

Scale of strategies and motivation for learning in virtual environments

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ABSTRACT

This study aimed to build and to gather evidence of validity for a scale of teaching, learning and motivational strategies for learning in online learning environments (EEAM-AVA). To investigate evidence for the validity of the scale, the internal structure and dimensions that emerged during this study were considered. Participating in the survey were 572 students enrolled on courses in mediated virtual learning environments. The research instrument was built using a scale of forty five items. The analysis of the data collected showed a structure of five dimensions, all with acceptable levels of inner consistency, indicating the validity of the scale and its psychometric properties. Additional studies to revise and improve the items presented on the scale were recommended. It is hoped that the results may be of benefit for educators and psychologists who research questions investigated in this study.

KEYWORDS

psychometric scale; learning in virtual environments; motivation; distance education.

ESCALA DE ESTRATÉGIAS E MOTIVAÇÃO PARA APRENDIZAGEM EM AMBIENTES VIRTUAIS

RESUMO

Este estudo teve por objetivo construir e levantar evidências de validade para a escala de estratégia de ensino, de aprendizagem e motivação para aprender em ambientes virtuais de aprendizagem (EEAM-AVA). A evidência de validade da escala foi investigada por meio da estrutura interna e das dimensões emergidas no decorrer deste estudo. Participaram da pesquisa 572 estudantes matriculados em cursos disponibilizados em ambientes virtuais de aprendizagem. O instrumento de pesquisa elaborado constituiu-se em uma escala com quarenta e cinco itens. A análise dos dados coletados apresentou uma estrutura de cinco dimensões, todas com índices de consistência interna aceitáveis, evidenciando a validade da escala e suas propriedades psicométricas. Estudos adicionais que revisem e aprimorem itens da escala apresentada são recomendados. Espera-se que os resultados tragam contribuições para educadores e psicólogos que pesquisam as questões aqui investigadas.

PALAVRAS-CHAVE

escala psicométrica; aprendizagem em ambientes virtuais; motivação; educação a distância.

ESCALA DE ESTRATEGIAS Y MOTIVACIÓN PARA EL APRENDIZAJE EN ENTORNOS VIRTUALES

RESUMEN

Este estudio tuvo como objetivo construir y reunir pruebas de validez para la escala de estrategia de enseñanza, de aprendizaje y motivación para aprender en entornos virtuales de aprendizaje (EEAM-AVA). La evidencia de validez de la escala se investigó por medio de la estructura interna y de las dimensiones que surgieron durante el estudio. Participaron en esta investigación 572 estudiantes inscritos en cursos ofrecidos en entornos virtuales de aprendizaje. El instrumento de investigación que se elaboró se constituyó en una escala con cuarenta y cinco ítems. El análisis de los datos recabados presentó una estructura de cinco dimensiones, todas con índices aceptables de consistencia interior, demostrado la validez de la escala y sus propiedades psicométricas. Se recomiendan estudios adicionales para revisar y perfeccionar los ítems de la escala presentada. Se espera que los resultados aporten contribuciones a los educadores y psicólogos que investigan cuestiones tratadas en este estudio.

PALABRAS CLAVE

escala psicométrica; aprendizaje en entornos virtuales; motivación; educación a distancia.

The realization of the educational process, whether in classrooms or online, results from interdependent and dialectic movements between teaching and learning. Studies of psycho-educational themes indicate that the realization of interactive and complementary actions, which take place between the teaching and learning processes, require that both teachers and students understand and use strategies (Anastasiou; Alves, 2004; Oliveira; Boruchovitch; Santos, 2010).

In relation to teaching strategies, these are emphasized by authors such as Anastasiou and Alves (2004) and Okane and Takahashi (2006) as intentional routes and actions, previously organized by the teacher, designed to help students to learn. Bzuneck (2010) emphasizes that these actions are fundamental to the promotion and maintenance of students' motivation in learning situations.

In this perspective, Bzuneck (2010) presents four categories of teaching strategies that help to motivate students to learn: the attribution of meaning and relevance to the academic/school tasks; the identification and use of motivating tasks and activities; the use of embellishments such as computers, games, manipulation of objects and the introduction of novelties; and pedagogical actions that guide the tasks undertaken. The use of challenging activities, the monitoring of the tasks undertaken by the students with evaluative feedback, the appropriate use of digital technology resources, and procedures for working with heterogeneous classes, among others, are some of the teaching strategies listed by the author.

In online education, the strategies are mediated through the use of interactive tools such as forums, chat rooms, email and others (Reis, 2009). These tools are commonly made available in virtual learning environments (VLEs). VLEs, also known as Learning Management Systems (LMS), are described by Silva (2003) as virtual spaces that integrate various interactive tools such as chat rooms, forums, email, blogs and others that contribute to the teaching strategies adopted and can intensify the possibilities of classroom education and make viable the psycho-educational processes conducted in online conditions.

This being the case, in the educational scenario mediated by VLEs, the educational strategies should give priority to interlocution between teachers, students and content/information made available in the environment, the strengthening of the perception of a bond, and the development of skills directed towards the monitoring of the learning, the management of the study time, and autonomy (Badia; Monereo, 2010; Mauri; Onrubia, 2010; Palloff; Pratt, 2002; Prado; Almeida, 2007).

Teaching strategies have a significant role in students' academic performance, but this performance is also influenced by the learning strategies used and understood by the students (Oliveira; Boruchovitch; Santos, 2010; Reeve *et al.*, 2004). Boruchovitch (1999) conceptualizes learning strategies as previously-planned behaviors that are directed towards complying with an educational task or to solving a specific learning problem or situation.

Studies undertaken by authors such as Dembo (1994), Boruchovitch (1999) and Oliveira, Boruchovitch and Santos (2010) categorize learning strategies in two large groups: those which are cognitive, and those which are metacognitive. The cognitive strategies act directly in the processes of organizing, storing and processing

information, while the metacognitive strategies design the students' actions, in a conscious and self-regulated way, which provide them the opportunity to plan, monitor and regulate their own thinking (Dembo, 1994). According to Dembo (*idem*), the metacognitive strategies are more complex than the cognitive strategies, given that these strategies deal with the management of the knowledge students have of themselves and of the processes that they undertake to learn.

According to authors such as Monereo (1990) and Veiga Simão (2004) it is necessary to invest in didactic actions that help students to learn, think and study, because studies by these authors indicate that many students have a restricted understanding of learning strategies and use them inappropriately. Thus, actions such as self checking, selection of principal ideas, processing of information, management of time, resources and the study environment, and regulation of the effort employed by the student, among others, have been the focus of investigation in psycho-educational studies, both in conditions of classroom and online education (Badia; Monereo, 2010; Zamora; Rubilar; Ramos, 2004).

Another relevant aspect in online education refers to the motivational dimension, given that continuing in the course and the effort to complete the tasks depend, to a large extent, on the students themselves (Guimarães; Bzuneck, 2008; Palloff; Pratt, 2002). According to Bzuneck (2001), motivation – an internal and complex construct that guides, alters and or maintains actions, goals and preferences – is one of the main determinants for the success and quality of learning in the school environment. Bzuneck understands that motivating students is not a simple task, and can be realized by a teacher based on intuition or information derived from common sense. For this reason, it is necessary to identify and apply effective teaching strategies (Bzuneck, 2010).

The scientific literature has traditionally characterized motivation in two main lines: intrinsic and extrinsic motivation. Intrinsic motivation is described by Bzuneck and Guimarães (2010) as a natural tendency to exercise one's own skills through challenges, in the search for novelty, through interest and satisfaction in realization of the task itself. Extrinsic motivation is characterized by behavior aimed at achieving a desired objective, such as, for example, rewards or awards, or even at impeding undesirable events such as, for example, punishments (Bzuneck; Guimarães, 2010; Rufini; Bzuneck; Oliveira, 2011).

In the 1970s, Edward Deci and Richard Ryan elaborated the theory of self-determination, to investigate the elements that constitute intrinsic and extrinsic motivation, and the factors that determine their promotion. This theory understands the human being as an active individual, who tends naturally to healthy growth and self-regulation (Deci; Ryan, 2000). In self-determination theory, the involvement of the individual in learning activities seeks to meet three basic and universal psychological needs: autonomy, competence and belonging and establishing bonds (Bzuneck; Guimarães, 2010).

Bzuneck and Guimarães (2010) report that the results of the studies conducted with self-determination theory overcome the dichotomy that defined motivation as either intrinsic or extrinsic, given that they identified various types of regulation of human behavior, which is subject to perceived levels of autonomy

and self-determination. In this understanding, the theory of self-determination proposes a continuum of internalization of external regulations that gradually pass through the four types of extrinsic motivation until they reach intrinsic motivation, considered to be the most self-regulated and autonomous level. This continuum also considers demotivation, understood as the absence of motivation (Bzuneck; Guimarães, 2010; Deci; Ryan, 2000; Rufini; Bzuneck; Oliveira, 2011).

The four types of extrinsic motivation consider the following regulations: the external (regulated by external controllers), the introjected (the controllers are internal and respond to the questions internalized by the individual), the identified (a certain level of autonomy is perceived, addressing the questions internalized by the student), and the integrated (characterized as the most autonomous type of extrinsic motivation). According to self-determination theory, all behavior is intentional and may be guided by autonomous motivation or by controlled motivation (Rufini; Bzuneck; Oliveira, 2011).

Autonomous motivation encompasses the regulations identified and integrated and the intrinsic motivation. This motivational category is characterized by actions undertaken through a student's own initiative, which, in turn, was personally accepted, or to which the individual conferred importance or value. Controlled motivation is represented by the external and introjected regulations and designates the actions that the students conduct to address the pressures from external events (deadlines to comply with, rewards and others) or internal events (flight from unpleasant feelings, such as guilt or anxiety or, even those related to self-esteem) (Bzuneck; Guimarães, 2010).

In recent years, it has been possible to observe a slight increase in the number of studies about motivation for learning in virtual learning environments (VLEs) (Chen; Jang, 2010; Fiúza; Sarriera; Bedin, 2013; Giesbers *et al.*, 2013; Hartnett; George; Dron, 2011; Sørebo *et al.*, 2009; Xie; Durrington; Yen, 2011). These studies have investigated the existence of a correlation between students' motivation for learning and the different dimensions, such as contextual support, autonomy, competence, academic performance, and engagement involved in the undertaking of the specified tasks with the use of interactive tools, among others.

It is not easy to promote students' motivation to learn, since this requires knowledge and the use of effective teaching strategies (Bzuneck, 2010; Reeve *et al.*, 2004). In this regard, Prado and Almeida (2007) warned that teachers must recognize that online education is not restricted to the virtualization of classroom practices, and emphasize that reducing this educational mode to the mere didactic transposition of the strategies adopted in on-site conditions leads to negative implications in the organization and recovery of information and in forms of communicating.

In this perspective, Palloff and Pratt (2002) and Prado and Almeida (2007), evidence the importance of strategies for online teaching that provide students with opportunities to manage resources, time, and study environments. Palloff and Pratt (2002) emphasize that the use of such strategies helps students to avoid situations that may be commonly observed in virtual environments: the phenomenon of infoglut (unnecessary overloading with information and tasks), procrastination for

undertaking activities, and the anxiety caused by waiting for responses to messages posted, or evaluative feedback.

Among the few studies existing at the time of writing, referent to learning strategies used by studies in VLE, emphasis is placed on investigations undertaken by Zerbini and Abbad (2008) and Tsai (2009). These researchers undertook studies seeking to validate scales for measuring self-regulatory learning strategies, such as: controlling emotion, monitoring understanding, and seeking help, among others.

In the study undertaken by Zerbini and Abbad (2008), data collection took place through a digitalized instrument, made available in an online environment, which investigated the dimensions of control of emotion and of motivation and monitoring of understanding. Subsequently, the study undertaken by Tsai (2009) also presented the elaboration of an instrument, the Online Learning Strategies Scale (OLSS), geared towards the evaluation of the following dimensions: the skill of perception, affection, and self-regulation. The results obtained in these studies led to the validation and reliability of both scales.

These considerations indicate that the specific characteristics of online education require professors to adopt didactic actions that assist in the use of strategies for managing what is learned. These strategies contribute to the promotion of autonomous motivation, which allows students to consciously protagonize their own learning. Given this situation, the acquisition of information that enhances study and assessing the teaching and learning strategies and motivation in VLEs is considered paramount to the quality of the educational processes mediated by virtual environments.

This being the case, this study proposes to construct and raise evidence of the validity of the scale for teaching strategy, learning and motivation for learning in virtual educational environments (EEAM-AVA) aimed at higher education students. The evidence of its validity was investigated through the internal structure and the correlation among the dimensions shown in the scale.

METHOD

PARTICIPANTS

A total of 572 students participated who were enrolled in courses mediated through VLEs, offered in conditions that combine classroom and distance learning. The students' mean age was 40 years and eight months ($SD = 7.96$), with a minimum age of 23, and a maximum of 67. Women represented 95.8% ($n = 548$) and men, 4.2% ($n = 24$). The students originated from undergraduate courses in pedagogy – Group 1 ($n = 544$; 95.1%), university extension courses in history – Group 2 ($n = 7$; 1.2%) and continuous training for teachers in a municipal school system – Group 3 ($n = 21$; 3.7%). The courses took place in the Brazilian state of Paraná.

The samples studied were selected by convenience. In both institutions – the university and municipal school system – the courses provided were mediated by the free Modular Object-Oriented Dynamic Learning Environment platform (Moodle).

INSTRUMENT

To evaluate students, Beluce and Oliveira (*apud* Beluce, 2012) developed the scale for teaching strategy, learning and motivation for learning in virtual educational environments (EEAM-AVA). It is important to clarify that the premises of self-determination theory (Deci; Ryan, 2000) supported the elaboration of the items used to evaluate motivation. The construction of the items related to learning strategies was based on the categorization undertaken by Dembo (1994) and Boruchovitch (1999). Finally, the production of the items consistent with the teaching strategies was understood in the light of the considerations raised by authors such as Palloff and Pratt (2002), Prado and Almeida (2007), Bzuneck (2010) and Mauri and Onrubia (2010).

The scale is made up of 45 items, which deal with issues related to teaching strategies (10 items), learning strategies (10 items) and motivation for learning (25 items) in virtual learning environments. The alternatives proposed were part of a three-point Likert scale that sought to measure the frequency with which the students identified: the efficiency of the teaching strategies used by the instructor/tutor: the learning strategies that they used, and their motivation for learning in these environments.

The three options were established as “always”, “sometimes”, and “never”. A value of 2 was attributed to “always”, a value of 1 to “sometimes”, and a value of 0 to the option “never”. The dimensions – motivation, learning strategies and teaching strategies – evaluated by the instrument are independent dimensions. As a result, the individual’s total score on the scale is not established.

The questionnaire constructed for the use of this study underwent a content validation procedure, and obtained an agreement of 80% among seven judges who are specialists in different areas. Of these judges, three were Ph.D researchers in the issue of motivation for learning, two were Ph.Ds who study learning strategies, and two judges focus their research on teaching strategies in virtual learning environments, one has a M.A and the other a Ph.D.

PROCEDURES

This study was based on Resolution 196/96 and on complementary measures of the Brazilian National Health Council. The teaching institutions selected for this study were contacted and the project forwarded to the Research Ethics Committee of a public state university in Paraná State which, under protocol 30,520/2011, approved and issued the appropriate authorizations.

The research instrument, containing the terms of free and informed consent, was made available over the Internet. To provide the participants with access to the link to this instrument, the homepage and email of the course’s virtual environment were used. These procedures ensured that access to the questionnaire was gained only by students in the courses studied. It is emphasized that the students accessed the pages with questions from the scale only after filling out the selection box that requested authorization to participate in the study.

The data collection procedure was undertaken in three stages. The first involved the participation of persons taking a continuing education course for primary school teachers in a municipal school system; the second and third stages involved the participation of course members from a public higher education institution, in the case of the second, they were participants in a pedagogy course, and, in the third, they were from a university extension course offered by the history department.

For better operationalization of the objectives, the data were organized on an electronic spreadsheet and were subjected to analysis. As a result, the analysis of the inferential statistics (exploratory factorial analysis and proof of correlation) and descriptive statistics (means and standard deviation) was undertaken to meet the objectives proposed by the study.

RESULTS

The exploratory factorial analysis was conducted to identify the dimensions that compose the scale. To do so, Bartlett's sphericity test was conducted, which is used to verify the viability of the application of the exploratory factorial analysis, which presented a correlation between the items ($\chi^2 [990; N = 572] = 5173.036; p < 0.001$), that is, an indication of suitability for the use of the factorial analysis. The Kaiser-Meyer-Olkin (KMO) index ascertained the sample's measure of suitability, which presented a result of 0.791.

Based on the factorial analysis, which considered principal components and varimax rotation, the authors obtained a structure of six dimensions for the scale applied, which presented eigenvalues above 1.0 and made it possible to explain 36.15% of the total variance. Thus, the dimensions were distributed as follows:

- a) Dimension 1: teaching strategies, with 9 items (1, 3, 4, 5, 6, 7, 8, 9 and 10);
- b) Dimension 2: autonomous motivation, with 5 items (36, 39, 40, 43, 44),
- c) Dimension 3: cognitive and metacognitive learning strategies, with 6 items (11, 13, 14, 16, 17, 18),
- d) Dimension 4: controlled motivation, with 6 items (21, 22, 23, 27, 32, 35),
- e) Dimension 5: demotivation, with 4 items (28, 29, 37, 41) and
- f) Dimension 6: monitoring of the learning, with 2 items (19 and 20).

After the factorial analysis, the scale which was initially composed of 45 items, was established with a total number of 32 items. The reduction is justified because the 13 items removed carried a theoretically-noncongruent dimension (24, 25, 26, 30, 31, 38 and 42) or did not present a factorial load index (02, 12, 15, 33, 34 and 45). The excluded items and their correspondent factorial loads are presented in Table 1.

Items 24 and 31, representing autonomous motivation, entailed both dimension 1, referent to teaching strategies, and dimension 3, concerning learning strategies. A similar situation was found for item 26, which also concerns autonomous motivation, which, after factorial analysis simultaneously entailed dimension 3 (learning strategies) and dimension 2 (representing controlled

motivation). Regarding suppression of items 25 and 30, which dealt with autonomous motivation, and items 38 and 42, representing controlled motivation, the analysis revealed that both the first and second items cited were scored in dimension 3, addressing the grouping of the learning strategies.

Table 1 – Excluded items and their correspondent factorial loads

Item	Question	Type	Factorial Load
24	I participate in the discussion forums because the debates help deepen my understanding of the contents studied.	Autonomous motivation	0.403 / 0.437
25	I undertake the activities proposed in the course environment because they encourage reflection on my pedagogical practice.	Autonomous motivation	0.432
26	I participate in the group activities because they are opportunities to broaden my knowledge.	Autonomous motivation	0.424
30	I follow the guidance on content and activities proposed because I believe that participating in and attending the course's environment are necessary to learning.	Autonomous motivation	0.396
31	I comment in the debates held in the discussion forums for the pleasure of involvement in interesting discussions with professors and colleagues.	Autonomous motivation	0.356 / 0.470
38	I enrolled in this course because I want to show myself that I am capable of participating in courses offered in virtual environments.	Controlled motivation	0.507
42	I enrolled in this course because, when I am participating in academic activities, I feel that I am important.	Controlled motivation	0.513

Source: Data base of the study
Preparation of the authors.

The results that indicate the distribution of the items by dimension in accordance with the factorial loads and, further, the respective values of these subscales based on the Cronbach alpha, may be observed in Table 2. These rates were obtained using the extraction method, which considers the analysis of the main components, and by the varimax rotation, with Kaiser normalization.

Although the items which made up the dimension of learning strategies were grouped with theoretical coherence, the Cronbach alpha value was not considered acceptable. For this reason, a further analysis was undertaken. Bartlett's Sphericity test was applied once again, because it is used to verify the viability of application of the exploratory factorial analysis, which presented a correlation between the items ($\chi^2 [276; N = 572] = 2557, 809; p < 0.001$). that is, the indication of suitability for use of the factorial analysis. The Kaiser-Meyer-Olkin (KMO) index ascertained the measure of suitability of the sample, which presented a result of 0.795.

Table 2 – Distribution of the items by factor, and their respective factorial loads

Item	Question	1	2	3	4	5	Total value subscale
1	The sending and receiving of messages, undertaken since the beginning of the course, has contributed to bringing together colleagues and professors/tutors.	.585					1 Teaching strategies $\alpha = 0.75$
3	The questions proposed on the discussion forums lead to observation, analysis and reflection on the content proposed and on my professional practice.	.596					
4	Sharing – on the discussion forums – my professional experiences with colleagues and professors, based on content worked with in the course, contributed to new learning.	.544					
5	Feedback to my questions and requests occurs within an appropriate time and assists understanding the content and undertaking of the activities.	.614					
6	Reporting in the logbook the strategies that I use in the course for understanding new knowledge helps me reflect on my learning.	.572					
7	The evaluative feedback sent by the instructor/ professor, referring to the activities that I undertake is clear, precise and provides guidance.	.595					
8	The conversations held in the chat rooms are essential for interaction with colleagues and teachers.	.373					
9	Guidance for the appropriate use of the material and tools of the virtual environment, made available at the start of the activities, facilitates familiarization with the educational dynamic of the course.	.564					
10	The selection and organization of the content and activities proposed during the course avoid overloading with information and tasks.	.554					
36	I seek to interact with colleagues and professors and make use of the content provided in the course environment because studying is a source of satisfaction for me.		.470				
39	I participate in this online course because studying is important to me.		.681				
40	I am enrolled in this course because I believe that this study will contribute to my professional competence.		.584				
43	I'm undertaking this course because I consider that studying is a privilege.		.602				
44	I am participating in this course because I know that I need to update my knowledge to undertake my professional practice.		.653				

(continued...)

(...continuation)

Item	Question	1	2	3	4	5	Total value subscale	
21	I participate in the debates and discussions proposed on the discussion forum because I am evaluated.			.574			3 Controlled motivation	$\alpha = 0.68$
22	I participate in the virtual courses because I can get a salary raise.			.614				
23	I comment during chats and discussion forums because it is what is expected of me.			.601				
27	I undertake the reading activities for the texts indicated because I am required to.			.544				
32	I make comments during meetings held in the chat rooms because I want to avoid people considering me to be absent or an unproductive student.			.606				
35	I participate in the activities, debates and virtual meetings because I want to receive a certificate.			.621			4 Demotivation	$\alpha = 0.63$
28	I feel that I really don't know why I am taking this course.				.585			
29	I enroll in virtual courses because I believe that I will not have many tasks to undertake.			.366	.356			
37	I believe that participating in this course is a waste of time.				.654			
41	I honestly don't know why I'm still accessing this course's page.				.711		5 Monitoring of learning	$\alpha = 0.66$
19	I realize that I have had difficulty understanding the content worked on during the course.					.719		
20	I realize that I had difficulty in developing comments on the issues discussed in the forums or chatrooms.					.782		

Source: Data base of the study.
Preparation of the authors.

After a second analysis, which excluded the items in the learning strategies dimension, the results obtained confirmed the alpha of the other dimensions checked in the first analysis. As a result, the scale was made up of five dimensions, namely:

- a) dimension 1 – teaching strategy;
- b) dimension 2 – autonomous motivation;
- c) dimension 3 – controlled motivation;
- d) dimension 4 – demotivation; and
- e) dimension 5 – monitoring of the learning.

The initial expectation was that the scale would present five dimensions after the factorial analysis: teaching strategies, autonomous motivation, controlled motivation, demotivation and learning strategies. However, two results guided the

final structure of the scale presented, namely: the dimension of learning strategies, which groups eight of the 10 items foreseen in the preparation of the instrument and did not have an acceptable Cronbach alpha value; and the remaining items (two) of the above-mentioned dimension, which grouped a specific dimension made up of strategies for monitoring learning.

The level of the lowest factorial load presented was 0.37, and the highest was 0.78. The Cronbach alpha of the total scale was not calculated, since it was understood that this involves separate constructs; for this reason the analysis was based on the alpha of each subscale.

Once the dimensions that make up the scale and their factorial loads mentioned above were identified, the descriptive statistical analysis sought to investigate the evidence for validity for the scale, based on the dimensions that emerged, that is, teaching strategies, autonomous and controlled motivation, demotivation and monitoring of the learning. The analysis of the data collected for dimension 1 dealt with the teaching strategies indicated by the students as effective in the educational process mediated by virtual learning environments. The results found for the above-mentioned dimension – which was composed of 9 items and a total of points with a possibility for variation between 0 and 27 – a mean of 11.81 ($SD = 2.61$), a minimum score of 3 ($n = 5$; 0.9%), a maximum of 16 ($n = 35$; 6.1%) and also a rate of $n = 2$ (0.3%) for responses that were not considered.

Regarding the results obtained for dimension 2 – autonomous motivation, established as 5 items and with a total of points varying between 0 and 15, these presented a mean of 9.22 ($SD = 1.24$), a maximum score of 10 ($n = 346$; 60.5%) and a minimum score of 2 points ($n = 1$; 0.2%). The analysis that investigated the data generated for dimension 3 – controlled motivation, made up of 6 items, found that its total score could vary from 0 to 18 points, the maximum score presented was 12 ($n = 4$; 0.7%), the minimum score was 0 ($n = 21$; 3.7%) and the mean was 5.07 ($SD = 2.62$).

In relation to the results presented for dimension 4 – demotivation, which combined 4 items on the scale and indicated a score varying between 0 and 12, the results revealed a significant mean of 0.40 ($SD = 0.95$), a minimum score of 0 ($n = 449$, 78.5%) and a maximum score of 8 ($n = 2$; 0.3%). Dimension 5 – monitoring of the learning, which joined 2 items with scores varying from 0 to 6 in the total score, presented a mean of 2.15 ($SD = 0.90$), a minimum score of 0 ($n = 28$; 4.9%) and a maximum score of 4 ($n = 55$; 9.6%). The Pearson correlation was then used to conduct the analysis that investigated the correlation between the dimensions mentioned.

To analyze the correlational data obtained, the following values were adopted: 0.10 as the low magnitude; between 0.10 and 0.30 for moderate magnitude; and correlations equal to or superior to 0.50 considered as the high magnitude. The results obtained based on this analysis may be verified in Table 3.

The results arising from the analysis that ascertained the correlation existing between the dimensions of teaching and learning strategy, and autonomous motivation demonstrated a moderate positive correlation. A low negative correlation was also identified between the dimensions of demotivation and teaching strategies, and the absence of a correlation between the later and the dimensions of controlled motivation and monitoring of the learning.

Table 3 – Rates referent to the correlations existing between the teaching strategies, the learning strategies, and the motivation of the students for learning in VLEs.

r	1 Teaching Strategy	2 Autonomous Motivation	3 Controlled Motivation	4 Demotivation	5 Mon. Of Learning
1 Teaching Strategy	1	.285**	-.035	-.103*	-.081
2 Autonomous Motivation	.285**	1	-.020	-.160**	-.041
3 Controlled Motivation	-.035	-.020	1	.342**	.101*
4 Demotivation	-.103*	-.160**	.342**	1	.149**
5 Monit. Of the Learning	-.081	-.041	.101*	.149**	1

** Significant correlation at the level of $\alpha=0.01$

* Significant correlation at the level of $\alpha=0.05$

Source: Data base of the study.

Preparation of the authors.

A relatively low negative correlation was found between the scores of the dimensions of autonomous motivation and demotivation. Also ascertained was the absence of correlation in the results of the analysis that dealt with the correlation between the dimension of autonomous motivation and the dimensions of controlled motivation and monitoring of the learning.

Regarding the analysis that investigated the correlation between the dimensions of controlled motivation and demotivation, the results indicated a relatively strong positive correlation. On the other hand, the results checked from the analysis of the correlation between the dimension of monitoring of learning and the dimensions of controlled motivation and demotivation indicated positive rates of low magnitude.

DISCUSSION

The study, which was based on the investigation and analysis of the data of the internal structure of the scale and of the correlation between the dimensions that compose it, demonstrated that the psychometric properties of the EEAM-AVA scale could be verified. As described, the first factorial analysis undertaken in this study indicated a structure of six dimensions for the scale, namely: teaching strategies, autonomous motivation, controlled motivation, learning strategies, demotivation and monitoring of the learning. However, the results obtained for the dimension of learning strategies ($\alpha=50$) did not present acceptable levels of internal consistency.

The possibility that this result would occur was considered as a possible limitation of this study, given that the complexity inherent to this dimension makes it difficult to be measured (Moreira, 1999). It is also thought that the student participants may have found certain difficulties identifying the learning strategies

used in courses/disciplines mediated by VLEs, given that the students' experience in this educational context is still incipient when compared with their experiences with classroom education. This interpretation is supported by the considerations presented by Dembo (1994), Monereo (1990) and Veiga Simão (2004), among others, who report the incipient knowledge that many students have regarding their own learning strategies, regarding classroom educational situations; that is, many students still have difficulty in understanding, identifying and using these strategies even in teaching environments considered familiar.

As a viable alternative, and based on the work of authors indicated in this study (Badia; Monereo, 2010; Boruchovitch, 1999), the need can be identified for further studies that consider the textual re-elaboration of the items of the dimension of learning strategies. These questions should give greater emphasis to examples that seek to indicate how the interactive tools, which integrate the virtual environments, were used in putting the strategies into effect, such as: requesting help, organizing the study environment and time for undertaking the tasks, raising and recording relevant information, selection of main ideas and monitoring and regulation of the learning. This textual re-elaboration allows a larger amount of information and, thus, a detailed understanding of the use of learning strategies by the student who participates in online courses/disciplines.

The second factorial analysis by principal components and varimax rotation confirmed the structure of five dimensions for the scale and, based on the Cronbach alpha, these dimensions' respective values were presented. The alpha values obtained revealed rates of internal consistency for each one of the dimensions structuring the scale, indicating the validity of the scale and its psychometric properties. It is emphasized that the results presented in this analysis demonstrated the suppression of the dimension of learning strategies, whose scores, once again, did not achieve acceptable rates of internal consistency.

In relation to the analysis of evidence of correlation between the dimensions which made up the scale, evidence was shown for the rates found referent to the positive moderate correlation between the dimensions of autonomous motivation and teaching strategies and to the negative correlation between the latter and demotivation. A tendency is observed here that indicates the contributions of the adoption of teaching strategies that motivate the promotion of the student's autonomous motivation. These results are in keeping with those found in the study undertaken by Reeve *et al.* (2004), which identified that the didactic actions of the professors significantly influence the self-determined behavior of the student.

The analysis also revealed significantly low and negative correlational rates between the dimensions of autonomous motivation and demotivation. On the other hand, between the dimensions of demotivation and controlled motivation, the results revealed a relatively strong positive correlation. These rates resemble those of results achieved in studies based on the proposals of the motivational continuum of the self-determination theory, therefore reaffirming this theoretical proposal and, as a consequence, the evaluative properties of the subscales corresponding to the constructs of motivation and demotivation. Similar results were found in the study

undertaken by Guimarães and Bzuneck (2008), which investigated the psychometric property of a scale for measuring university students' motivation for learning.

It is also appropriate to emphasize the results that indicated behavior regulated by autonomous motivation for the majority of the students who participated in the online courses researched. This suggests that the students perceive themselves to be motivated to some degree, whether through aggregating personal values to the requested task or to the satisfaction achieved for undertaking the activity itself, to participate in educational situations mediated by virtual environments (Bzuneck; Guimarães, 2010).

In relation to correlational analysis undertaken between the dimension of monitoring of learning and the other dimensions checked by the scale, the results revealed did not find correspondence with the theoretical understanding presented in relation to this construct. It is worth remembering that monitoring of the learning is indicated by authors such as Dembo (1994), Boruchovitch (1999), Veiga Simão (2004) and others, as one of the subcategories that integrate the construct of learning strategies.

In this regard, one can consider that, although the items that compose this dimension received the score's highest alpha rates, it is possible that failures in the textual elaboration of the statements may have interfered in the interpretation of the items proposed. This difficulty in interpretation is combined with the possibility that the student has limited knowledge about monitoring of the learning, as mentioned above, in the discussion about the items that made up the dimension of learning strategies, suppressed in the second factorial analysis undertaken in this study. The rates found suggest that the items grouped for monitoring of the learning must be restructured and applied again, to identify the representative questions of the dimension mentioned.

In general, it is believed that the results achieved are relevant, since they broaden the set of information needed to investigate questions related to strategies of teaching and monitoring of learning, and to the motivation of students for learning in virtual learning environments. However, additional actions are needed that give priority to refining the questions proposed in the scale and the importance of further studies that help to raise the levels of the EEAM-AVA scale's psychometric accuracy.

FINAL CONSIDERATIONS

New forms of learning and, consequently, new forms of teaching are required by the insertion and popularization of new technologies in society. Efforts to meet the growing demand of students for higher education and or continuous professional training has popularized the use of virtual learning environments. Virtual learning environments have specific characteristics, such as flexible schedules, geographical distance and access to a large quantity of information, requiring the teacher to use teaching strategies that help students to adopt autonomous positions in which they are responsible for their learning. The commitment and the effort to regulate learning are actions of the students who demonstrate motivated behavior for learning.

In this context, this study met the initially proposed objectives, revealing results that indicate the evidence of the validity of the scale for teaching strategy, learning and motivation for learning in virtual educational environments (EEAM-AVA). Nevertheless, there are certain issues that indicate this study's limitations.

These limitations are highlighted by the results that reveal the need for additional revisions, notably, of those issues that deal with the re-elaboration of the items that sought to assess the strategies for monitoring the learning used by the students. It can be debated that a textual re-elaboration that presents more detailed information about the use of strategies for monitoring learning by students who participate in courses and disciplines in virtual environments could improve the questions concerning this dimension. In this way, it is considered that it may be possible to make viable the evaluation and understanding of the correlations that are established between this construct and the other dimensions that compose the scale.

Even so, it was possible to identify that the scale for teaching strategy, learning and motivation for learning in virtual educational environments (EEAM-AVA) presented the prerequisites necessary to serve as a diagnostic means for measuring teaching and learning strategies and the motivation of students in virtual learning environments. As a result, it is expected that the results achieved in this study can help professors and psychologists in future studies that seek to investigate and, consequently, qualify the educational process in online teaching conditions.

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