Improving Reusability of OER

Educational Patterns for Content Sharing

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Abstract. The effect of Open Educational Resources (OER) on Higher Education is still disappointing. (Re)use of materials, which can be accessed and employed freely, has not developed in such a way that it has changed the attitudes and behavior of teachers. After analyzing several aspects of the problem the article will focus on educational reasons to improve this situation. It is argued that to strive for context free learning objects is heading in the wrong direction. The author proposes to link OER not only with an educational taxonomy of learning outcomes but also with typical patterns of educational scenarios.

1 Barriers to overcome for using OER

The work for reusable learning objects (RLO's) started almost 15 years ago [1–3]. In combination with the idea of open educational resources (OER) – material, which can be accessed and used freely – it was assumed that the typical provision of learning material would change radically: from printed material protected by copyright to OER delivered electronically by the internet.

There is growing critique about the missing impact of RLO & OER in Higher Education. In February 2013 Gerd Kortemayer summed up the situation in educause.edu: "OERs have not noticeably disrupted the traditional business model of higher education or affected daily teaching approaches at most institutions" [4]. He is only one member of the increasing camp of skeptics and there are many different assumptions why there is so little success and acceptance of OER. The following paragraphs summarize some of the hurdles to overcome.

1.1 Difficulty to find the appropriate learning material

It is still not easy to find quickly the appropriate material for the intended learning/teaching purpose. There exist different dimensions of this problem:

- *Economy of scale*: Even with objects in the magnitude order of billions we face the problem of dragnet investigation. We are not looking for educational material as such but for an object with many detailed characteristics. This desired list of qualities are linked with the "and" operator and are therefore limiting the search result

with every additional property. It is very doubtful if teachers trying to find these kinds of specified objects might succeed. Imagine for instance a teacher searching

- for a course in a specified subject (e.g. mathematics)
- for a specified very detailed teaching/learning area (e.g. factorizing quadratic trinomials)
- for a specified pedagogical strategy (e.g. to explain, to practice, to demonstrate, to visualize)
- for a specified language (e.g. German)
- for a specified target group (e.g. adults with rudimental mathematic knowledge/experience)
- for a specified number of learners
- for a certain learning time (in hours)
- for a specified learning environment or learning platform (e.g. lecture hall, moodle, etc.)
- for a specified license model (e.g. creative common: by name, commercial and share alike)
- …

— *Educational metadata*: In spite of sophisticated federated search engines and well known huge content portals we are still missing a formal educational taxonomy where important sectors of the educational community can agree. The LOM-standard is for the above specified educational purposes ridiculous weak. What does it mean for instance that some educational elements like level of interactivity, semantic density, and difficulty vary in five categories (very easy, easy, medium, difficult, very difficult)? And what is the yardstick for these properties and who judges them? – But even though there are agreed application profiles: Who will undertake the tedious task of filling in all the many necessary details? Experiences show that most of the material collected in portals or found with sophisticated search engines lack educational metadata at all.

— *Educational culture*: There is the well know problem to overcome the barrier that objects created for a limited personal usage have to undergo still a long and cumbersome enterprise to make it fool proof for every possible standard situations. Who will get the payoff for this work? In order to promote the development and improvement of OER educational systems would have to cherish exchange or gift cultures in contrast to traditionally predominant business models.

— *Educational quality assurance*: Evaluating the quality of OER for learning/teaching purposes has to overcome different hurdles:

- Who has the necessary qualification and authority? This is not only a question of competence but in a participatory community model also a question of regulatory procedure and power relations.
- What kind of agreed and fast procedure is to follow? The blind peer review as the traditional model of quality assurance in science is not only far too slow but also seems inadequate in an open community model of fine grained different needs and diverse interest/target groups committed to a variety of educational models and approaches.

As one can see I have focused my list of difficulties to the organizational and pedagogical sphere and not elaborated on technical problems related to RLO's and OER. This concentration on organizational and educational issues is not only governed by my own competences in pedagogy but is also a result of my conviction that we have to enforce the pedagogical point of view in order to move forward OER practices considerably.

1.2 For a conceptual turn – Context (not content) is king

During the last 15 years I have argued from an educational point of view that content is just another element of the complex learning situation (also known as "context"). I have stressed the relationship of educational theory such as behaviorism, cognitivism and constructivism to the dynamics of content provision [5]. I described the different learning attitudes as Learning I, II and III and demonstrated the different perspective to the role of content in these three models. Only in "Learning I" is the transfer of "correct" or "true" knowledge the predominant strategy. In constructivist environments ("Learning III") even "bad" content can be used to the best advantage of learning processes (e.g. when students have to find mistakes and wrong assumptions in order to improve or elaborate the material).

I believe that there are two key features essential for a paradigmatic turn:

From sender/receiver model to the self-determinated learner. The idea that high reusable content has to be context free as much as possible is still following the – at least in education – long ago outdated communication model where the teacher (sender) is just transmitting neutral information to the learner (receiver). The congenial categorical teaching model of this approach is the so-called "educational triangle" (cf. Fig. 1), which has only a unidirectional sequence from teacher to learner transferring the content [6, 7].

Nowadays categorical teaching models are not only more complex but are centered on the learner and not on the teacher. In addition to simply transfer content there is also the contextual/situational learning challenge learner have to meet. (Cf. as an example of an advanced categorical educational model Fig. 2. The numbers in the diagramm shows all the different bilateral connections as a subset of a dynamic network of the huge variety of possible relationships between the different educational categories.)

Additionally we know that various types of motivations shape learning experiences essentially. This qualification refers not only to the somewhat crude and well known distinction of external and internal motivation but also – as Deci/Ryan have shown empirically and convincingly – to different degrees between these opposites [8–10].

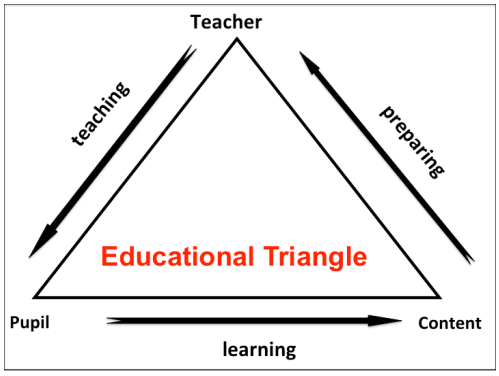


Fig. 1. Educational Triangle

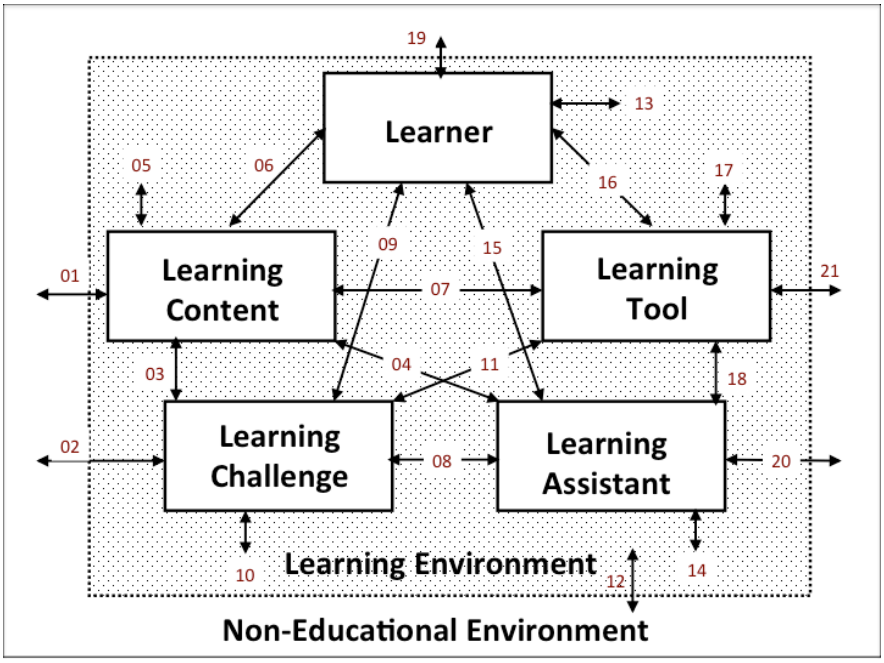


Fig. 2. Categorical Educational Model [11]

From thinking in separated modules to a holistic network approach. The second new important change in the conceptual orientation to overcome problems in using OER is abandoning the so-called Lego approach of learning objects. According to this now criticized view we have to build small content units with standardized interfaces [12–14, 1, 3]. Similar like Lego's building blocks we can assemble complex structures by putting these different components via their interfaces together. A consequence of using the Lego metaphor is the discussion on granularity: How small grained should the standardized building block be? [15–17]

But this approach does not even work with Lego as the ingenious enterprise knows. Lego is providing quite a different range of building blocks to support a variety of usage and construction ideas (cf. Fig. 3). And as one can see the heuristic rule "build content block as small as possible in order to be maximized for reuse" does not work even in the basic metaphor: The Lego "atom" cannot provide even for the simple constructions in the right hand upper blue arc sitting on a red bridge.

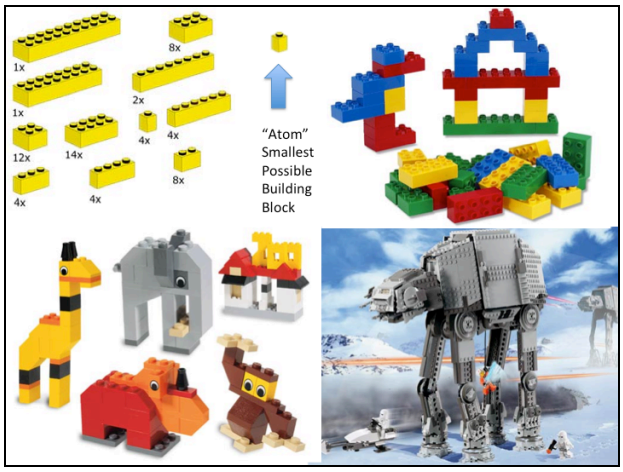


Fig. 3. Lego: Uniform buildings block do not match the variety of user wants

But what is wrong with a module approach in pedagogy? Aren't we using this conception of building blocks, so-called "modules", for the development of our course curricula as well? No, there is one big difference: Planning a curriculum is a holistic enterprise, starting top-down, not bottom-up: The first question is: "What are the learning outcomes (necessarily acquired competences) for a specific curriculum?" Only after answering this primal question we are concerned with modularization. Knowing all the time that a good curriculum should not only have modules which build on each other but also have as many relations between modules as possible. The Lego approach in learning objects goes the reverse direction: "What are feasible small learning units which could be used many times in different situation/curricula so that there is a high return of investments (ROI) for the development costs?".

From the educational point of view there is also a ROI schema, which is very different: I call it the Reusability of Instruction paradox (ROI paradox): Instead of a standardized learning environment which covers all possible situations the art of instructional design has to reflect and integrate all the different contextual conditions of the learning environment in order to be a learning process of high efficiency. Some of the questions to be answered and to be accounted for are:

- What is the specific purpose of the intended learning process?
- What is the previous knowledge/experience of the learners?
- How much time is available (for learner as well as for teacher)?
- What group size is expected?

- What kind of (virtual) educational environment can be accounted for?
- What kind of intervention for the intended learning outcome is most appropriate?
- …

In the rest of the article I will outline an alternative approach of building blocks for dynamic and interrelated learning processes.

2 Reestablish the wholeness of the learning situation

2.1 The reconceptualization of the learning object

The main problem of the Lego approach for learning object is the destruction of the wholeness of the learning situation. One part of a complex learning arrangement – the learning content – is taken as the representative for the interrelated connection of all parts. The consequence is a certain overemphasis of content ("Content is king") and a fallback to the education triangle model. To distinguish this extended conception I will change the name "learning object" of this building block with regard to content to information object (IO). To reestablish the wholeness of the learning experience we would need to focus our attention of all the relevant elements of the educational situation. I call the collection of these interrelated parts the educational scenario (ES).

But how are these two essential parts of every learning situation linked together? The glue that brings them together and attaches them to each other is the learning target (LT). Nowadays educational specialists distinguish between learning goals and learning outcomes. As far as this paper is concerned I will use both terms equivalent. Therefore we have saved the abbreviation "LO" (learning object) for the whole new construction (cf. Fig. 4).

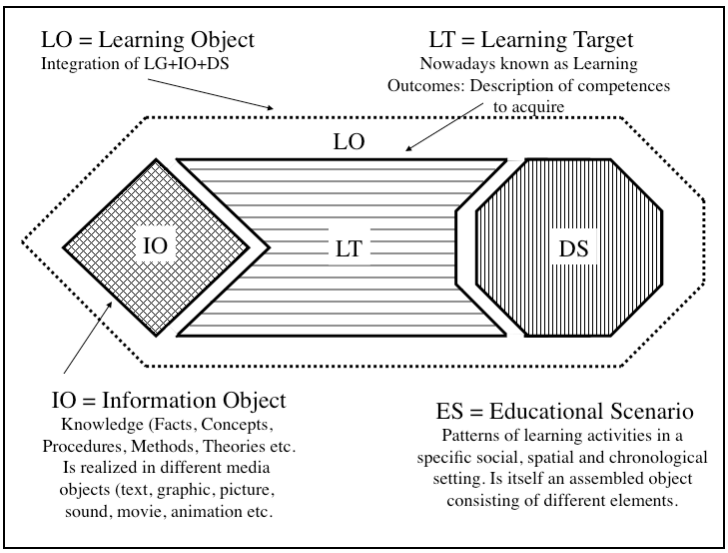


Fig. 4. The parts of the new learning object

2.2 Educational repositories instead of just content repositories

Instead of content portals were one can find just information objects the new educational repository consists of three different collections:

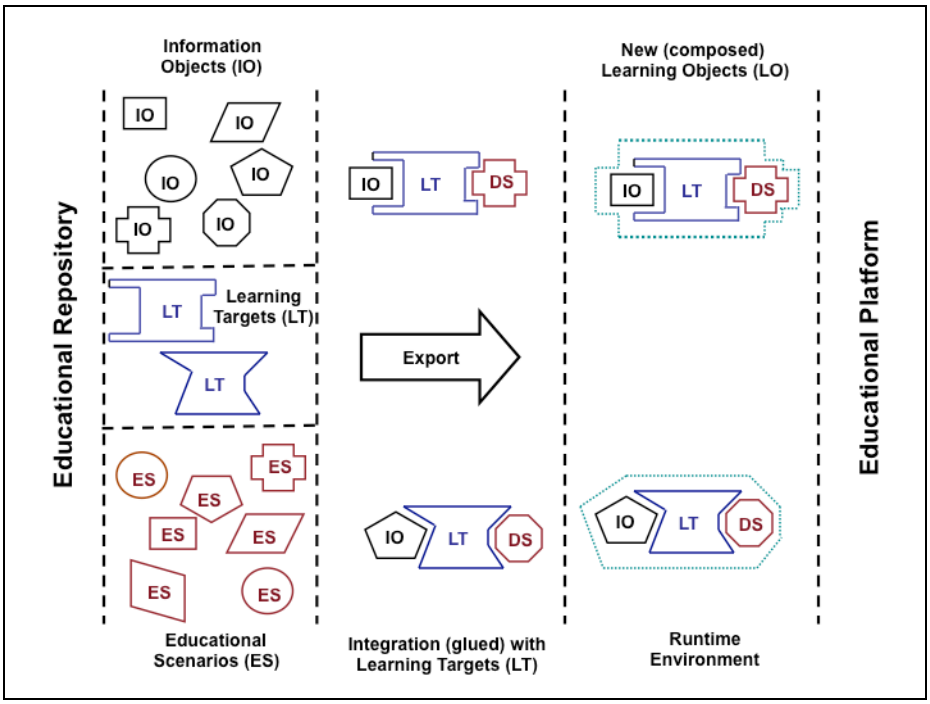
- *Information Objects (IO):* This repository has a similar structure like the content repositories we already know. The only differences are shown in the classification part of the LOM metadata. Especially the "Purpose" element has to be reconceptionalized in a much more formal way. It has to be based on a sophisticated taxonomy of learning objectives. Either the enhanced taxonomy of Bloom [18–21] or the approach of Marzano/Kendall [22, 23] could be used.
  It is important to understand that the same information object could be used for different learning targets. For instance, using the vocabulary of the revised taxonomy by Anderson and colleagues one information object could be targeted at different cognitive process dimensions: remember, understand, apply, analyze, evaluate, create. In that case the information object would need alternative classification elements.
- *Learning Target (LT):* These days the description of learning outcomes for modules or courses is obligatory. Therefore it should be easy to collect and provide this essential information and to pack it into a searchable object. But there is still some homework to be done: The used vocabulary has to be restricted to a chosen taxonomy of learning objectives. This chosen taxonomy has to be made explicit and their vocabulary has to be used throughout the whole system, e.g. the collection of learning targets, information objects and educational scenarios have to apply the same taxonomy.
- *Educational Scenario (ES):* Here is the real challenge: We do not have an agreed taxonomy of educational scenarios and we are also lacking a formal system of descriptions in order to specify the dynamic and complexity of these elements of the learning situation. In some educational communities the pattern language approach of the architect Christopher Alexander [24–26] is discussed as a possible candidate for this kind of description [27–31]. This discussion is grounded on the conception of teaching as a design science and community endeavor [32]. There is also starting a lively debate about philosophical underpinnings of this approach after Alexander has published his four volume magnum opus "The Nature of Order" [33].

3 Summary and Outlook

Especially on the educational side of the learning object equation much work has still to be done. We need a huge collection of educational scenarios based on a (somewhat) formalized description system, which could be derived from the Alexandrian pattern language approach.

The result would be a new kind of educational repository as demonstrated in figure 5. At edu-sharing.net, an interdisciplinary community of computer scientists, psychologists, educational specialists, teachers and administrators are currently con-

structing and exploring the viability of the conceptual approach described in this paper.



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