett's test (1431.09; gl=6; p=0.0001). Robust analyses (χ2=24.180; p=0.0001; TLI=0.955; CFI=0.998; GFI=0.998; AGFI=0.994, and RMSR=0.043), show that the unidimensional structure acceptable and reported an internal consistency of 0.932.

Conclusion The EBAA-4 is valid and reliable. Therefore, its use is recommended for university students.

Keywords Autonomous Learning; Autonomous Learning Scale; Whatsapp

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Introduction

Autonomous learning guides the development of a set of skills that allows students to problematize and argue to make their own decisions, as part of the pragmatics of the speech act where the development of learning strategies based on sensory, cognitive, contextual, ethical, cultural and social knowledge is argued and counter-argued [1]. Learning is achieved when the problematization of the educational activity is generated in contact with reality, where learning spaces are opened with trial and error learning experiences, learning from negative and constructive experiences, contingent, intuitive, deductive-inductive, hypothetical experiences, and higher-order thinking skills [2].

As of October 2020, the social network WhatsApp ranked number one in a ranking of global messaging applications, with 0.7 billion more users than Facebook Messenger and estimated to have surpassed 1.5 billion users worldwide; Latin America is no exception Sub-Saharan Africa and Latin America lead in the use of WhatsApp with 97% of its population [3]. Also, there is increasing use of social networks in learning in the university system. Their use opens spaces to develop academic activities, enabling and encouraging direct communication between students and teachers [4]. Allowing to reduce the development of classroom lectures emphasizes the storage of content and the application of evaluations of understanding or the degree of learning of the contents, which manifests the acquired learning [5].

Previous studies in Saudi Arabia found that the exchange of documents and socialization through social networks generated better academic achievement in university students [6]. In this process, the role of the teacher is fundamental, as a guide and facilitator of information to promote the construction of knowledge after having presented, transferred and managed. The student will be the protagonist in constructing their learning autonomously, with initiative and communication [7].

In this context, it is important to evaluate the development of autonomous learning using WhatsApp. In this regard, it has been found that there are few studies such as the one conducted with 1760 university students in Hong Kong where they validated the Self-Directed Learning Scale (SDLS); this instrument was found to be unidimensional through a Confirmatory Factor Analysis (CFA), a multigroup CFA supported the structure as invariant across genders. In addition, Cronbach's alpha score showed that the scale was internally consistent. Moreover, its criterion validity was evidenced by its correlations with public and university test scores [8]. However, this instrument does not yet assess autonomous learning from the context of virtuality and WhatsApp as a platform that could contribute to the development of autonomous learning.

In this sense, the present study aimed to analyze the validity and reliability properties of the Brief Scale of Autonomous Learning with WhatsApp in university students in the city of Chimbote, Peru.

Materials and Methods

Design and context

This non-experimental instrumental study, with a non-probabilistic sample of university students, was performed in Chimbote, Peru, in 2020.

The city of Chimbote is located on the coast of Ferrol Bay, 130 km south of Trujillo and 420 kilometers north of Lima on the Panamerican Highway North; it has a population of 213,872 inhabitants as of 2018. It is the beginning of a chain of important cities like Trujillo on the northern Peruvian coast. The commercial activity is fishing, iron and steel and agriculture.

Population and sample

The population consisted of university students from Chimbote, department of Ancash, Peru. At the same time, the sample consisted of n=411 students who were included by non-probabilistic convenience sampling between December 2010 and March 2020.

Study variable

The study variable was Autonomous Learning through the use of WhatsApp, which is defined as the development of a set of skills that allows students to problematize, and argue to make their own decisions, as part of the pragmatics of the speech act where the development of learning strategies based on sensory knowledge is argued, cognitive, contextual, ethical, cultural and social [1], in a context of the use of the WhatsApp platform in learning in the university system, because its use opens spaces in the development of academic activities, enabling and encouraging direct interaction in communication between students and teachers [4].

The operational level comprises four items, with a Likert-type response and tabulated with values between 1 and 5 points (Always, Almost always, Sometimes, Rarely, Never).

Scale construction

The research team, which consisted of two psychologists and two educators, built the first version of the instrument; once it was developed, we requested the judgment of seven experts, two psychologists and five educators with master's and doctoral degrees, who made improvements in the items. Once the observations had been made, we asked for their agreement and then proceeded to conduct the pilot test with a group of 15 students; at the end of the application of the scale, we conducted a group interview to request suggestions for improving the items. All the students' suggestions were recorded with an audio recording. We proceeded to listen to all of the research team

members to validate and include the improvements suggested by the university students.

Collection Procedure

Initially, authorization was requested from the academic authorities of a private university in the city of Chimbote; then, coordinated with the teachers of the faculties of health sciences and business to guide the way to present the survey online, through social networks such as WhatsApp Messenger and text messages. The teachers in training via phone call by the researchers were trained for 30 minutes each, on how to submit the survey with a sentence *"Dear student, please enter the following link and read the presentation of the study, if you are interested in participating, click on I accept and you can develop the survey, thank you for your participation"*.

In the first part, the survey presented the informed consent where the objectives of the project and the rights of the participants in the study were explained; once confirmed their desire to participate, the survey was presented. The survey was presented up to three times to the groups of students, clarifying that if they had already developed the survey, it was unnecessary to develop it again. Once the data was collected, we proceeded to download it from the Google Forms cloud and perform the data cleaning and later the instrumental analysis.

Data analysis

In the first phase, content validity was carried out through Aiken's V test based on the judgments of seven experts. In the second phase, the mean, standard deviation, skewness and kurtosis of the four items of the EBAA-4 were calculated. An exploratory factor analysis (EFA) by unweighted least squares was carried out in the third phase. Bartlett's test and the Kaiser-Meyer-Olkin coefficient (KMO) were used. The parallel analysis revealed the existence of a single factor. In the fourth phase, reliability was estimated through Cronbach's alpha coefficient and their respective confidence intervals [9].

FACTOR Analysis 10.1 was used for the descriptive analysis, and SPSS 25.0 statistical software was used to calculate the scale's reliability.

Ethical Aspects

The study was approved by the Institutional Research Ethics Committee of the Universidad Católica Los Ángeles de Chimbote. It respected the principles of autonomy, confidentiality and justice of the Declaration of Helsinki [10].

Findings

The judgment of seven experts was requested to analyze the relevance, representativeness and clarity of the EBAA-4 items; the assigned scores were quantified with Aiken's V coefficient proposed by the researcher Ventura (Ventura-León, 2019). The four items were evaluated and rated favorably by the experts (V≥76). Regarding relevance, it is observed that all four items are relevant (V=1.00; IC95%: 0.86 - 1.00); while in representativeness items 3 and 4 are the most representative (V=1.00; IC95%:0.86 - 1.00); likewise, on clarity, it is reported that item 3 is the clearest (V= 1.00; IC95%: 0.86 - 1.00). It is also observed that the values of the lower limit (Li) of the 95% CI are adequate. All the Aiken's V coefficient values were statistically significant or valid (Table 1).

Table 1) Aiken's V for assessing the relevance, representativeness and clarity of the EBAA-4 items

Items	Mean	Standard Deviation	Aiken's V	95%CI
Relevance				
1	3.00	0.00	1.00	0.86 - 1.00
2	3.00	0.00	1.00	0.86 - 1.00
3	3.00	0.00	1.00	0.86 - 1.00
4	3.00	0.00	1.00	0.86 - 1.00
Representativeness				
1	2.86	0.38	0.95	0.79 - 0.99
2	2.86	0.38	0.95	0.79 - 0.99
3	3.00	0.00	1.00	0.86 - 1.00
4	3.00	0.00	1.00	0.86 - 1.00
Clarity				
1	2.29	0.76	0.76	0.56 - 0.89
2	2.71	0.49	0.90	0.73 - 0.97
3	3.00	0.00	1.00	0.86 - 1.00
4	2.71	0.49	0.90	0.73 - 0.97

Preliminary item analysis

The mean of four items were 3.56±1.21, 3.86±1.06, 3.61±1.16, and 3.82±1.10, respectively. The skewness and kurtosis values of the four scale items did not exceed the range >±1.5 [11], which indicated that the variables follow a normal distribution. Likewise, the correlations between the items were significant (>0.7; Table 2).

Table 2) Descriptives of the EBAA-4 scale

Items	Skewness	Kurtosis	4	3	2	1
1	-0.473	-0.590	0.728	0.850	0.728	1
2	-0.744	-0.009	0.824	0.757	1	
3	-0.510	-0.495	0.772	1		
4	-0.746	-0.043	1			

Exploratory factor analysis

The relevance of the PFA is demonstrated by the values of the KMO coefficient (0.816) and Bartlett's test (1431.09; gl=6; p=0.0001) being acceptable and significant. The AFE revealed that the four items of the EBAA-4 scale were saturated in a single factor. The unweighted least squares method was used, obtaining a unidimensional model. The factor obtained explains 83.22% of the total variance of the test, and its factor loadings range from 0.869 to 0.909 (Table 3). The robust analyses (χ^2=24.180; p=0.0001; TLI=0.955; CFI=0.998; GFI=0.998; AGFI=0.994; and RMSR=0.043), show that the unidimensional structure was acceptable.

In relation to the scale's internal consistency, Cronbach's alpha coefficient was 0.932

(95%CI=0.91-0.94), which indicated that the scale was reliable.

Table 3) Factor analysis of the EBAA-4

Items	F1	h2
1. Did the teacher's message with the student sent by WhatsApp generate the motivation to develop the learning activity?	0.869	0.755
2. Did the student-to-student messages guide the search for alternative solutions to the activity?	0.869	0.755
3. Did the teacher's guide to the student via WhatsApp motivate you to transform your ideas into actions?	0.909	0.827
4. Did the student-to-student communication via WhatsApp allow you to raise improvements in your learning outcomes?	0.877	0.769

Discussion

Although there are some scales that assess autonomous learning in university students, they are not adapted to assess the use of WhatsApp or social networks [8]. Especially in the global health crisis due to SARS-CoV-2 that has forced us to adapt to virtuality in education at all levels, including university education [12]. Therefore, the importance of our study that set out to analyze the validity and reliability properties of the Brief Scale of Autonomous Learning with the use of WhatsApp (EBAA-4) in university students in the city of Chimbote, Peru.

Against this, the EBAA-4 showed excellent content validity properties through Aiken's V (V≥76) from seven expert judges (2 psychologists with knowledge in psychometrics and five educators with theoretical knowledge of autonomous learning), all with master's and/or doctoral degrees, who at the time practiced university teaching in universities in the city of Chimbote. This content validity sought to evaluate the relevance, representativeness and clarity of the items to avoid irrelevant variance associated with the construct [13]. The EBAA-4 showed statistically significant values that demonstrated its validity in the content of its items.

The AFE revealed that all four items of the scale were saturated on a single factor. That analysis was conducted with the intention of developing and refining the new EBAA-4 scale through the identification of the underlying structure from its principle of parsimony that indicates that the factors have at least three items with factor loadings greater than .30 and the interpretability that determines its coincidence with the theory proposed [14]; in this regard, the EBAA-4 showed a single dimension with adequate factor loadings per item (F1≥0.869).

In relation to the internal consistency of the scale, the Cronbach's alpha coefficient was 0.932 (95%CI=0.91-0.94), which indicates that scale a is reliable. An instrument is said to be reliable when its statements prove to be homogeneous, that is, they correlate with each other; Cronbach's alpha was used for this purpose. In it, reliability is measured in degrees. Still, it is interpreted as a correlation coefficient that can vary from 0 to 1, considering that the margins between 0 and 0.5 are unacceptable levels, between 0.5 and 0.6 poor level, 0.6 and 0.7 weak level, 0.7 and 0.8 acceptable level, 0.8 and 0.9 good level, and greater than 0.9 excellent level [15]. So it could be stated that the EBAA-4 showed excellent reliability. Reliability is affected by the quality of the items and the quality of the translation in the case of adaptation to a new context [16].

One of the limitations of the study was not having a probability sample of university students; however, the sample size (n=411) is an important number, so the study is not without its value. Also, its short scale characteristic limits it to have a basic look at autonomous learning in the context of virtual education; however, the factorial structure has shown that having four items with factor loadings greater than (F1≥0.869) supports its coincidence with the theory that it is intended to evaluate.

Conclusion

The EBAA-4 demonstrated excellent psychometric properties of content validity, factorial structure and reliability, so its use is recommended for Peruvian university students developing their learning from the WhatsApp platform. Further studies could develop a broader scale to measure the entire construct of autonomous learning in virtual environments.

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