# Virtual learning object and environment: a concept analysis

*Objeto e ambiente virtual de aprendizagem: análise de conceito*

*Objeto y ambiente virtual de aprendizaje: análisis de concepto*

**Pétala Tuani Candido de Oliveira Salvador[I,II], Manacés dos Santos Bezerril[I,II],**
**Camila Maria Santos Mariz[II], Maria Isabel Domingues Fernandes[III], José Carlos Amado Martins[III],**
**Viviane Euzébia Pereira Santos[I,II]**

[I] *Universidade Federal do Rio Grande do Norte, Postgraduate Program in Nursing. Natal, Rio Grande do Norte, Brazil.*
[II] *Universidade Federal do Rio Grande do Norte, Research Group and Laboratory of Investigation in Care, Safety, and Health and Nursing Technologies. Natal, Rio Grande do Norte, Brazil.*
[III] *Escola Superior de Enfermagem de Coimbra, Scientific-Pedagogical Unit of Medical-Surgical Nursing. Coimbra, Portugal.*

**ABSTRACT**
**Objective:** To analyze the concept of virtual learning object and environment according to Rodgers' evolutionary perspective. **Method:** Descriptive study with a mixed approach, based on the stages proposed by Rodgers in his concept analysis method. Data collection occurred in August 2015 with the search of dissertations and theses in the Bank of Theses of the Coordination for the Improvement of Higher Education Personnel. Quantitative data were analyzed based on simple descriptive statistics and the concepts through lexicographic analysis with support of the IRAMUTEQ software. **Results:** The sample was made up of 161 studies. The concept of "virtual learning environment" was presented in 99 (61.5%) studies, whereas the concept of "virtual learning object" was presented in only 15 (9.3%) studies. **Conclusion:** A virtual learning environment includes several and different types of virtual learning objects in a common pedagogical context.
**Descriptors:** Educational Technology; Teaching Materials; Concept Formation; Research; Technology.

**RESUMO**
**Objetivo:** Analisar o conceito de objeto e de ambiente virtual de aprendizagem na perspectiva evolucionária de Rodgers. **Método:** Estudo descritivo, de abordagem mista, realizado a partir das etapas propostas por Rodgers em seu modelo de análise conceitual. A coleta de dados ocorreu em agosto de 2015 com a busca de dissertações e teses no Banco de Teses e Dissertações da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Os dados quantitativos foram analisados a partir de estatística descritiva simples e os conceitos pela análise lexicográfica com suporte do IRAMUTEQ. **Resultados:** A amostra é constituída de 161 estudos. O conceito de "ambiente virtual de aprendizagem" foi apresentado em 99 (61,5%) estudos, enquanto o de "objeto virtual de aprendizagem" em apenas 15 (9,3%). **Conclusão:** Concluiu-se que um ambiente virtual de aprendizagem reúne vários e diferentes tipos de objetos virtuais de aprendizagem em um contexto pedagógico comum.
**Descritores:** Tecnologia Educacional; Materiais de Ensino; Formação de Conceito; Pesquisa; Tecnologia.

**RESUMEN**
**Objetivo**: Analizar el concepto de objeto y de ambiente virtual de aprendizaje en la visión evolutiva de Rodgers. **Método**: Estudio descriptivo de abordaje mixto, realizado a partir de las etapas propostas por Rodgers en su modelo de análisis conceptual. Datos recolectados en agosto de 2015, sobre búsqueda de disertaciones y tesis en Banco de Tesis y Disertaciones de la Coordinación de Perfeccionamiento de Personal de Nivel Superior. Los datos cuantitativos fueron

analizados mediante estadística descriptiva simple, y los conceptos, por análisis lexicográfico con soporte IRAMUTEQ. **Resultados**: La muestra estuvo constituida por 161 estudios. El concepto de "ambiente virtual de aprendizaje" estuvo presente en 99 estudios (61,5%); mientras que el de "objeto virtual de aprendizaje", sólo en 15 (9,3%). **Conclusión**: Se concluye en que un ambiente virtual de aprendizaje reúne varios diferentes tipos de objetos virtuales de aprendizaje en un contexto pedagógico común.

**Descriptores**: Tecnología Educacional; Materiales de Enseñanza; Formación de Concepto; Investigación; Tecnología.

CORRESPONDING AUTHOR     **Pétala Tuani Candido de Oliveira Salvador**          E-mail: petalatuani@hotmail.com

## INTRODUCTION

In the context of technological advances, educational institutions face emerging challenges: the need for meeting demands of the information society; and a new learning population characterized as digital students, for instance[1].

Therefore, contemporary needs require universities that understand the outstanding importance of dynamic, flexible, cooperative, personalized, and interactive educational models[2].

The challenge is to enable students to become political, social, and intellectual beings, in a free and independent way. For this purpose, going beyond classroom walls is needed, with the development of innovative pedagogical proposals[3].

In this outlook, the development of information and communications technologies (ICTs) has led to innovations in the teaching-learning process. The integration of new technologies in education allows professors to create and recreate learning materials based on a combination of interactive multimedia resources[4].

In addition, the integration of digital learning with ICTs reduced significantly the barrier to innovative education and helped to overcome time and space as restrictions in traditional teaching models, thus moving students from passive reception of knowledge to more active learning approaches[4].

Incorporating technological innovations into education constitutes a reality and requirement for teaching environments. However, this process should not occur far from pedagogical reflections and development of appropriate educational materials.

Regarding educational materials that integrate ICTs, virtual learning objects (VLOs) and virtual learning environments (VLEs) stand out, which are widely glimpsed as potential support tools for the teaching-learning process[5-6].

These tools must be understood in their essence, so their incorporation into the teaching environment is in accordance with pedagogical approaches required for innovative teaching.

For this purpose, it is relevant to carry out a conceptual analysis based on Rodgers' evolutionary method[7], which considers contextual aspects as influencing concept.

This cyclical process considers that the meaning of a specific concept depends on its use and application, and is carried out by three elements: meaning, use, and application[7].

Therefore, the present study tries to respond to the following research questions: How are the concepts "virtual learning object" and "virtual learning environment" used in Brazilian scientific productions? What is the contextual base, substitute terms, and concepts associated with "virtual learning object" and "virtual learning environment" according to Rodgers' evolutionary perspective?

The objective of the present study was to analyze the concept of virtual learning object and environment according to Rodgers' evolutionary perspective.

## METHOD

### Ethical aspects
Ethical approval was not required for this study, since it used public domain documents.

### Theoretical-methodological framework and type of study
A descriptive study with a mixed approach was carried out based on the stages proposed by Rodgers[7] in his concept analysis method: 1) to define the concept of interest; 2) to select the field for data collection; 3) to highlight the attributes of the concept and contextual bases (antecedents and consequences); 4) to analyze the characteristics of the concept (substitute terms and related concepts); 5) to identify, if necessary, an example of a concept; and 6) to determine the implications of the concept.

"Virtual learning environment" and "virtual learning object" were defined as concepts of interest.

### Methodological procedures

#### Data source
The data collection source was the Bank of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES, as per its acronym in Portuguese), which is a database that gathers dissertations and theses developed in Brazil. These monographs were chosen as field for data collection, because they are studies that present more detailed theoretical discussions on the theme.

#### Data collection and organization
Data collection occurred in August 2015 by means of two searches in the field "subject", resulting from the combination of the controlled descriptor "Educational Technology" with the non-controlled descriptors "Virtual Learning Environment" and "Virtual Learning Object".

Full scientific productions related to the theme, available online, were included. The following stages were carried out: analysis of titles and abstracts; exclusion of duplicate studies; search of the full version; and full reading (Figure 1).
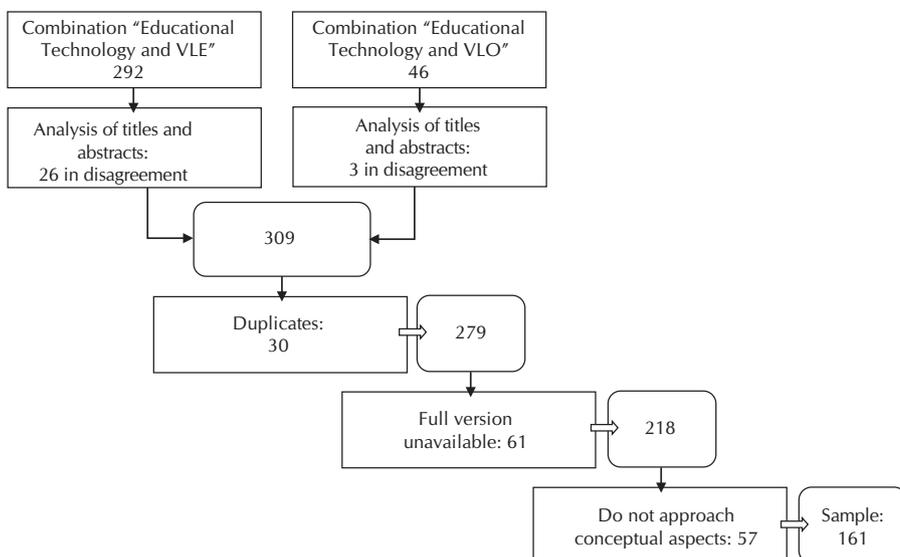
Note: VLE – virtual learning environment; VLO – virtual learning object

**Figure 1 –** Data collection flowchart

### Data analysis

The studies were analyzed based on previously standardized indicators to characterize them and develop the conceptual analysis (Chart 1).

Quantitative data were analyzed based on simple descriptive statistics; and the concepts, through lexicographical analysis with support of the software *Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* (IRAMUTEQ)[8].

With the aim of establishing the stage 5 of the conceptual model of Rodgers[7] - to identify, if necessary, an example of a context - a lexicographical analysis of the concepts of VLO and VLE presented in the studies analyzed was carried out, based on analysis of similarity with the support of the IRAMUTEQ software.

In the analysis of similarity, it is important to analyze the size of the words and thickness of the lines that connect them, which are aspects that show the significance of the terms to understand the phenomenon analyzed.

## RESULTS

The sample was made up of 161 studies: 129 dissertations (80.1%) and 32 theses (19.9%). There was a prevalence of dissertations from academic master's degree students (108; 67.1%). The studies analyzed were submitted in 2011 (88; 54.0%) and 2012 (74; 46.0%).

They were developed in 65 different higher education institutions (HEIs), with a prevalence of HEIs located in the Southeast region of Brazil (32; 49.1%), followed by the South (17; 26.2%), Northeast (11; 17.0%), and Central-West regions (5; 7.7%).

The authors of the dissertations and theses came from 43 degrees, with emphasis on Languages (25; 15.7%), Pedagogy (23; 14.5%), Mathematics (16; 9.9%), and Computer Sciences (12; 7.5%).

The concept "virtual learning environment" (VLE) was presented in 99 (61.5%) studies, whereas the concept "virtual learning object" (VLO) was presented in only 15 (9.3%) studies. The attributes, antecedents, and consequences identified for both concepts are presented in Table 1.

As substitute terms, the concept of VLE had 12 synonyms, with emphasis on virtual teaching and learning environment (12; 7.5%). The other terms used were: virtual environment (9; 5.6%); digital learning environment (7; 4.3%); virtual teaching environment (6; 3.7%); virtual classroom (5; 3.1%); distance learning environment (4; 2.4%); computer-based learning environment (4; 2.4%); collaborative learning environment (3; 1.9%); virtual learning environment (1; 0.6%); virtual reality environment (1; 0.6%); collaborative virtual environment (1; 0.6%); and virtual transmission of information environment (1; 0.6%).

The term VLO presented five substitutes, with prevalence of Learning Object (11; 6.8%). Other terms also used were: hypermedia learning object (2; 1.2%); learning objects (1; 0.6%); digital educational object (1; 0.6%); and digital learning object (1; 0.6%).

**Chart 1** - Analysis indicators and their respective standardizations

| Area | Indicator | Standardization |
|---|---|---|
| Characteristics | Title | Article's title |
| | Year | Year of submission |
| | Academic level | Academic Master's Degree, Professional Master's Degree, or PhD |
| | Education institution | University of development of the study |
| | Area of knowledge | Indicated in the CAPES Thesis Portal |
| | Author's academic degree | Degree according to Lattes Resume |
| Conceptual analysis | Concept | Concept of VLO and VLE |
| | Attributes | Characteristics of a VLO and a VLE |
| | Antecedents | Events that contributed to the emerging of VLOs and VLEs |
| | Consequences | Consequences resulting from the use of VLOs and VLEs |
| | Substitute terms | Synonyms used for VLO and VLE |
| | Related concepts | Concepts developed with the concepts of VLO and VLE |

Note: VLE – virtual learning environment; VLO – virtual learning object; CAPES - Coordination for the Improvement of Higher Education Personnel

**Table 1 -** Attributes, antecedents, and consequences of the concepts, Brazil

| Variable | n (N = 161) | % |
|---|---|---|
| **Attributes** | | |
| Incentive to participation, collaboration, and interaction of students | 77 | 47.8 |
| Intertextuality, navigability, and integration of diverse media | 74 | 46.0 |
| More active, dynamic, and personalized teaching-learning process | 29 | 18.0 |
| Encouragement to autonomy of students | 29 | 18.0 |
| Re-dimensioning of time and space of the traditional education model | 20 | 12.4 |
| Flexible organization of the teaching-learning process | 18 | 11.2 |
| Possibility of linear and non-linear learning | 17 | 10.6 |
| Professors become advisers/mediators | 16 | 9.9 |
| Strengthening of the relationship between professors and students | 15 | 9.3 |
| Presentation of the content in an organized and systematic way | 15 | 9.3 |
| Potential for a significant learning experience | 14 | 8.7 |
| Possibility of simple and intuitive use | 12 | 7.5 |
| Importance of the participants' intentionality | 10 | 6.2 |
| Possibility of change according to needs | 7 | 4.3 |
| Filing and reuse of the material produced | 6 | 3.7 |
| Possibility of use in distance learning or to support face-to-face activities | 5 | 3.1 |
| Safe learning environment | 3 | 1.9 |
| **Antecedents** | | |
| Popularization of the Internet | 52 | 32.3 |
| Evolution of the five generations of distance learning | 37 | 23.0 |
| Technological advances and easy access to information | 36 | 22.7 |
| Demand for education adapted to new requirements | 32 | 19.9 |
| Development of ICTs | 28 | 17.4 |
| Need for complementing the traditional teaching model | 27 | 16.8 |
| **Consequences** | | |
| Requirement of a collaborative learning | 30 | 18.6 |
| Need for incorporating technologies in the face of pedagogical approaches | 28 | 17.4 |
| Professors with new skills and technical-pedagogical support | 25 | 15.5 |
| Need for independent apprentices | 24 | 14.9 |
| Need for developing appropriate educational materials | 22 | 13.7 |
| Need for technical guidance for the beginning of the process of use | 18 | 11.2 |
| Potential response to new demands presented by the current society | 12 | 7.5 |
| Guarantee of conditions for accessibility and use of the equipment | 11 | 6.8 |
| Need for establishing an organizational culture | 5 | 3.1 |

*Note: ICTs – information and communication technologies*
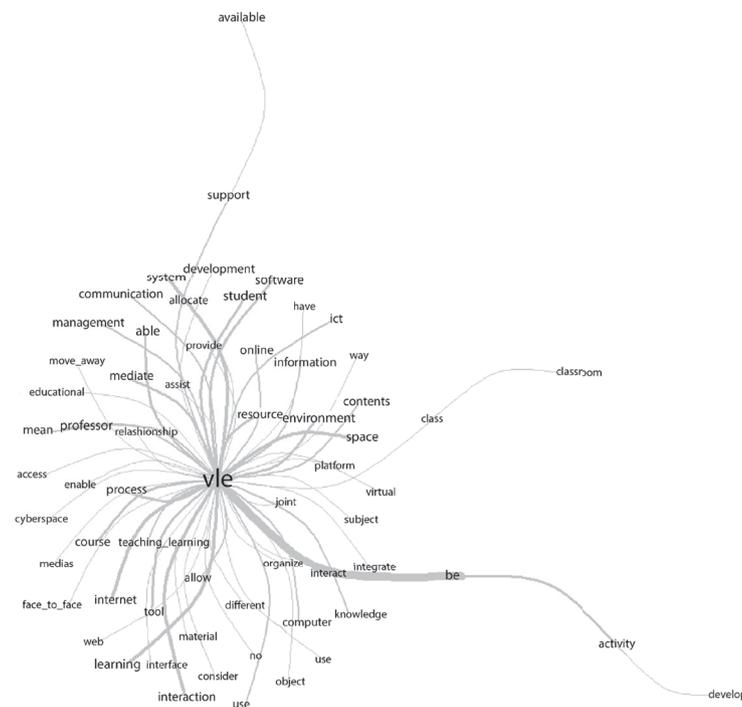


*Note: VLE – virtual learning environment.*

**Figure 2 -** Analysis of similarity of the concept virtual learning environment

As regards related concepts, distance learning was discussed in all works analyzed (161; 100.0%). In addition, ICTs (64; 40.0%), new teaching conceptions (26; 16.1%), b-learning (7; 4.3%), and e-learning (5; 3.1%) were also highlighted.

Figure 2 presents the analysis of similarity on the concept of VLE, with emphasis on the following words: system, space, Internet, learning, and interaction.

In addition to these aspects, it is important to highlight the attributes that were inherent to the concept of VLE in the analysis of the dissertations and theses: production of contents and several communication channels by means of synchronous and asynchronous tools (29; 18.0%); storage, distribution, and management of learning contents (23; 14.3%); control and assessment tools of the didactic process (20; 12.4%); and possibility for individuals geographically dispersed throughout the world of interacting in diverse times and spaces (11; 6.8%).
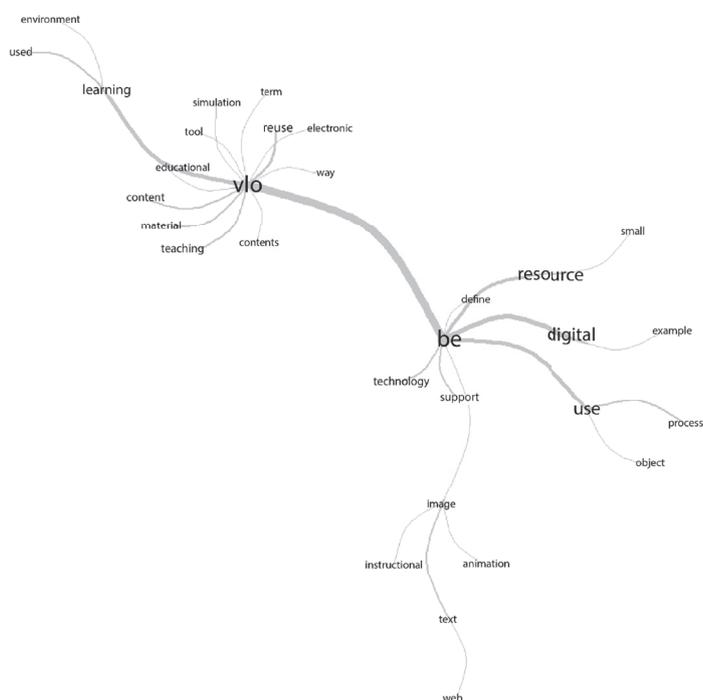
Note: VLO – virtual learning objec.

**Figure 3 –** Analysis of similarity of the concept virtual learning object

In the scope of the analysis of similarity of the concept VLO presented in Figure 3, the following terms were highlighted: resource, digital, learning, and use.

As regards the specific attribute of the VLO, all 15 (9.3%) works that conceptualized it showed that it is characterized by its reusability, adaptability, granularity, modularity, interactivity, conceptuality, accessibility, portability, and durability.

## DISCUSSION

The restriction on the time dimension of the sample results from an update of the Bank of Theses and Dissertations of CAPES. Consequently, at the time of the research, only studies of these years were available.

The prevalence of academic master's courses and HEIs located in the Southeast region is in accordance with the quantitative distribution of graduate programs in Brazil[9].

In line with the complex and integrative process of multiple professionals, which is the development and validation of an educational tool[1,10], the authors of the dissertations and theses came from 43 different academic degrees.

Collaborative learning stood out as an attribute of virtual learning objects and environments. This is mentioned by the literature as a pedagogical tool to minimize the disadvantages of distance learning, so the social component is incorporated into e-learning environments, requiring a continuous analysis of professors regarding the actions of students[11].

In the scope of VLOs and VLEs, it is worth mentioning computer-supported collaborative learning (CSCL). Researchers suggest a theoretical picture for a better understanding

and consolidation of the collaboration in these environments, based on three main elements: the pedagogical aspect, level of learning, and unit of learning[12].

The pedagogical element refers to tools used to support and guide individuals, teams, and communities through a set of learning goals. The level of learning refers to abilities that students use to work together in a team, which includes the process of communication, level of motivation, and social aspects involved in the interaction among students and between students and professors. The third element, the unit of learning, refers to technological needs of the activity, depending on the composition of the environment, which will determine the way technology is used and the activity effectiveness[12].

In the context of VLOs and VLEs, collaboration should be understood as an essential and decisive element for the achievement of pedagogical goals. For this purpose, students and professors assume new roles: whereas those are more active, independent, and dynamic, these assume new responsibilities of mediation and motivation in the teaching-learning process.

A study carried out in Spain with the aim of analyzing the effects from interactivity in e-learning showed that students seek higher levels of interactivity and understand that collaboration in education provides positive subjective experiences. These, in turn, unchain results of utmost importance for teaching institutions: favorable attitudes and positive intentions to continue surfing the virtual environment[13].

The integration of several media was also highlighted in studies analyzed on the quality of attribute of virtual learning objects and environments.

These educational tools are characterized as self-directed and flexible, in which access to multimedia files, sites, and original content may result in a truly multifaceted learning experience[14].

In this context, researchers indicate the benefits of synesthetic learning. A study carried out in the United States - that investigated the effects of a mixed reality simulation game on the results of learning, by comparing the performance of the participants in the experimental simulation with a control group using the same simulation game in a desktop computer - showed that the group of participants who used their whole bodies to be involved with the concepts of physics presented higher learning and more positive attitudes in relation to the simulation experience and learning environment[15].

Therefore, the development of learning environments supported by technology constitutes a continuing innovation field, with the aim of increasingly benefiting the teaching-learning process, which is characterized by dynamism and interaction.

Consequently, the personalized and independent education process, aspect also shown as an attribute of VLOs and

VLEs, is recognized as an optimizer of effective learning mediated by technology.

In this context, studies carried out in Brazil[6,16], the United States[15], the United Kingdom[14], Taiwan[17], Spain[2], Thailand[18], Malaysia[19], Iran[20], Colombia[21], and other countries, already showed the benefits in the use of virtual learning objects and environments and the effective results when compared with traditional education processes.

In the context of healthcare education, a benefit/attribute of VLOs and VLEs is also highlighted by the literature: safety in the teaching-learning process. From the bioethical point of view and didactic considerations that include this teaching, the use of virtual objects and environments to promote a safe learning environment is relevant, which is an aspect that is also reflected in the optimization of patient safety in clinical environments[15,22].

In the form of antecedents of the concepts analyzed, that is, historical facts that contributed to their development, the studies highlighted the popularization of the Internet and ICTs, with their consequent technological advances and new demands in the teaching-learning process, in a context in which the traditional teaching model needs to be complemented.

It is worth mentioning that the advent of the computer, in parallel with the development of the Internet, led to important changes in human relations. In other words, the way human beings interact with each other was revolutionized due to advances carried out in the computer and Internet contexts[21].

The presence of cyberspaces has changed societies, which, in turn, led to the development of digital learning[20], leading the academic environment to face new challenges in order to be integrated in the cybernetic space.

As a consequence of this process, the dissertations and theses analyzed showed an important aspect in line with international researchers: the need for incorporating and developing technological tools in education to the face of pedagogical approaches[15,23-24].

The potential benefits of virtual learning objects and environments may be annulled due to the lack of a pedagogical reflection from those involved in the teaching-learning process[23].

Furthermore, the incorporation of these technologies provides new educational training possibilities, but reviewing the theoretical bases that form a pedagogical model is required, as well as clarifying new roles of professors and students in these new teaching-learning settings, since it is clear that the traditional teaching model is not enough to meet new educational demands.

The use of VLOs and VLEs should not only be concentrated in the training of procedures and knowledge, but also generate a learning environment that integrates the development of other skills of communication, reflection, critical thinking, and decision making[22].

Another challenge is finding effective ways to provide feedback on the interactions of users. Comments and actions promoted in VLOs and VLEs might often show a reminiscence of formal instruction and be harmful to apprentices[15].

The advantageous aspects are easily provided by these environments, such as the use of quizzes, which are important for both students, who can self-assess the knowledge acquired, and professors, who can check if their teaching strategies are appropriate, measuring how much of the themes were assimilated by students. However, assessment cannot be limited to the results of tests and trials[24].

Enhancing these results with data on interactions between the users (students and professors) and systems could be a solution. For example, the level of participation in different activities, quality of interaction and communication among peers could be interesting data to be used during the assessment[24].

Another consequence highlighted in the study was the required technical and pedagogical support of professors, as well as the promotion of an organizational culture in HEIs that promotes the development and incorporation of VLOs and VLEs appropriate to the proposed pedagogical process.

A case study based on the experience in implementing a semi-distance learning approach to a reading course for students of methodology in the College of Foreign Languages at the Moscow State University in Russia found the importance of an appropriate academic policy with management support in the use of technologies in education as one of the pillars for an effective learning[25].

In the quality of concepts associated with virtual learning environments and objects, b-learning or blended learning is highlighted, which is a modality increasingly discussed and incorporated into education institutions.

Blended learning has been highly regarded as a combination of classroom and on-line activities. While the definition is clear and simplistic, its implementation is complex and significantly challenging[19].

A B-learning system is supported by technology with a combination of teaching techniques, including self-study and an on-line classroom with work instructions, adapting to the individual needs of students[19].

This teaching method is in accordance with the elements of the flipped classroom, known as inverted classroom, and includes the autonomy of students in learning at home, with support of VLOs and VLEs, and the school while environment of discussion and learning, mediated by professors[19].

These pedagogical approaches not only represent a combination of on-line and off-line teaching methods, but also of learning theories, such as problem-based approaches, supported by constructive ideology versus traditional lessons, which originate from the method of direct instruction based on behaviorist principles.

The relevance in this process, as already highlighted, is that the technological tool is understood as a teaching support, in the face of pedagogical approaches.

Finally, as a result of the conceptual analysis, based on the analysis of similarity of the concepts VLE and VLO, it was possible to check the attributes that distinguish these two teaching tools. VLE was understood as a computer system that integrates features and tools, enabling the development of an on-line interactive teaching-learning process accessed by navigators in the Internet or local networks.

As differentiating attributes of the VLE, the use of synchronous and asynchronous tools of communication stands out, especially forums and chats; the storage, distribution, and management of the learning contents that enables flexible learning in time

and space; and the use of control and assessment tools of the didactic process, based on reports of access and participation, which, in an essential way, is mediated by tutoring systems[14,24].

Virtual learning objects were highly regarded as a digital resource of limited size that can be reused within several pedagogical activities and strategies. VLOs are tools characterized by their reusability, adaptability, granularity, modularity, interactivity, conceptuality, accessibility, portability, and durability[16]. Therefore, virtual objects include a variety of didactic material (images, videos, games, sites, etc.), as long as used in a teaching-learning process with technological base.

In summary, a VLE is a collaborative environment supported by technology that integrates several and different types of VLOs in a common pedagogical context.

### Study limitations

The present study presented as limitation the reduced time dimension of the studies analyzed, an aspect resulting from an update of the Bank of Theses and Dissertations of CAPES.

The authors suggest expanding the study to the international scope, in order to understand whether conceptual analyses carried out in Brazilian studies are in accordance with the global perspective.

### Contributions to the healthcare area

The effective understanding of the use and application of these concepts is expected to guide the development and validation of these relevant educational tools. In addition, the conceptual analysis carried out may benefit the standardization of the use and meaning of the concepts by researchers in diverse areas of knowledge.

### CONCLUSION

The conceptual analysis enabled the understanding of the multiple interfaces of the concepts of virtual learning object and environment, in order to elucidate their similarities, differences, and associations.

In conclusion, a virtual learning environment includes several and different types of virtual learning objects in a common pedagogical context.

### FUNDING

## REFERENCES

1. Santos IM, Ali N, Hill A. Students as co-designers of a virtual learning commons: results of a collaborative action research study. JAL [Internet]. 2016 [cited 2016 Oct 02];42:8-14. Available from: http://www.sciencedirect.com/science/journal/00991333/42/1

2. González-González I, Jiménez-Zarco AI. Using learning methodologies and resources in the development of critical thinking competency: an exploratory study in a virtual learning environment. Comput Human Behav [Internet]. 2015[cited 2016 Oct 02];51:1359–66. Available from: http://www.sciencedirect.com/science/article/pii/S0747563214005780

3. Goés FSN, Fonseca LMM, Leite AM, Furtado MCC, Scochi CGS. Development and evaluation of an interactive virtual learning object on the diagnostic reasoning in nursing applied to preterm newborns. Procedia Soc Behav Sci [Internet]. 2012 [cited 2016 Oct 02];46:617-23. Available from: http://www.scielo.br/pdf/rlae/v19n4/07.pdf

4. Huang TC, Chen CC, Chou YW. Animating eco-education: to see, feel, and discover in an augmented reality-based experiential learning environment. Comput Educ[Internet]. 2016[Cited 2016 Oct 02];96:72–82

5. Kurilovas E, Juskeviciene A. Creation of Web 2.0 tools ontology to improve learning. Comput Human Behav [Internet]. 2015 [cited 2016 Oct 02];51:1380–6. Available from: http://dl.acm.org/citation.cfm?id=2828779

6. Tubelo RA, Branco VLC, Dahmer A, Samuel SMW, Collares FM. The influence of a learning object with virtual simulation fordentistry: a randomized controlled trial. Int J Med Inform [Internet]. 2016 [cited 2016 Dec 16];85:68-75. Available from: https://www.ncbi.nlm.nih.gov/pubmed/26601728

7. Rodgers BL. Concept Analysis: an evolutionary. In Rodgers BL, Knafl KA (Eds.). Concept developmente in nursing. 2ª ed. Philadelphia: Saunders; 2000. p. 77-101

8. Marchand P, Ratinaud P. L'analyse de similitude appliqueé aux corpus textueles: les primaires socialistes pour l'election présidentielle française. In: Actes des 11eme Journées internationales d'Analyse statistique des Données Textuelles; 2011; Liège, Belgique. Belgique; 2011. p. 687-99.

9. Geocapes. Sistema de Informações Georreferenciadas CAPES. Distribuição de programas de pós-graduação no Brasil [Internet]. 2014 [cited 2016 Mar 16]. Available from: http://geocapes.capes.gov.br/geocapes2/#

10. Bisol CA, Valentini CB, Braun KCR. Teacher education for inclusion: can a virtual learning object help? Comput Educ [Internet]. 2015 [cited 2016 Dec 16];85:203-10. Available from: http://www.sciencedirect.com/science/article/pii/S0360131515000706

11. Anaya AR, Luque M, Peinado M. A visual recommender tool in a collaborative learning experience. Expert Syst Appl [Internet]. 2016 [cited 2016 Dec 16];45:248-59. Available from: http://www.sciencedirect.com/science/article/pii/S0957417415006624

12. Kirschner PA, Erkens G. Toward a framework for CSCL research. Educ Psychol. 2013;48(1):1-8.

13. Rodríguez-Ardura I, Meseguer-Artola A. E-learning continuance: The impact of interactivity and the mediating role of imagery,

presence and flow. Inf Manag [Internet]. 2016 [cited 2016 Dec 16];53(4):504-16. Available from: http://www.sciencedirect.com/science/article/pii/S0378720615001317

14. Elledge R, McAleer S, Thakar M, Begum M, Singhota S, Grew N. Use of a virtual learning environment for training in maxilla facial emergencies: impact on the knowledge and attitudes of staff in accident and emergency departments. Br J Oral Maxillofac Surg [Internet]. 2016 [cited 2016 Dec 16];54(2):166-9. Available from: https://www.ncbi.nlm.nih.gov/pubmed/26725011

15. Lindgreen R, Tscholl M, Wang S, Jonhson E. Enhancing learning and engagement through embodied interaction within a mixed reality simulation. Comput Educ [Internet]. 2016 [cited 2016 Dec 16];95(C):174-87. Available from: http://dl.acm.org/citation.cfm?id=2905376.2905457

16. Fonseca LMM, Medeiros MJ, Goés FSN, Zamberlan-Amorim NE, Scochi CGS. Evaluation of the digital learning object taking care of the sensory environment in neonatal units: noise, light and handling. Procedia Soc Behav Sci. 2012;46:509-14.

17. Hsiao HS, Chen JC. Using a gesture interactive game-based learning approach to improve preschool children's learning performance and motor skills. Comput Educ [Internet].2016 [cited 2016 Dec 16];95:151-62. Available from: http://dl.acm.org/citation.cfm?id=2905460

18. Pattanasith S, Rampai N, Kanperm J. The development model of learning though virtual learning environments (VLEs) for graduated students, department of educational technology, faculty of education, Kasetsart University. Procedia Soc Behav Sci [Internet].2015 [cited 2016 Dec 16];176:60-4. Available from: http://www.sciencedirect.com/science/article/pii/S1877042815004814

19. Noor AM, Attaran M, Alias N. Students' experiences in using spectrum: textbook or classroom? Procedia Soc Behav Sci [Internet]. 2015 [cited 2016 Dec 16];176:667-73. Available from: http://www.sciencedirect.com/science/article/pii/S1877042815005625

20. Yadollahi H, Rahimi A. The effects of different task types on learners' performance in collaborative virtual learning environment. Procedia Soc Behav Sci [Internet]. 2015 [cited 2016 Dec 16];192:526-33. Available from: http://www.sciencedirect.com/science/article/pii/S1877042815035545

21. Gaviria D, Arango J, Valencia A. Reflections about the use of information and communication technologies in accounting education. Procedia Soc Behav Sci [Internet]. 2015 [cited 2016 Dec 16];176:992-7. Available from: http://www.sciencedirect.com/science/article/pii/S1877042815006060

22. Piña-Jiménez I, Amador-Aguilar R. La enseñanza de la enfermería con simuladores, consideraciones teórico-pedagógicas para perfilar un modelo didáctico. Enferm Univ [Internet]. 2015 [cited 2016 Dec 16];12(3):152-9. Available from: http://www.scielo.org.mx/pdf/eu/v12n3/1665-7063-eu-12-03-00152.pdf

23. Abdullah F, Ward R. Developing a general extended technology acceptance model for e-learning (GETAMEL) by analysing commonly used external factors. Comput Human Behav [Internet]. 2016 [cited 2016 Dec 16];56:238-56. Available from: http://eprints.hud.ac.uk/26720/

24. Pesare E, Roselli T, Rossano V, Di Bitonto P. Digitally enhanced assessment in virtual learning environments. JVLC [Internet]. 2015 [cited 2016 Dec 16];31:252-9. Available from: http://dl.acm.org/citation.cfm?id=2870235

25. Nazarenko A. Blended Learning vs Traditional Learning: What Works? (A Case Study Research). Procedia Soc Behav Sci [Internet]. 2015 [cited 2016 Dec 16];200:77-82. Available from: http://www.sciencedirect.com/science/article/pii/S1877042815046662