

Reusing Cases for Teaching Enterprise Modelling – Feasibility Study and Reality Check

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Abstract. Using case-based learning when teaching enterprise modeling could provide the realism needed for students to understand the complexity of a real modeling situation. This realism could be enhanced further by having case material presented in the form similar to what is found in modeling practice, such as recorded interviews and internal and external documents. However, creating this kind of material may be costly, thus there is an interest in reusing case material in several courses. In this paper, the issue of reusing case material is examined from two angles. Firstly, a feasibility study has been completed based on an example where existing multi-media material created for one course, potentially, could be reused in other courses. In the feasibility study interviews with teachers has been carried out, resulting in a set of identified opportunities and challenges for reusing case material. Secondly, these challenges and opportunities were compared and discussed in the light of actual experience where case material has been reused in three different courses.

Keywords: Case based learning, modeling skills, information systems, reuse

1 Introduction

Enterprise modeling is an important element in information systems courses. Enterprise modeling is the process of modeling organizations and its components using various modeling techniques such as goal modeling, process modeling, and conceptual modeling. These modeling techniques can then be used for analyzing business situations as-is and/or design desirable solutions for the future by means of information systems. A common approach to getting students to practice these modeling techniques is using case-based learning (CBL). CBL is a teaching method whereby students through working with a realistic case are getting an opportunity to apply concepts and theories in complex situations and develop their analytical skills [1]. CBL is widely used in the majority of information system courses given by the department of Computer and Systems Sciences (DSV) at Stockholm University. Typically, a case is presented to the students in form of a real or imaginary business situation asking them to build a model of it or showing how such model can be built. Cases are used in project assignments, lectures, seminars, exams, etc.

One way to implement CBL in education is in the form of textual descriptions of cases that are handed out to the students. The disadvantage of this approach is that important aspects, such as the work with collecting and analyzing the information is lost [2]. In real life, an analyst is not getting a textual description of a business situation to analyze, rather the analysis is done based on examining existing documentation, performing interviews, workshops, and so on. As pointed out by [3], an analysis of a business situation based on enterprise modelling requires a combination of techniques and tools. Thus requiring more skills than just knowing the syntax of the enterprise model to be created. As has been shown in our previous works [4,5], a good approach is to use a *multimedia case presentation* as a way to simulate a real modeling situation. The multimedia case presentation may include: (a) recorded interviews with stakeholders, e.g., CEO, CIO, (b) samples of relevant documents, e.g., meetings protocols, forms for managing orders, (c) web-based sources, e.g., a company web site, results of Twitter search on company name etc.

Creating case material requires resources for creating or collecting realistic documents, recording interviews and so on. Even though the resources it takes to create case material may be fairly low (for example, some of the authors of this paper did this for a course in just 55 person-hours [4]), there are incentives to reuse the created material fully or partially. Firstly, cost saving effects could be achieved if the case material is reused in several courses. Secondly, re-using the same case material in several courses can be a way for the students to get a more holistic view on the information system field. The reason for this is that a single case can be described from multiple perspectives: organizational analysis, business process design, IT system and database design and so on. If each course uses a completely different case it will be difficult for the student to see how different perspectives are connected.

Research on reusing course material have so far pointed out positive effects of reuse in terms of increased quality and productivity [14]. However, attention has been focused on the packaging and modularization of course material, such as shown in [11]. So far, modules of course materials that have little coupling to each other have been considered positive for reuse [16,17] since limited dependencies between the material simplify the reuse. This can be put in contrast to the reuse of course material describing a case, where the material is coupled to a single case. Thus, it is of interest to study the reuse of case material further.

Even if reuse of case material is beneficial, it might not be easy to achieve it. If the case material is in text form, it could be fairly inexpensive to change or add details to a case description. However, for material such as recorded interviews, it is substantially more demanding to change the contents. Thus, it is of interest to examine if reuse is possible, to what extent it is possible, and to examine what are the challenges and opportunities for the reuse of case material. In our previous work [6], we examined the issue of case material reuse from a theoretical perspective by identifying a structure for case descriptions consisting of *case presentation assets* packaged into *learning objects*. We also tentatively identified issues of reuse in terms of administrative and technical issues, and the issues of deciding the granularity of the material to be reused.

In this paper, we examine the reuse of case material in practical settings using two different approaches – a feasibility study and a reality check.

Feasibility study. By using case material from one course as an example, we have examined the potential challenges and opportunities of reusing case material. The feasibility study was based on interviews with teachers of four courses, where the teachers were asked to identify potential challenges and opportunities of reusing case material in their courses.

Reality check. After the feasibility study had been completed, reuse of course material was implemented in a set of three courses, which were different from the four courses used in the feasibility study. In the *reality check*, we compare the outcome of the feasibility study (the challenges and opportunities) with the actual experience of reuse. The reality check was completed via reflection of the teachers of the courses, and by examining results from a survey performed among students.

The feasibility study and reality check are presented in the subsequent sections according to the following structure. In Section 2, we make an overview of the literature on the representation of modeling cases and the reuse of learning objects. Section 3 briefly describes the cases used for the feasibility study and reality check respectively. In Section 4, the result of the feasibility study in terms of challenges and opportunities for reuse is presented, and compared with the actual experience of reuse (i.e., the reality check). Section 5 concludes the paper.

2 Overview of related research

Reuse of simulated case representations is related to the field of *Case Based Learning* (CBL), and the discussion of general *representation* and *reuse* of course content within that field.

Case-based learning, in which students build a model of a real or imaginary case, is often used in teaching information system courses. The case can be given to the students in various ways, the simplest one is by giving them a textual description of the organization [7], but also by referring the students to a real-life organization [8]. A case can also be given in the form of a simulated situation; one field where the simulation has been successfully used in teaching is the medical field where a patient is simulated, see for example [9]. Case presentations discussed in this paper use simulation in form of an apprenticeship situation, where an apprentice follows master analysts who gather information about the case to be used in modelling tasks. As has been described in our previous research [4,5], this type of case simulation has been successfully exploited in a number of rounds of a course at DSV.

The *representation* of course material put requirements on both the pedagogical structure and the technical structure of the course material. The use of *learning objects* is a way for organizations to create, manage, and update learning material in a structured way [10]. According to the IEEE Standard for Learning Object Metadata [11], a learning object is defined as any entity, digital or non-digital, that may be used for learning, education, or training. Development of learning objects and associated tools has focused on both the technical side in terms of platforms and exchange formats [12] as well as on the pedagogic content [13]. Besides assets in terms of documents, tutorials and so on, a learning object may also contain pedagogic goals, defined activities, and may even include the sequencing of activities and the management

required by teachers [12]. In this paper, we use the term learning object, but the focus is on using the learning objects as a way to describe a case.

The *reuse* of course material has got increased attention with the introduction of learning platforms. If the learning objects have the right properties the positive effects of reuse in terms of increased productivity and quality are put forward [14]. What is considered as good properties of a learning object is generally the same as for all teaching activities – they should have clear learning goals, be related to the examination and so on [15]. However, when focusing on reusability, the learning object should have other properties as well. As pointed out by [14] the reusability properties of a learning object are interestingly often touted to be the same as in the field of software engineering. For example, [16] refers to the desired properties in form of high cohesion and low coupling. That is, a learning object should be self-contained and have few dependencies to other learning objects. This is also in line with [17] that argues for the properties of coupling and cohesion, and adds that a learning object should have the proper technical packaging to be reusable.

What sets our paper apart from the previous studies is that we focus on the reuse of case descriptions. Such focus leads to a different result, compared to the previous studies, both in terms of potential benefits and required properties of the learning objects.

3 Cases and method

Two different cases have been used for the feasibility study and reality check: the “AFFE” case for the feasibility study and the “Harmony inside” case for the reality check. Each case describes a business situation of an organization that the students should model and analyze, for example by depicting the business processes as-is of an organization using a process modeling notation. The AFFE case has been used in several rounds of one course, while the Harmony inside case has been used, so far, in three different courses (one round each). In the following section, we briefly describe the cases and the methods used for the feasibility study and reality check.

3.1 Feasibility study – the AFFE case

As described in our previous work [4,5], a case description based on multi-media content is used in the course *IT in organizations* (ITO). One of the main learning activities in the ITO course is a project assignment that requires the students in groups to build various types of enterprise models of an imaginary company, called “AFFE”. In earlier rounds of the course, the same case was presented in form of a textual description. The text description is now substituted with a web site that contains multimedia sources of information and a number of modelling assignments left to the students by a “master” – a teacher who guides the students through the assignments. The multimedia sources includes: interviews with stakeholders, excel spreadsheets with economic information, twitter feeds, meeting protocols, etc.; some examples are shown in Figure 1.

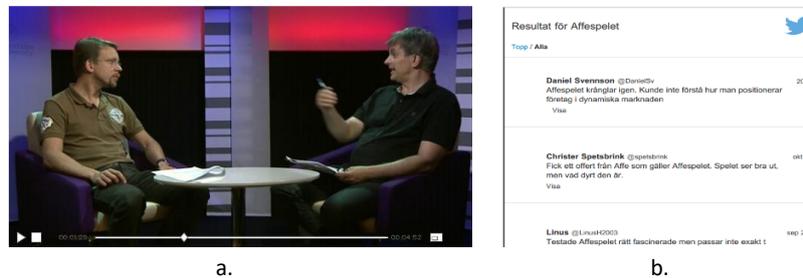


Fig. 1, Example interview (a) and Twitter feed (b) from the AFFE case

To summarize, the “AFFE” case uses a fictitious organisation that is described via multi-media sources, such as documents and structured recorded interviews, created based on the previous textual description of the case.

To examine the opportunities for reusing case descriptions a feasibility study was carried out in which the “AFFE” case was shown as an example to four teachers engaged in teaching of other courses. These teachers were then interviewed on their opinion on the potential of reuse. The teachers were selected based on applicability – they were teaching courses that contained some elements of enterprise modelling. The selection was also based on convenience – the teachers were all part of the same department unit at the university. Based on the transcribed interview data, a thematic analysis [18] was performed. This led to a number of codes, each pointing towards an issue (positive or negative) with reuse of case descriptions. The codes were then grouped into themes, each theme describing a *challenge* or/and an *opportunity* for reusing case material in general (independently from the AFFE case).

The interviewed teachers were engaged in teaching the following courses: Business process design and integration (BPDI), Requirements engineering (REQ), Object-oriented analysis and design (OOS), and Database management systems (DB).

3.2 Reality check – the Harmony inside case

In order to contrast and compare the opinions about reuse gathered through the feasibility study, a set of courses that have been using the same case was examined. Currently, three courses at the department use the same case description: Business process and case management (BPCM), Citizen centric service design (SERDES) and Systems theory, organization and IT (SYSTOIT). All three courses contain elements of enterprise modelling, and make use of the same “Harmony Inside” case description for project assignments. The “Harmony Inside” case is based on a real company and includes recorded interviews with real stakeholders. The case description also contains a company web page and a few additional documents such as fictive mails.

To summarize, the “Harmony inside” case is based on a real case and the core of the case description is open ended interviews with real stakeholders. This is in contrast to the “AFFE” case with fictitious company and simulated structured interviews. As it is described later, this difference affects the potential for reuse.

The first three authors of this paper were engaged in the development and teaching of the three selected courses; thus our reflections were used when matching the experience with the reuse challenges and opportunities identified during the feasibility study. These reflections, however, were complemented by surveys and interviews with the students that attended the courses. The survey we refer to in this paper surveyed opinions of the 10 students that took two of the courses (BPCM and SERDES), while 3 open interviews were held with students taking all three courses.

3.3 Limitations of the study

This work is based on the two aforementioned cases used at DSV. There a number of factors that could have affected the conclusions drawn here. Firstly, the feasibility study was using the “AFFE” case as a starting point for the interviews with teachers. Even though general questions about reusability was asked, the teachers may have been affected by the applicability of the shown case, thus skewing the result. Moreover, the teachers interviewed was from the same department, risking being a too homogenous group with a strong tradition of using enterprise modelling. It should be noted that the feasibility study and the reality check are performed based on two separate cases – ideally would be to use the same case. However, this was not practically possible.

4 Results and discussion

Based on the interviews with the teachers in the feasibility study, eight main themes were identified (Figure 2). The themes were grouped into opportunities and challenges of reuse. In the following subsections, we describe each of the main themes and makes a comparison with our experiences of reusing the “Harmony inside” case.

In the following text, we refer to any part of representation of the case, e.g., a simulated protocol from a meeting, or a recorded interview with a CIO, as to a *presentation asset*. We also use term *learning object* as a package of one or more assets together with the task to be performed, for example, to apply a certain modeling technique to create a model with a certain purpose.

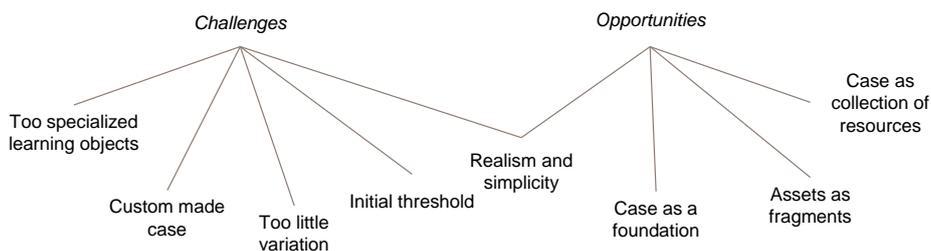


Fig. 2. Overview of themes found in the case study

4.1 Challenges

Too specialized learning objects. One argument against reusing learning objects is that they might not support the course goals. For example, the teacher on the BPDI course noted that some learning objects from the ITO course have limited relevance for the course, for example the learning object concerning goal modelling syntax, which is not in focus in the BPDI course. It is interesting to note that the teacher on the DB course initially shared this view, but also added that “how we use information [to satisfy organizational goals] actually affects the way we store it [based on database models]”. Thus even though this was not a part of the DB course goals, the ITO learning objects may provide the students with valuable information, for example, what the organizational goals are for introducing an information system.

Reality check. In the three courses that shared the “Harmony inside” case, this challenge was tackled by not reusing the complete *learning object* with learning goals, assignments and so on. Rather reuse was performed on a lower level of *presentation assets*. The benefits with this were that each of the three courses using the same case could set its own learning goals. Another alternative would be to let the courses share a common learning goal (for example to understand the business processes of a business by modelling and analyzing a process model), and then let each course specialize that learning goal (for example to use a process model to design a service in the SERDES course).

Custom made cases. This challenge points out that a case as a whole may be custom made for a specific course. For example, the teacher of the BPDI course explains: “especially on the advanced level, I need to ensure that my cases contain problems that are relevant for just my course”. In the case of BPDI, for example, it requires a case that describes an organisation that has issues with a deadlock of processes and some other issues related to the advanced use of executable process models. Thus, the ITO case, being a description of a general software development company, was deemed as not containing the necessary problems.

Reality check. When actually reusing a case, this challenge turned out to be surprisingly simple to meet. The solution was to add small pieces of the case description that were specific for a single course. For example, the recorded interviews in the “Harmony inside” case only briefly mention the need to record certain business events. In the SERDES course, there was a need to extend the case with more details about the information structures that the business should record. This was solved by adding a fictitious mail to the case description that detailed the information that was managed. This mail has not been used in other courses.

Too little variations. This challenge was pointed out as existing from both a teacher and student perspective. It was deemed that both student and teachers might get bored of the same case if it were used in too many courses. Moreover, there is a risk that the student gets to know too few types of organisations, e.g., the ITO case covers only one type of organization - a software development company. This factor was mentioned by both the OOS and DB teachers; the teacher of the DB course noted: “if the same case is used you lose that the same modelling patterns occur in different domains”. Another important side effect of having too little variations was deemed to be plagiarism – the

teacher of the DB course stated that having the same case for each course round might lead to students copying solutions from the previous course rounds.

Reality check. After implementing the same case in three courses, a survey was performed among the 10 students that participated in both of the first two courses (BPCM and SERDES). One part of the survey specifically asked about if using the same case was making the assignments more interesting. The result was that 4 out of 7 of the students that replied thought that the reuse of the case made the assignments more interesting. Furthermore, 5 out of 7 stated that they would consider it as an advantage if a course used the same case as the one with which they already had experience. This points towards that the challenge of variation from a student perspective is not that important to meet. Another result from the survey was that the students considered the reuse as a benefit because they could quickly focus on what was relevant to the next course rather than spending time understanding a new case.

The issue with letting the student get accustomed to too few types of organizations was partially countered by focusing on different aspects of a single organization for the three courses. For example, the SERDES course focused on external system-to-system communication, while the BPCM course focused more on internal processes. Covering more domains in a single case would entail identifying the specific aspects of the domain and to add that to the case. Thus, if there is a desire to cover the financial domain, or goods producing organizations, the specific aspects of these domains, such as real-time transactions and inventory keeping, could be added to the case.

The challenge of plagiarism, mentioned above, has not been examined further – the three courses have only been held once.

Initial thresholds. This is a challenge of overcoming the barriers of introducing a new (reused) case in a course. This concerns both the actual efforts (person-hours) of introducing the case in the course, but also conquering the resistance towards changing the existing course case. As the teacher of BPDI pointed out “teachers would like to have control, introducing too many standard [cases] could remove part of the enthusiasm”. The teacher of REQ noted that this threshold might be solved by incentives from the management, for example by giving course teachers an extra budget for introducing a new case.

Reality check. The reuse of the cases in three courses did not cause any perceived thresholds. It was rather seen as a benefit – the course design had a good starting point and a case did not have to be created from scratch. However, this could be due to the following two factors: a) the teachers were involved in creating the original case, and b) the teachers were enthusiastic about reuse and initiated the reuse of the case.

4.2 Opportunities

Case as a foundation. This opportunity highlights that the case might be reusable in multiple courses, but only as a basis to build upon, rather than being used as the finished case description in a course. For example, the teacher of OOS noted that “this [the case description] could fit as background information if the students want to understand the case better”. Another teacher noted that the case description could provide a basis for a good teaching example – by showing them the case description and the expected results

in terms of models. The student could then model another, similar or more advanced case.

Reality check. The opportunity of using a case as a foundation was exploited in the three courses that reuse the same case. Most of the “Harmony inside” case material was used in all three courses. However, the arrangement of the material was specific for each course. For example, presentation assets, e.g., video clips, that were connected to specific assignments in one course could be used as background information in another course. Each course could also use presentation assets specifically designed for the course.

Assets as fragments is an opportunity of *only* reusing the underlying presentation assets, such as a text document or a video recording without using the whole case. As an example, the teacher of BPDI was in favour of reusing fragments of the case in terms of assets: “I don’t believe in the reuse of an entire case description. I see more potential with reuse on the asset level”. Moreover, a potential for using existing assets and extending them was expressed, this would give the opportunity to have a “base” asset that could be detailed in each course by adding more assets.

Reality check. In the three courses the case was reused at the presentation asset level, rather than on the learning objects level. This is because the subjects of the courses were quite different. Reuse on the learning object level (also including assignments and learnings goals) most likely fits better for courses that are closer in subject – for example, a more extensive in scope or/and more advanced version of an introductory course in process modelling. The opportunity of using “base assets” was employed by extending the assets on the SERDES course.

Case as collection of resources. This opportunity views the case as a potential shared resource, where courses could contribute with their own learning objects and assets. The teacher of OOS expressed this idea: “most of the cases used in information systems education could be connected to a large case”. However, to make it possible to pick out the learning objects and assets that should be part of a particular course needs some form of support. A large case simply requires more maintenance and a better structure. The same OOS teacher expressed this requirement, and the following potential solution: “one idea is to have a detailed meta-model of the available assets and learning objects”. The teacher of REQ also saw some issues with an expanding case description: “coordinating between all courses [to create a combined case description] would be too much work”.

Reality check. The opportunity of using a case as an explicitly manageable collection of resources has not been tested. There are several reasons for this, such as: (a) the teachers of the three courses where the same case was used all knew each other and had prior experience of collaboration, thus there was no need for explicit management; (b) formal mechanisms of managing a collection of assets has not been yet established. As more courses and teachers start sharing case descriptions, the needs for coordination and “maintenance” of the case material are likely to increase.

Realism and simplicity of the case description could be considered as both an opportunity and a challenge. Real-life work with modelling always contains an element of abstracting, i.e., focusing on the aspects that are important, and disregarding what is not important, for example, while designing a process model. Thus, a realistic learning

object and its assets may include details that the students should not model. The teacher on the DB course noted: “The more realistic you do it for the students the better it is, on the other hand, it also hinders”. Realism can lead to complexity for the students, while this is desired for advanced courses it may not be ideal for basic level courses.

Reality check: In the three courses using the “Harmony inside” case the realism of the case proved to be a bigger *opportunity* than it was first thought to be. The recorded interviews contained a surprising amount of information. The two interviews in total of 32 minutes could be used for process modelling (BPMC), service value modelling (SERDES) and system modeling (SYSTOIT), e.g., modeling an organization as a viable system.

The need for simplicity as a *challenge* did not play a major role in these courses. It was partly met by the assignments and modelling notations serving as a limitation on what kind of information the students should include in the models. Also, the interviews were split in a number of segments each of which getting a name and an explanation on what each segment was about, and whether it contained important information for a specific assignment or represented a general background. The confusion that still appeared was dealt with at runtime during the meetings with the students, question answering forums, and feedback on the intermediate results of assignments. It also worth mentioning that all three courses that used the “Harmony inside” case were on a master program level, which required more realistic settings for the project assignments.

5 Conclusion

In this paper, we have examined the potential for reuse of case descriptions among courses in enterprise modelling from two perspectives. Firstly, a feasibility study based on interviews resulted in a set of identified challenges and opportunities for reuse. The result was eight themes – each representing a certain challenge or/and opportunity with reuse. These challenges and opportunities were then contrasted to the experiences of actually reusing a case in three courses that constituted a “reality check”.

The result of the “reality check” is that most of the challenges identified in the feasibility study proved to be easy to overcome. Most notably the challenge that the case needed to be heavily specialized for each course proved to be easily resolved by adding a few details in the case of each course. In addition, the challenge of having too little variation between courses turned out to be an opportunity. The students simply saw that using the same case made them more efficient in learning, and also increased the engagement, provided that the case is interesting and have sufficient for learning details.

Note. Due to the limitation on space, we could not present details on the “Harmony” case. An interested reader can find the relevant information via Table 1.

Table 1. Harmony courses websites

Course abbreviation	Website address
BPCM	http://harmonyproject.blogs.dsv.su.se/
SERDES	http://harmonyserviceproject.blogs.dsv.su.se/
SYSTOIT	http://harmonysyst.blogs.dsv.su.se

References

1. Herreid, F. C : Because wisdom can't be told: Using case studies to teach science, PeerReview, 7 (2), Association of American Colleges and Universities, (2005)
2. Guy, E. Pemberton, L. Knight, J.,: Rich Cases: a framework for interactive case studies in Information Systems teaching, European Journal of Open Distance and E-learning, 3(2), (2000)
3. Harris, A., Lang, M., Oates, B., Siau, K., Systems Analysis & Design: An Essential Part of IS Education, Journal of Information Systems Education, Vol. 17, No. 3, pp. 241-248 (2006)
4. Bider, I., Henkel, M., Kowalski, S., Perjons, E.: Teaching Enterprise Modeling based on Multi-Media Simulation: a Pragmatic Approach. In Benyoucef, M., Weiss, M., Mili, H., eds. : 2015 MCETECH Conference, Montreal (2015)
5. Bider, I., Henkel, M., Kowalski, S., Perjons, E.: Simulating apprenticeship using multimedia in Higher Education: a case from the information systems field. Interactive Technology and Smart Education 12(2) (2015)
6. Bider, I., Henkel, M., Kowalski, S., Perjons, E. : Reuse of Simulated Cases in Teaching Enterprise Modelling. In International Conference on Conceptual Modeling, Springer International Publishing, pp. 337-346 (2015)
7. Fenstermacher, K. D.: If I had a Model, I'd Model in the Morning. In : Proceeding of OOPSLA'04, pp.88-89 (2004)
8. Recker, J., Rosemann, M.: Teaching Business Process Modelling: Experiences and Recommendations. Communications of the AIS 25, pp. 379-394 (2009)
9. Ellaway, R., Poulton, T., Fors, U., McGee, J., Albright: Building a virtual patient commons. Med Teach 30, pp. 170-174 (2008)
10. Tono, L. .: Learning Objects: Implications for Instructional Designers. International Journal of Instructional Media 38(3), pp. 253-260 (2011)
11. IEEE: IEEE Standard for Learning Object Metadata., The Institute of Electrical and Electronics Engineers, New York (2002)
12. Jesukiewicz, P.: Sharable Content Object Reference Model (SCORM), 4th Edition Content Aggregation Model., Advanced Distributed Learning (2009)
13. Rodríguez-Artacho, M. .: Modeling Educational Content: The Cognitive Approach of the PALO Language., pp. 124-137 (2004)
14. Parrish, P. E.: The trouble with learning objects, Journal of Educational Technology Research and Development, Springer, 52(1), pp. 49-67 (2004)
15. Blummer, B.A. and Kritskaya, O. , : Best practices for creating an online tutorial: a literature review, Journal of Web Librarianship, 3(3), pp.199-216 (2009)
16. Boyle, T. : Design principles for authoring dynamic, reusable learning objects, Australian Journal of Educational Technology, 19(1), pp. 46-58 (2003)
17. Rodríguez, J. S., Doderó, J. M., Sanchez-Alonso, S.: A preliminary analysis of software engineering metrics-based criteria for the evaluation of learning objects reusability. Data Structure and Software Engineering: Challenges and Improvements, Apple Academic Press, pp. 53-56 (2011)
18. Braun, V., Clarke, V.: Using thematic analysis in psychology, Journal of Qualitative research in psychology, 3(2), pp 77-101 (2006)