Twelve tips for pedagogical production of learning objects for distance continuing medical education

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Abstract

The creation of learning objects (LO) in the context of distance education (DE) implicates several components, such as pedagogical guidance, multidisciplinary teams and management of the production process. In this article we present 12 tips for a successful pedagogical production process for DE in medical education, which comprises the team's characteristics, selection of content authors, storyboard development, development of educational resources and LO validation, among other aspects. These recommendations are based upon the experience of a specialization course of preceptorship in family medicine, together with the available literature regarding the steps of the process of pedagogical production of LO. The integration of pedagogical, graphic and technical contents is key for the production of an LO that allows the medical student to interact with elements that resemble his experiences and that meet his expectations and learning needs.

Keywords: Distance Education; Continuing Medical Education; Pedagogy; Learning Object

Introduction

The creation of distance education (DE) materials and learning objects (LO) comprises several components, such as pedagogical guidance, multidisciplinary teams and management of the production process. LO can be defined as a set of instructional materials structured to meet a specific educational objective, allowing for a new approach to the educational activity, making medical education more efficient and potentially more cost-effective (Ruiz, Mintzer and Issenberg, 2006).

Although some e-learning activities can be described as direct analogs of face-to-face activities, the majority (such as asynchronous communication) is significantly transformed in the online environment, while others (such as
interactive simulations and animations) are difficult to provide in offline settings (Ellaway and Masters, 2008). The LO production implicates a baseline content that feeds on several educational resources, which demands a multidisciplinary team: production coordinator, content author, pedagogue, content coordinator, proofreader, DE illustrator, video editor, screenwriter, graphic designer and web designer. The assembly of a team for the production of LO is one of the main requirements to attain quality of the produced objects (Guterres et al., 2016).

The DE course production system comprises steps that range from demand planning to offering it to the students. The pedagogical production implicates in a work process with several creation and validation steps and substeps, which aim the LO production to be in accordance with the guidelines and to be reusable by other educational initiatives. However, if not carefully developed minding this premise, the reuse of LOs can become a complex process, filled with inconsistencies of context, culture, language and professional specificity (Ellaway and Masters, 2008).

According to Sandars and Patel (2020), it is important that medical educators share their experience regarding the development of online learning resources; nevertheless, it is also essential that such reports have sufficient information to help guide medical educators in different settings. There is evidence highlighting the importance of establishing a protocol to monitor the development of DE modules and the feasibility of using a formal online module development process to create and deliver medical educational content (Skye et al., 2011). In this article we present 12 tips to a successful pedagogical production process for DE in medical teaching, based upon the experience of a specialization course of preceptorship in family medicine offered online. The course is tutored, comprises national territory, has a 550-hour workload, and currently holds 543 active students. So far in its third edition, the course has systematized the production of 9 content modules regarding family medicine and preceptorship. The course is an initiative of Hospital Moinhos de Vento in collaboration with Universidade Federal de Ciências da Saúde de Porto Alegre and the Brazilian Ministry of Health, through the Institutional Development Program of the Brazilian National Health System (PROADI-SUS), supported by the Brazilian Society of Family Medicine. It is also a part of the National Plan for the Training of Preceptors of the education pillar of the Brazilian More Doctors Program.

Tip 1 - Rely on an integrated multidisciplinary team who is also up to date regarding good practices in the production of LO in DE settings

The production of LOs that assure characteristics of dialogicity, interactiveness, educational resource diversity, updating and reuse assumes the integrated work of several professionals of a multidisciplinary team. The need to rely on different types of professionals who can answer for both the pedagogical and technical aspects is well known (Pessoa and Benitti, 2008). The integration of all participants of the process of production of the LO is key and can be attained through teamwork among professionals with different roles. It is also important to mention that previously defined pedagogical guidelines, which comprise dimensions such as structure, content, language and activities, should be appropriated by all professionals involved in the process, considering they are fundamental to assure didactic coherence of the LO to be produced.

Tip 2 - Select content authors based on well-defined criteria, according to the pedagogical planning and curriculum

The process begins by selecting the content authors whose main attribution is research, organize and develop relevant and updated content, according to the learning objectives previously defined, to integrate the LOs that will
be produced (Guterres et al., 2016). Therefore, it is important to define criteria that are consistent with what is expected of an expert in the field. In our course, to meet the relational aspect existing between the three areas of expertise that form the curriculum of the course (family medicine, preceptorship and complex clinical cases), a selection process was launched with criteria such as specialization in family medicine, experience in DE (as a content author, student or tutor) and experience in preceptorship.

**Tip 3 - Provide pedagogical orientation to the content author**

The development of LOs should be in accordance with the course’s pedagogical principles and it should have clear goals and results (Russel et al., 2013). Thus, it is important to encompass a few subjects with the content authors, such as the pedagogical guidelines, the pursued DE type and the diversity of educational resources that can be used in the DE setting. In the preceptorship course the content authors participated in an 8-hour face-to-face workshop in order to get to know the process of content development and production and to start the development of the pedagogical action plan (PAP) based on the reference term developed by the course’s coordination staff. The reference term includes the principal and the specific objectives, as well as workload, course content and suggested bibliography. The development of LOs should be in accordance with the course’s pedagogical principles and it should have clear goals and results (Russel et al., 2013). Thus, it is important to encompass a few subjects with the content authors, such as the pedagogical guidelines, the pursued DE type and the diversity of educational resources that can be used in the DE setting. In the preceptorship course the content authors participated in an 8-hour face-to-face workshop in order to get to know the process of content development and production and to start the development of the pedagogical action plan (PAP) based on the reference term developed by the course’s coordination staff. The reference term includes the principal and the specific objectives, as well as workload, course content and suggested bibliography.

**Tip 4 - Assist in the development of integrational PAP elements**

The PAP comprises the didactical structure of the module under development, encompassing elements such as: module name, authorship, workload, target audience, principal objective, syllabus, learning goals, content, educational resources, evaluation methods and bibliography. We recommend that content authors of the same course develop the PAP under the advice of a team of pedagogues, accounting for the course’s pedagogical guidelines and keeping didactical coherence with the curriculum. The curriculum aspect should also account for the organization of the contents that will comprise the LOs, a task that should be accompanied by the content coordinator, who is responsible for the medical content.

**Tip 5 - Assist in the development of a detailed storyboard**

As the PAP development, the storyboard development should be guided by the pedagogical team and by the content coordination staff. The storyboard shows a detailed script for the mediatic-pedagogical transformation of the contents. Based on the PAP, the content authors prepare the content on the storyboard and indicate the use of educational resources to be developed. The use of different properly organized resources, with light texts, visual effects and on-screen movement, with the potential to increase student engagement (such as audios and short videos), offers learning opportunities for students with different learning styles (Ruiz, Mintzer and Leipzig, 2006; Skye et al., 2011). The storyboard comprises the graphic resources and outlines an interaction between a person and a product in a narrative format, which includes a series of drawings, sketches or images and words, assisting in the instructional design process (Yusoff and Salim, 2016). A detailed storyboard includes, in addition to the
aforementioned, activity suggestions, which can be formative, with automatic feedbacks. Involvement in evaluation tasks is encouraged by using a variety of question types such as: true or false; multiple choice; fill in the blank; drag and drop matching; and drag and drop sequence (Russell et al., 2013). It is also recommended that there be a clear progression from the simplest to the most complex tasks (Russell et al., 2013).

Tip 6 - Perform a technical and pedagogical storyboard review

At the end of the first version, the storyboard should undergo a pedagogical and technical content review, using a checklist to be delivered to the content author, with the recommendations to be adjusted in the preliminary version. This item systematized review aims to verify whether the writing included the contents to be studied and the pedagogical planning, both previously defined in the PAP. After adjustments, the storyboard should undergo a second review with validation purposes and later follow to the production phase.

Tip 7 - Request a language review

The proofreader makes grammatical adjustments in the texts, checks the adequacy of the information's hierarchy (titles and subtitles), minding coherence and cohesion, and reviews the use of abbreviations and acronyms, which are widely used in medical content. It is also recommended that the content coordinator together with the content authors reaches a prior agreement on editorial standards to ensure language consistency between LOs. A common terminology should also be created to refer to certain concepts throughout modules of the same course (Polsani, 2003).

Tip 8 - Proceed to the creation of layout and approval considering the student’s experience

Appearance and style are extremely important for effective presentation of LOs, and developers must provide specifications for the use of colors, fonts and layout of images and text (Polsani, 2003). The demanding stakeholder or the technical expert should conduct a briefing with the design team in order to create this layout. The creation involves attention to characteristics aimed to provide a good user experience for the students, such as: the interface and browsing components must be presented in a way that they can be seen and functionable; and the content must be sufficiently detailed to be concisely understood. Having an easy-to-navigate menu and making no sections mandatory allows students to establish their own learning objectives, gaining access and returning to content that is useful to them (Halpern and Tucker, 2015). Thus, the menu also facilitates the student's own time management needed for learning.

Tip 9 - Manage production of the several educational resources that will constitute the LO

Some principles for the use of resources in learning objects are described: the multimedia principle states that adding charts to the text can improve learning; the contiguity principle indicates that placing text close to charts improves learning; and the principle of modality establishes that audio-explained charts improve learning in situations where overload is likely (Clark and Mayer, 2002).

The original illustrations have the purpose of presenting the content in the form of contextualized situations, which are close to those experienced by healthcare professionals, and comprises resources such as illustrations, comics, illustrated stories, et cetera. It is based on the script for the image creation (in some cases, it is recommended that the content author arranges a meeting with the artist for a briefing on the desired creation / representation). Image
diagramming involves resources such as graphs, diagrams, infographics, figures, tables, sketches, et cetera, informed on the storyboard. Some cases may also involve the original illustrations; in this case, it is recommended that the designer works in partnership with the artist.

For the development of audiovisual resources, based on the previously validated script during the pedagogical review stage, the technician performs the video recording and/or editing. To this end, a prior agenda is organized with the content author, with the definition of the location for recording and checking the equipment to be used. For podcast production, the technician uses a software to edit audios recorded by the content author in order to improve their quality (removing background noise and/or other technical issues), so that they do not interfere with the student’s understanding of the content. It is recommended that the final version of each resource be validated by the content author in order to have the various resources previously completed in the final validation stages of the LO as a whole.

**Tip 10 - Make independent, accessible and reusable LOs**

The LO can be thought of as an independent educational unit, with a beginning, middle and end since it must meet the learning objectives to which it was assembled for. Independent LOs can be combined to support individual instructional objectives and for usage in different settings (Alonso et al., 2008). Reusability implies that once created, an LO can be reused in different instructional contexts (Polsani, 2003; Pessoa and Benitti, 2008). The production of the various accessible educational resources should account for the use of programming languages compatible with the main browsers used by students, in order to guarantee access even in situations of poor internet connection.

In order to account for these aspects, the production of LOs is recommended through the use of a set of WEB (World Wide Web) technologies such as JavaScript programming language; HTML (HyTime and SGML) that comprises the text markup language for content and hypermedia; and CSS (Cascading Style Sheets), which involves the development of visual identity. The use of these technologies allows for edition optimization, as well as usage and treatment of the educational elements of the LO, both by the developing institution and by other institutions that may wish to reuse it in the future. Furthermore, the use of these languages can also allow the LO to meet responsiveness requirements, reorganizing its content on screen in order to adapt itself according to different types of devices, such as cell phones and tablets, besides personal computers (PC) and laptops.

**Tip 11 - Perform the pedagogical and technical review of the developed LO**

Having the user experience as base, the production and content coordinators review the whole LO in the online setting, in the format it will be available for the student. During this stage a second checklist is used to verify if the LO accounts for the pedagogical aspects, highlighting the learning goals the proper workload and the clarity of the methods of evaluation; the technical aspects of the content, especially the proper content adaptation considering the target audience; and usability aspects, mainly the quality of the interface, the navigation and interactivity. In the absence of developmental adjustments, we go towards the last development stage.

**Tip 12 - Proceed to the developed LO’s validation in three different areas**

The LO development should include at least one review of the entire object on account of the content author (Pessoa and Benitti, 2008), which can be performed together with the pedagogical and technical validation of the developed
LO layout. In the final stage, the LO should be assessable in a digital platform and validated in three different areas: content validation performed by the content author; pedagogical validation performed by another pedagogue teammate to ensure it meets the pedagogical guidelines; and technical validation performed by a designer teammate in order to verify if it meets the visual, functional and navigational standards established in the layout.

**Conclusions**

In the DE setting, the concept of management is key to the process of pedagogical production, considering that in this teaching modality the integration of the pedagogical, graphic and technical contents is fundamental to the production of an LO that allows the medical student to interact with elements that resemble his experiences and that meet his expectations and learning needs. From the experience acquainted with the specialization course of preceptorship in family medicine and literature we presented tips that can guide the production of other materials in the context of DE to continuing medical education in a systematic way, involving a multidisciplinary team and having the excellence and applicability of the final product as guideline.

**Take Home Messages**

- The pedagogical production implicates in a work process with several creation and validation steps and substeps.
- The production of the learning object (LO) demands a multidisciplinary and integrated team.
- The knowledge of the pedagogical guidelines by the multiprofessional team is fundamental to the quality of the OA, ensuring that the product's objectives are achieved.

**Notes On Contributors**

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Bibliography/References

Alonso, F., López, G., Manrique, D. and Viñes, J. M. (2008) ‘Learning objects, learning objectives and learning design’, Innovations in Education and Teaching International, 45(4), pp. 389-400. https://doi.org/10.1080/14703290802377265.

Clark, R. and Mayer, R. (2002) E-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning. San Francisco: Jossey-Bass/Pfeiffer.

Ellaway, R. and Masters, K. (2008) ‘AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment’, Medical Teacher, 30(5), pp. 455-473. https://doi.org/10.1080/01421590802108331.

Guterres, J. P. D., Moraes, M. C., Kampff, A. J. C. and Silveira, M. S. (2016) ‘An analysis of different roles involved in learning objects production’, Proceedings of the 2016 XI Latin American Conference on Learning Objects and Technology (LACLO), (October), San Carlos, pp. 1-9. https://doi.org/10.1109/LACLO.2016.7751774.

Halpern, R. and Tucker, C. (2015) ‘Leveraging adult learning theory with online tutorials’, Reference Services Review, 43(1), pp. 112-124. https://doi.org/10.1108/RSR-10-2014-0042.

Pessoa, M. C. and Benitti, F. B. V. (2008) ‘Proposta de um processo para produção de objetos de aprendizagem’ [Proposal for a process for the production of learning objects], Hifen (online), 32(62), pp. 172-180.

Polsani, P. R. (2003) ‘Use and Abuse of Reusable Learning Objects’, Journal of Digital Information, 3(4).

Ruiz, J. G., Mintzer, M. J. and Issenberg, S. B. (2006) ‘Learning objects in medical education’, Medical Teacher, 28(7), pp. 599-605. https://doi.org/10.1080/01421590601039893.

Ruiz, J. G., Mintzer, M. J. and Leipzig, R. M. (2006) ‘The impact of e-learning in medical education’, Academic Medicine, 81(3), pp. 207-12. https://doi.org/10.1097/00001888-200603000-00002.

Russell, P., Ryder, G., Kerins, G., and Phelan, M. (2013) ‘Creating, sharing and reusing learning objects to enhance information literacy’, J Inf Lit. 7(2): 60-79. https://doi.org/10.11645/7.2.1744.

Sandars, J. and Patel, R. (2020) ‘The challenge of online learning for medical education during the COVID-19 pandemic’, International Journal of Medical Education, 11, pp. 169-170. https://doi.org/10.5116/ijme.5f20.55f2.

Skye, E. P., Wimsatt, L. A., Master-Hunter, T. A. and Locke, A. P. (2011) ‘Developing Online Learning Modules in a Family Medicine Residency’, Family Medicine, 43(3), pp. 185-192.

Yusoff, N. M. and Salim, S. S. (2016) ‘Reflections on eLearning Storyboard for Interaction Design’. In: Zaphiris P and Ioannou A. (eds) Learning and Collaboration Technologies (LCT 2016), Lecture Notes in Computer Science, vol. 9753, Cham: Springer, pp. 60-69. https://doi.org/10.1007/978-3-319-39483-1_6.

Appendices

None.
Declarations

The author has declared that there are no conflicts of interest.

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