RELEASE THE CROWD! FACILITATE STUDENT PRODUCTION OF OPEN EDUCATIONAL RESOURCES IN HIGHER EDUCATION

Per Lauvås
Westerdals Oslo ACT (NORWAY)

Abstract

Teaching a course can be modelled with a well-known triangle called “The didactic model”. The model conceptualizes teaching and learning. The corners in the triangle; teacher, student and content are the three main elements of a didactic system. The didactic model has been expanded by multiple authors over the years. Kinnunen[1] introduced multiple layers in the model to place teaching and learning in a bigger context than the course itself. A second layer describes the course in an organizational context (e.g. university). A third layer describes the society where the educational organizations exist.

Within the “content” corner of the didactic model, we find course resources. In recent years, sharing resources within the international educational community has been well established. This community is all about sharing what we call Open Educational Resources (OER). In this paper, we look at OER production through the lenses of two well-known guidelines within computer programming: High Cohesion and Low Coupling. We show that using these guidelines results in small-scoped resources where clearly defined concepts or subtopics are explained. These small resources should be created with a low degree of dependency to an outer context. In this paper, we discuss benefits of producing these Small Open Educational Resources (SOER) in all levels in Kinnunens model. And by emphasising resources covering subtopics within a course, we introduce a new layer 0 in the model.

The traditional production of OER is reserved faculty staff. SOER are easier to produce as they are small and independent. In this paper, we argue that we as educators should facilitate student production of SOER. Students should be encouraged to share their newly acquired knowledge and skills through these resources. In fact, SOER production can be used in evaluating learning outcomes. And as students produce SOER, educators within the international educational community can use these resources when maintaining existing courses, or creating new courses. And as the resources are loosely coupled, they should be easy to use in multiple contexts. We exemplify this by looking at SOER production in an introductory database course.

There are multiple dedicated OER repositories with resources ready to be reused. However, the dedicated repositories are not the first choice for people searching for educational resources. Earlier research suggests that the everyday search engines are the primary tool to find relevant resources. We argue that student production of SOER will have a positive effect, not only for the community, but also for the student herself. And when all students tag their resource with the tag “OER”, we will find it, even outside a dedicated OER repository.

Keywords: Open Educational Resources, OER, OER repository, SOER, assessment, student engagement, diploma.

1 INTRODUCTION

High cohesion and low coupling are well known concepts within object oriented programming. High cohesion can be defined as measurement of the degree to which elements of a module belong together [2]. High cohesion for classes in a computer program enhances program comprehension, testing, reusability and maintainability. Coupling describes the interdependency between modules. There are many types of couplings, and they can be describes as having different strengths [3]. These are important concepts when computer programs grow in size and complexity, and are to be maintained by several developers over a period of time.

A study program consists of a set of courses. The set of courses can, and will, change over time. The individual courses within the program will also change as they are further developed by faculty staff members, hopefully each year. Some of the courses within a program will have dependencies to other courses. The learning goals in a course cannot have a high degree of overlap with other courses within the same program. And some courses require completion of preliminary courses.
The teaching of the courses can be modelled. One alternative model is the didactic triangle (Figure 1).

Figure 1. The didactic triangle.

The model conceptualizes teaching and learning. The corners in the triangle: teacher, student and content are the three main elements of a didactic system. The main elements are related to each other. The simplistic model has been interpreted and expanded over the years. Kansanen [4] and Kansanen and Meri [5] expanded the model by adding a new relation in the triangle from the teacher to the learning process of the student, the CONTENT-STUDENT relationship (Figure 2). The arrow represents the relation between the teacher and the students’ studying and learning process.

Figure 2. The didactic model by Kansanen.

Kinnunen [1] further developed Kansanens model, and introduced a three-layered structure. The model was created as a base for categorizing existing educational research in computing education (Figure 3). In addition to adding the three layers, Kinnunen added another initial relation from the student node to the relation to the teachers’ pedagogical actions. This was done to emphasize the importance of students’ perceptions of the teacher’s pedagogical actions, like giving a lecture.
The didactic model is no longer solely modeling a course context with the teacher, content and student (inner layer – layer 1). The three layers are not isolated; they coexist and interact with each other. A student is a part of a larger community of students (layer 2), and also to the community outside the educational setting (citizen – layer 3). The teacher is a staff member in an organization (e.g. university – layer 2). The organization will fulfill a role in the society’s educational goals, and is therefore a part of the society (layer 3). Course content is a part of some degree program (layer 2). The program must fit some general goal for education in the society (layer 3).

2 COURSE MATERIAL

Within the context of teaching courses, we find course material (or learning material for a course). Course material is not explicitly described in Kinnunen’s model, but is an important part of teaching and learning. Course material is normally decided by a teacher creating or maintaining a course. In the planning process, there might be guidelines or constraint on the material from the organization or society. Course material is an important part of the teacher’s aid to the students learning process (Kansanen’s addition). The students may also find their own course materials during their learning process. The material can be found and used individually or shared within the community of students, or within a larger community.

Traditionally, a text book plays an important part as course material in a course. Now, other types of course material can be found online. For example, using online videos in an educational setting has been a research topic in recent years. Some try to evaluate what constitutes a good video in a learning perspective (e.g. [6]). Others describe solutions that can wrap videos into a better learning context and provide more than just the video itself (e.g. [7],[8],[9]). Within educational online videos, there is a wide variety from small how-to videos [7] to large video lectures [10].

Online course material can be a part of an online course (for example a MOOC or Khan Academy), or the material can be used in a traditional classroom setting. A lecturer in a classroom setting will naturally search for course material that will help the students in their learning process. In the search, the lecturer might find material that somewhat matches the content of the course. Figure 4 describes some course material (circles) in relation to course content, or learning goals – the square.
Course material A could be a text book covering most of the topics in the course. The book also covers topics not found in the course description. Material B could be lecture notes from a lecture covering topics also described in the text book. Material C could be lecture notes from a lecture covering topics for the most part not found within the text book. Material D could be a short online article. Material E could be a video covering a topic not found in the course description. In this example, multiple course materials are used to cover all topics within the course, and even more are needed.

Some courses might have a text book that matches well with the course content. Other courses might have no fitting text book, but can use a multitude of online resources (e.g. articles, blogs, videos). These resources can be combined with materials created by the lecturer himself (slides, articles, prints from books, compendiums, videos). The size of the bubbles in the figures can be thought of as scope. Generally speaking, a text book involves a much greater scope than, for example, an article or a video. When the scope increases, it will be harder to find a good match where the amount of unnecessary or borderline content is minimal.

Figure 4 described learning material for an entire course. The same type of figure can be used for describing learning material for a topic or subtopic within a course. As an example, ACM provides curriculum guidelines for a multitude of programs, and Computer Science is one of them. In the Curriculum Guidelines for Undergraduate Degree Programs in Computer Science from 2013 [11], we find “CS430: Database Systems” from Colorado State University as an example course. The course materials for the course are described as a required textbook “Database Systems Concepts” [12] and two recommended supplementary text books. In the course description, it says: “Instructor’s slides and different webpages supplement the textbook and are distributed via the course home page.”[11, p. 299] In the description of the course, we also find knowledge units with multiple topics. In the “Query languages” unit, we find eight topics, and one of them being “SQL queries”. Although not described in the course description, we could apply even more subtopics within “SQL queries”, like GROUP BY or JOIN.

Focusing on a small subtopic within a course, the course material could be as displayed in figure 5.
From reading the course description: The subtopic will likely be covered by the textbook(s), and/or by “slides and webpage supplement distributed by the instructor”.

Continuing with the CS430 course example, the textbook in the course has a greater scope than the supporting learning materials. The book was not written specifically for CS430: “The text is designed for a first course in databases at the junior/senior undergraduate level or the first year graduate level. It also contains additional material that can be used as supplements or as introductory material for an advanced course.”[13] This book was probably found to cover many (or all) of the “knowledge units” in the CS430 course, and therefore placed on the curriculum.

Some course material will be coupled directly to a specific course (slides, compendiums, course specific videos etc.), and some material is produced in a larger context. In Kinnunen’s model, the text book can be placed in a layer 3 context, while specific course material will reside in layer 1. Course material in layer 1 will naturally be targeting a narrower target audience than the material produced for layer 3. There can be multiple reasons to produce/reuse specific course material:

- The material covers topics not covered in the textbook(s) for the course.
- The material describes topics in a different way than the textbook(s).
- The material is to be used in course specific learning activities.

In a layer 3 context, specific course material is expensive. If course material can be used outside a specific course context, it will reduce cost at the society layer. As an extreme example, it would be very expensive for society if every instructor wrote a dedicated textbook for each course she instructed.

3 SHARING KNOWLEDGE

3.1 Open educational resources (OER)

Using the same textbook across multiple course deliveries around the world is nothing new. It has been the case for hundreds of years. In recent years, sharing dedicated course material has been made easier by information technology. The Open Educational Resources movement is advocating open learning resources that can be accessed and used by everyone. The William and Flora Hewlett Foundation defines an OER like this: “Open Educational Resources are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and repurposing by others. OER include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge.”[14]
As OER are open they should be easily accessible. It is therefore created multiple OER repositories where OER can be found, like OER Commons (oercommons.org) and Ariadne (ariadne-eu.org). Barros et al [15] conducted a survey to find out if these repositories are frequently used when people are searching for educational resources. The findings supported Dichev and Dicheva [16]: Users searching for educational resources prefer to use standard search engines over specific search with OER repositories. Another challenge with the different repositories is that they use different metadata standards for the OER. According to Atena and Havemann [17], only 38.75% of the 80 repositories in their study used standardized metadata at all. This motivates development of tools for evaluating the quality of such repositories [18].

3.2 Small OER (SOER) – learning material in a HC/LC context

As OER include a multitude of different educational resources, SOER are small OER in regard to scope. Continuing the CS430 course example, a SOER item could be a video explaining GROUP BY. The video will have high cohesion, as it will only explain GROUP BY, and no other subtopic within SQL. If we aim for low coupling, the video should not be dependent on any other course material or activity within a dedicated course. If a technical environment is found needed to explain GROUP BY, a coupling to the environment should be explicitly explained. The environment should be easily available to as many potential viewers as possible (no cost, easy to obtain). If a specific database is used in an explanation, it should also be accessible to the viewer (i.e. openly available example databases like “world” [19] or “SAKILA” [20]). Using a non-accessible course specific database would increase the strength of the coupling, and reduce the value of the OER item in a layer 3 context. The same applies to code examples in a computer programming course. The code itself should be available, for example through GitHub (github.com) or other code sharing sites.

When the SOER item has high cohesion and low coupling, it makes sense to publish it in the open, in contrast to inside a protected LMS. The SOER is all about specific, small topics. Possible necessary dependencies (like technical environment) are explicitly described. As they are small, there should be less need of extensive metadata.

It could be argued that small OER are easier to produce than larger course materials. The topic is isolated and small. This opens up the opportunity that not only faculty staff produces them.

3.3 Releasing the crowd

A student in the CS430 course will hopefully, some point in time during the course, understand how to use GROUP BY in an SQL query. What if the student is encouraged to display the newly developed understanding through a SOER item? There are multiple good reasons for a student to do so:

- Creating the SOER item will be a learning activity, strengthening the knowledge on the specific topic [21].
- The student create course material that others can learn from:
  - fellow students in the course (Kinnunen’s layer 1)
  - students in subsequent cohorts at the same learning facility (layer 2)
  - people outside the learning facility (both students and non-students – layer 3)
- The student adds an important addition to the documentation of her knowledge and competence.

Although the motivation for a student to create SOER should be clear, the instructor can facilitate and motivate the production by:

- Setting an example by producing own SOER.
- Guide the students on
  - possible SOER format choices (text, audio, video)
  - SOER quality measures
  - SOER publication options
- Include SOER production as a dedicated activity within the course.
- Include SOER as a part of the formal assessment of the student learning in the course.
As SOER are small and cover a dedicated small topic, it could be argued that we could expand Kinnunen's model with a new first layer. SOER fit the model in a layer below the course layer: The topic layer. The teacher node is the instructor teaching a specific topic. The student node is the student learning a specific topic within a course. The content node is the specific topic. As Kinnunen originally expanded the model in the setting of categorizing research papers, the new layer still seems reasonable. An example of a research paper in the new layer could be a paper describing the looping constructs (e.g. [22]) in a computer programming course.

A student generating SOER will build a portfolio of elements documenting not only knowledge gained through the study program, but also the ability to explain it. There is reason to believe that recruiters will find this documentation very useful when recruiting graduate candidates. The candidate will present an understanding of topic knowledge, an ability to explain topics, and also the willingness to share the knowledge to a community. A portfolio with documentation has been standard practice within other occupational recruitments (e.g. photographer). With the easily available open publishing platforms we have today, it should be time for other professional prospects to present their knowledge with something more than the standard diploma displaying course grades.

3.4 Publishing SOER

The dedicated OER repositories within the OER community do not fit well with student contribution by SOER production. We propose publishing SOER on open well known platforms (e.g. youtube.com, vimeo.com, blog platforms), and not in specific OER repositories. By using existing platforms, well known by the students, they will not have an unknown hurdle to climb over in the publishing process, and the publication can take place without instructor involvement. The students can provide metadata by using the standard format of the publishing platform (title, description, language etc.). To facilitate search within normal search engines, all students should tag the SOER with a common tag. As it is an OER (Open Educational Resource), and OER is already an existing phenomenon, the tag “OER” should be used. The OER tag will indicate that the object was created and published with an educational purpose. If the instructor wants the student to provide additional tags (name of educational site, name of department etc.), the instructors can ask their students to do so. When students are instructed to tag their own school, the school can more easily keep track of their total amount of OERs being published. That amount can be considered a success criterion for a course delivery.

4 POSSIBLE GAINS WITH HIGH SOCIETY SOER PRODUCTION

If we achieve a high volume of SOER at the society layer in education, we receive benefits. Instructors delivering courses around the world can more easily pick “missing pieces of the puzzle” when planning course deliveries. The intention is not to let SOER account for all course materials, but the instructor can find good explanations to specific topics, and can more easily present multiple different types of explanations within the same topic. It is likely that a student explanation can provide something different than an explanation from an instructor. It might be that a student can use a more familiar language to a fellow student, than what an instructor is able to.

When these SOER are published on existing platforms where viewer feedback is possible, the community will evaluate the contributions. The evaluation from the community will provide help to instructors searching for a well suited SOER item. Although the instructor must make sure the SOER item meets the requirements before placing it on a curriculum. When using video, the instructor may also use an analytic tool to monitor online content presented to the students, and evaluate the video in regard to the students viewing patterns [8].

All students are different, and they have different learning strategies. Students will have different preferences when it comes to what course material will help them learn new topics. In an educational setting where SOER are easily retrievable, it will provide students with options. The students may choose from a variety of materials provided by the instructor (if the instructor presents alternatives), or the student may retrieve SOER by their own. Maybe a student finds a specific former student explaining topics in a way that the student find easy to understand? Being provided with options is a big contrast to a fixed set of course materials that are meant for all students in a class.

Finding relevant SOER can also be a dedicated learning activity within a course. Good SOER, not originally found on the curriculum, can be highlighted within the course, and placed on the curriculum for the next delivery. This will enhance the quality of course material from delivery to delivery, and students can play an important part in the enhancement. The activity of finding good educational
resources will give the students practice in something they will find use for after they have graduated. Students finding course material outside the curriculum is not something new. But with a high production of student SOER and a common tag for defining an item that is produced as an educational resource can make the search easier.

The industry hiring graduated CS students will have more information on their candidates when they produce SOER. It is not always easy to understand precisely what kind of skills and knowledge lies behind a grade in a course. The course description will tell us the learning goals of a course, and the grade will tell us something about the learning outcome for the student. A recruiter watching a video of a student explaining GROUP BY can provide a lot of information. How are the communication skills? How familiar is the student with using industry tools? How confident is the student in this subject matter? And if there are some specific skills that are important to the recruiter, the student may display exact examples of those skills.

High cohesion and low coupling in an object oriented computer program module makes it easier to reuse and maintain the module. When SOER are present as course material, we could argue that the same applies for topics within courses. When a topic within a course is removed, the dedicated SOER for the topic will be removed as well. Course material for a new topic within a course can be added by complementing SOER if the text book on the curriculum does not cover the new topic. As the SOER should be loosely coupled, they can be useful in many different types of educational activities. They can be resources to use as preparation before a lecture. They can be used within a lecture. They can be excellent resources to use when preparing for a session in a flipped classroom setting.

Students producing SOER are students sharing knowledge. At a society level, we could argue that society will gain from having educational facilities aiding students to become accustomed to sharing knowledge. Open resources are helpful within different professional communities. And within those communities, we need contributors and not consumers only.

5 FUTURE WORK AND LIMITATIONS

Although the positive effects of producing SOER from a student perspective should be clear, getting students to produce them is not easy. A better understanding of why students are reluctant to produce SOER voluntarily is needed. A possible solution could be to give a student the possibility of being evaluated in a course based on the evaluation of the SOER produced in the course. This will be tested at Westerdals Oslo ACT in the near future.

It could be argued that students producing SOER can lead to uncertainty in regard to quality. Could we end up with students watching videos that are providing false or inaccurate information? Or may we argue that evaluating open content found on the Internet is an essential skill that must be developed, and can be developed with aid from the instructor of the course using SOER? These questions are interesting, but are not within the scope of this article.

This paper has focused on SOER. There is no reason to restrict students to produce small OERs only. SOER are considered a starting point for student production of OER. If students are familiar with this type of activity, they could also provide bigger OER.

6 CONCLUSION

Not all course materials for a course should be short how-to videos explaining specific small topics. But in this paper, we argue that students producing small open educational resources can give positive effects on many levels. The student will gain a deeper understand of the specific topic while creating the material. Other people may learn by accessing the openly available material (fellow students, students in the next cohort, students elsewhere and non-students). Teachers can more easily present multiple different explanations to specific topics. With SOER production as a learning activity within a course, the course will evolve over time, and the students will play an important part in the evolvement. The students creating SOER will contribute to a community, but they will also gain a broader documentation of the knowledge they acquire through their studies.
REFERENCES


