Re-thinking Digital Textbooks: Students as Co-authors

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Abstract. The steadily widening access to instruments and services for digital content production allows students and teachers to modify, remix and re-use a wide range of existing artefacts or create new artefacts and assemble them into various content collections. This development holds the potential for shifting patterns of power, roles, and responsibilities of students in digital textbook publishing sector and for supporting the strategic educational vision of "students as creators". However, this vision causes a growing pressure on academic publishers and other learning resource providers, as it tends to intervene and disrupt existing practices and business models of content development and provision. Existing models of interaction analysis are not suitable for the emerging context of mash-up learning resources co-authored by learners. The paper proposes a new analytic framework LoCA for evaluating level of learner's interaction with and co-authorship of digital content.

Keywords: Trialogical learning · Curating · Authorship levels · E-textbooks · Knowledge creation

1 Introduction

An increasing number of everyday activities are enhanced and transformed through the extensive growth of digitisation in our societies. This development has been accelerating by a massive growth of personal mobile device ownership. Thus personal and social computing is becoming truly pervasive and ubiquitous [1], supported by, and supporting, an ever-changing configuration of networked devices, applications and actors [2, 3]. It is becoming the norm that we can all access, interpret and process informational artefacts on the go, transform them into various representational states, or create entirely new ones. We can decouple from, and recouple with, external resources and artefacts of various kinds on a continuous, interactive basis [4]. Be it laptops, smart phones, or tablets - these devices are becoming also increasingly accessible and affordable for our student populations. Thus, a growing number of students experience that the digital realm is gradually penetrating a widening range of activities in their life. In principle this development holds the potential for shifting patterns of power, roles, and responsibilities in educational settings, too. Proponents of such a change vision continue to emphasise that students should be enabled to form their own digital learning ecosystems and design their personal learning environments for various learning purposes [5]. Students can (and should) learn how to take control and responsibility for systematically re-instrumenting their (learning) activities.

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From this perspective, mastering a range of digital instruments for working on diverse sets of digital artefacts, is increasingly seen as the pre-requisite for become contributors and (co-)creators of knowledge. By offering their own interpretations, explanations and examples [6], students are shifting ownership of, and control over, knowledge artefacts and the development of their own learning environments.

Current educational policy in Estonia – as formulated in the "Estonian Lifelong Learning Strategy 2020" - is trying to support and stimulate a system-wide change project under the label of "digital turn in schools" that embraces, among other aspects, the idea of "students as creators". Students are expected to collaborate, communicate and connect to ideas in entirely new ways through authoring, remixing, and co-creating digital, networked artifacts of various kinds and of different representational qualities. It is also envisioned that all schools are providing digital resources, making a modern infrastructure available for one-to-one computing, incorporating digital culture in teaching and learning practices and focusing on supporting learners' critical thinking, creativity, knowledge building, and problem solving.

In the context of this ambitious national project of change, existing models and formats of digital textbook production and provision are also scrutinized from the perspective of a future educational practice that would systematically support a shift towards the concept of "student as creator" that we have briefly outlined above. In the remaining paper we want to highlight and discuss some insights and unresolved challenges that we have gathered in the context of Learnmix – an applied research project focusing on the pedagogical and technical re-conceptualisation of the next-generation digital textbook production and provision model in Estonian context.

2 Trialogical Learning and the Concept of Students as Creators

The increasing pervasion of personal and social computing among students offers multiple ways to interact with, reuse, create, and author digital artefacts of all kinds. In consequence, we seemingly need a rather different set of frameworks and metaphors for addressing and capturing this emerging form of learning activity and its mediation. Inspired by Scardamalia and Bereiter's work [7] Paavola et al. [8] propose, for example, a knowledge creation and building metaphor, which they call "trialogical learning". Trialogical learning emphasizes the central role of operations on, and through, knowledge objects. In this view it is essential that students collaboratively create and develop shared, novel (digital) artefacts with the support of (digital) instruments of various kinds. Paavola and Hakkarainen [9] state that "*in trialogues the central aim is not to enhance dialogues but the common ground is provided by jointly constructing external representations, practices and artefacts (dialogues can, of course, help here). In trialogical processes the common ground is deepened (and provided) by modifying those artefacts and practices (*"*shared objects*"*), which are objects of joint activity. In trialogues we are not interacting only with words or concepts, but also modifying conceptual artefacts, external representations, and practices*" (p. 12). Knowledge building and creation stresses the importance of idea (conceptual artefact) advancement, expansion and improvement; and the ability of students to develop cultural or conceptual objects. In

this manner, students can construct their own knowledge by incorporating and elaborating on artefacts that are, for instance, professionally developed by instructional designers, e-textbook authors, teachers, and so forth or even create their own objects from scratch. According to [9] the objects "*can be knowledge artefacts, practices, ideas, models, representations, etc. but understood as something concrete to be developed collaboratively*" (p. 4).

While the concept of *students as creators and producers* is certainly not an entirely new one, digitisation has transformed existing practices and is stimulating the emergence of new types of creation and production. In this way, it is allowing students to express themselves in a widening range of re-presentational modes. Teachers and students are slowly expanding the boundaries of their respective roles in education. They are becoming (co-)authors of digital content, thus challenging established models and processes of educational content production, its organisation, and provision.

3 Authoring Digital Content Collections

In the context of the Learnmix project, we carried out empirical research on interaction with digital content in 6 schools, where teachers and researchers co-designed 12 lessons where students (age ranging from 8 to 18 years) used personal digital devices to learn through using, editing and creating digital learning resources. All lessons were observed, protocolled and video-recorded by one researcher. Qualitative analysis of lesson protocols and videos showed that when trialogical learning scenarios were successfully implemented, the students were actively engaged in interaction with the content in the role of a creator. The products of the student-centered knowledge creation process were increasingly of an aggregated, collage-like nature. Over time we came to see this practice of combining and aggregating various content items in meaningful ways as yet another, particular aspect of "co-authorship" (see [10]).

In networked environments teachers and students potentially have access to countless content items (images, graphs, videos, tables, text, and so forth) of various quality and origin. Some of them are professionally produced, stored in dedicated repositories, and equipped with different licensing models and metadata. Some of them are freely available, created and designed by "amateurs". This seemingly infinite pool of digital content provides teachers and students with numerous ways to assemble and curate content item collections. Depending on the type of educational scenarios that are initiated and supported, students might even create, collage-like, artefact collections, which may not make use of professionally created artefacts at all.

As part of our work around a series of intervention studies in Estonian K-12 education we traced and modeled the (inter-)action levels with digital micro-content, and various content collections, as they occurred throughout the execution of a variety of scenario based teaching approaches – all designed around the general notion of "students as creators".

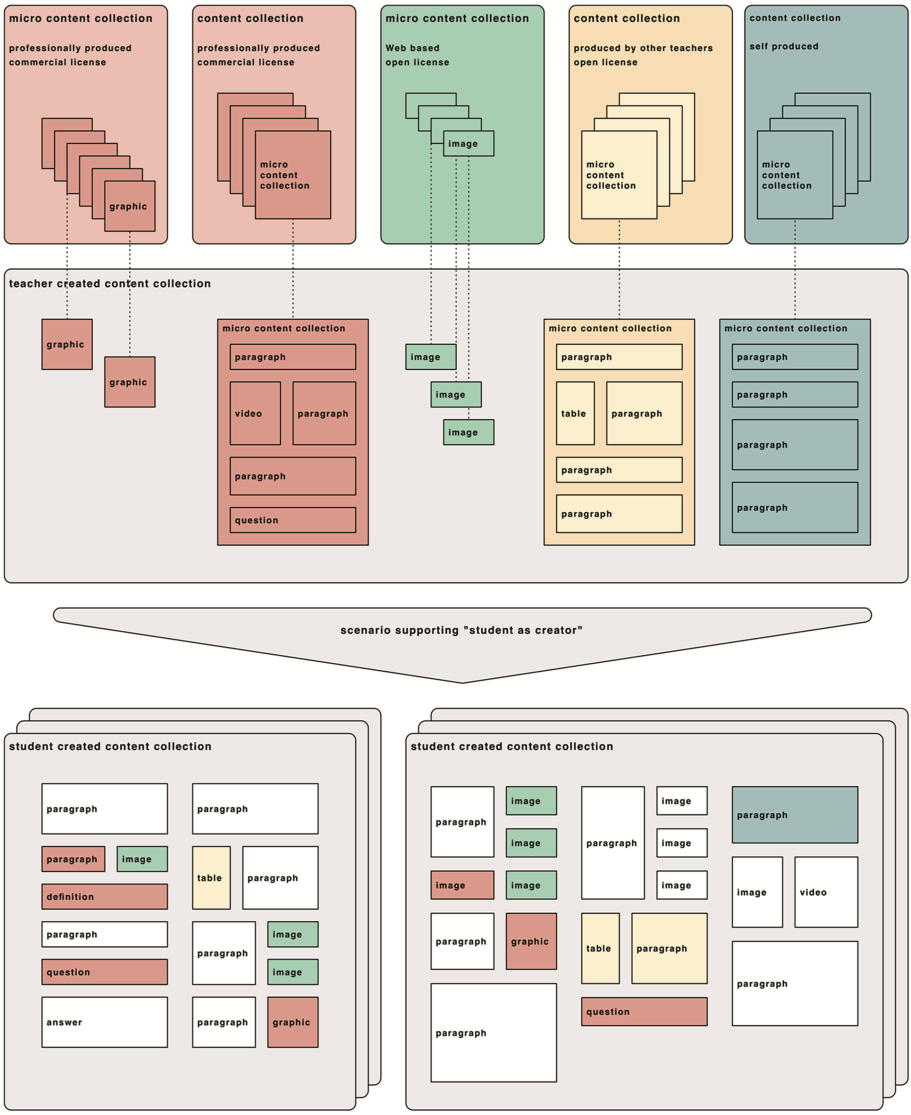

Fig. 1. Illustration of the formation and composition of teacher and student curated content collections

Without going into the details of specific scenarios and their particularities, we would like to emphasise that we were not only able to trace a whole range of individual interactions and authorship levels in relation to specific (micro-)content items, but also the composition and formation of mash-up artifact collections as products of collective knowledge building. Figure 1 on the following page might serve as an illustrative example of such an analytical perspective. The documented case depicts how a teacher pre-selects and arranges a variety of micro-content items or collections of micro-contents

in preparation for a particular teaching and learning scenario. The various items sit on a range of repositories. Some graphics and some more elaborated and pre-structured micro-content collections (such as topic based, informational "modules" made of text, graphics, video, questions…) are actually retrieved from professionally produced content repositories that carry some sort of a commercial license. Some additional images come from a Web-based collection offering a range of open licenses. Additional "modules" (of structured and aggregated micro-content) are retrieved from a repository that provides open-licensed content that is created and shared by other teachers. And finally some additional items come from a collection of self-produced, digital content that may only be stored locally by the teacher herself.

If we finally analyse the products that student groups have co-authored while going through a particular scenario (supporting the notion of "students as creators"), we get a rather rich, collage-like image of aggregated content collections that combine various items that were originally provided by the teachers, items that were modified, and items that were created from scratch by the participating students.

It should be rather obvious that this type of educational practice in which students and teachers move beyond simple levels of (inter-)action into the field of content authoring and the creation of content collections, poses further challenges for academic publishers and commercial content providers. Based on the conceptual and empirical work that we carried out within the context of Learnmix project, we see a considerable misfit between the current status quo of contentment provision and production among academic publishers and the importance of supporting the full range of levels of interaction and co-authorship that contemporary educational frameworks such as "trialogical learning" suggest. We see it as an important challenge for educational research and development to design, develop, and test new approaches that potentially align innovative learning and teaching scenarios with the affordances of expanding digital and networked technology, and revised business models for content production, publishing and distribution.

4 Levels of Co-authorship with Digital Content

In the realm of professional and commercial content production for education, however, "interaction" has been promoted as the key added value of digital learning materials. Apparently, it is a widely shared belief among publishing companies, educators, instructional designers and policy makers, that e-textbooks and digital materials need to (and can) be redesigned in ways that enable somewhat more variable modes of interaction with content. Turning e-textbooks and any other digital learning material more interactive in comparison to their printed counterparts is considered to be a significant step further in terms of technical and conceptual development.

However, the bulk of digital learning material and e-textbook solutions currently available are hardly supporting the more ambitious notion of various levels of distributed co-authorship of digital artefacts, as it emphasised within frameworks such as the trialogical learning and knowledge creation that we have mentioned above.

In the context of a national research and development project called Learnmix we attempted to address the changing roles of teachers and students as creators and authors of content. We re-designed learning and teaching practices so that students can become

active (co-)constructors of their own knowledge by creating, modifying and integrating various physical, and digital artefacts. In these practices textbooks didn't function as the main references tool and primary means of delivering course content anymore. Instead, participants were making use of various micro content and content collections from a wide range of authors ranging from professional content designers to students and other Internet users interested in the topic at hand. In addition to a descriptive analytical framework, which allows to focus on specific actions, mediating artefacts, and micro-content used or created before and during the learning experience [10], we also extracted 7 distinct levels of co-authorship on digital textbooks to describe how teachers and students worked with artefacts in the context of our intervention studies (Fig. 2). Our taxonomy - Levels of Co-Authorship (LoCA):

0. **Consume** - The lowest and the most static way to interact with content is to simply consume it. This refers to viewing a video clip, listening a podcast or for instance just reading a text. The content item will remain untouched by its users, no changes will be done with the actual content of that artefact.
1. **Annotate** - The next level allows annotation of content with various types of meta-data: e.g. highlights, likes, ratings, tags, comments. Annotation makes content meaningful and personal for the user as he/she carries out some operations with it, mainly at a metadata level. Some annotations (tags, bookmarks) can be shared within online communities.
2. **Manipulate** - This is the most common level of interaction among professional e-textbooks publishers today (e.g. while publishing in iBook, mobi or ePub formats). Although learners are engaged in interacting with some components of the textbook by clicking on hot spots, dragging and dropping some elements to correct location, or filling in some fields in a digital form, they cannot modify or add the content. The software gives immediate personal feedback to learner's interactions with content, while teacher or other learners cannot receive, view or analyse the responses of the learner. The learner's co-authorship remains restricted and temporary, as a digital content of e-textbook is not changed permanently.
3. **Submit** - On this level, the learners are prompted to solve some problems, manipulate interactive content or enter responses to questions. Unlike with the previous level, the results of such interaction or problem-solving will be submitted for review and feedback to the teacher or other participants in the process of learning. The input requested from learners and the feedback given by the teacher will not be included in the textbook itself, but sometimes it is archived as a companion or annex.
4. **Expand** - On the level of expansion a user can edit or complement an artefact, add some micro content to the original artefact, however, the core content of that artefact remains mainly intact. For instance, merging together some video clips, filling in blanks in a self-test, adding a story to a photo etc. While the previous levels of the authorship didn't allow changing the original core content, with this level the original content itself will be complemented with some additions, however, the core parts of the content are still visible and recognisable. We consider this (inter-)action level to mark the starting point for a progressive transition into "authorship".
5. **Remix** - Remixing means altering the original state of the content by adding, removing, and/or changing pieces of the item. In the case of remixing it is difficult

to extract its initial version and parts. The main characteristic of remixing is that it appropriates and changes other materials to create something new. Here, the original author is distanced from her material. The original meaning of the content and the intention of the author might change entirely. The remixer makes the material her own.

6. **Create** - A user can create a totally new artefact from scratch. In this case the user doesn't make use of any other content, but develops his own.

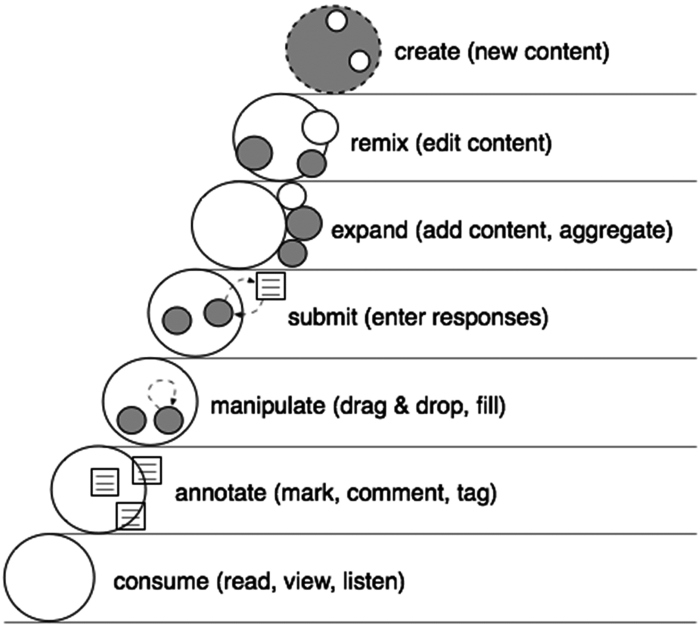

Fig. 2. Levels of co-authorship of digital textbooks

Distinguishing between these different levels of co-authorship of digital textbooks has given us an analytical instrument for describing how particular learning and teaching scenarios support various forms of interaction and co-authorship. It also helps us to explore to what extent a particular scenario allows students to become the author of their own knowledge representations. We have also found it useful to apply this analytical perspective while designing and describing new scenarios.

It is quite obvious that the need to support more advanced forms of interaction, where students and teachers progress into "authorship" territory, put a considerable pressure on academic textbook publishers and other learning material providers.

Digital artefacts are more fluid, unstable and liable to mutate than traditional forms of content provision such as print. In an increasingly networked and digitised world, we all not only have instantaneous access to digital artefacts of various kind, we can also easily produce our own. In consequence, academic publishers and their textbook authors are gradually losing their position as sole authors and owners of authoritative (learning)

materials. The steadily widening access to instruments and services for digital content production is increasingly diffusing the power of publishers. Students and teachers already hold the means to modify and compartmentalise a wide range of existing artefacts. They can also produce a variety of digital content items such as photos, video clips, audio recording, and so forth. However, they can also assemble, curate, and share their own collections of micro content according to their desires and needs. The identity of the 'original' author(s) of each fragment often becomes ambiguous or even invisible in the process of this practice.

However, the traditional practices in textbook publishing world have always drawn very clear boundaries between authors and passive users (teachers, students), also between commercially produced (print) content and user-generated (digital) content. Even today, the national legislation in Estonia defines and regulates explicitly the process and quality assurance mechanisms concerning only the printed textbooks and workbooks. While Estonian teachers have been increasingly authoring and using digital learning resources over the last decade, the user-generated digital learning content has existed in completely separate ecosystem than commercially/professionally produced textbooks (e.g.: separate repositories, regulations, delivery channels, legitimacy, pedagogical patterns and platforms of use). The situation is about to change soon, as the Ministry of Education and Research of Estonia has decreed that all newly published textbooks and workbooks have to be available also in the digital format starting from May 2015. As there have been no specifications regarding expected digital formats for upcoming e-textbooks, publishers are pursuing various routes to digital realm. While all textbook publishers acknowledge that digital textbooks cannot be merely static copies of their printed counterparts, the way interaction is introduced in pilot e-textbooks demonstrates the desire of textbook industry to maintain the strict separation of author's and user's roles also in the future. For instance, popular e-textbooks published in the Apple iBook format provide quite limited range of interactivity, as students are allowed merely to fill in or choose the right answer, which will not be shown even to the teacher. Students and teachers cannot add resources to iBook or hide some parts that are not relevant. Yet, some other publishers are experimenting with Web-based textbooks allowing various ways and levels of contributions from teachers and learners. Our agenda behind creating the LoCA analytic framework is helping the textbook publishers, researchers and teachers in comparing, analysing and developing innovative digital textbooks that support trialogical learning. Our next step is validation of the LoCA framework by applying it for comparative analysis of different e-textbooks in Estonia and Finland.

5 Concluding Remarks

It seems obvious that the emerging notion of "students as creators" and related conceptual frameworks like "trialogical learning" and "knowledge building" carry several challenges that go beyond the current state of affairs in the realm of professional and commercial content production, publishing and distribution. If we truly want to support emerging digital practices that augment the productive and creative co-authoring of

knowledge artefacts, we need to reconsider what type of models of digital content provision actually make a fit with our emerging vision of education (students as creators) in the digital age.

The changing extent of content and content collection authorships raises a number of particular questions, such as who is the owner of the content; how the ownership is changing in the process of modifying an artefact and who can and should control its distribution in terms of timing, cost, licensing, openness, and so forth. We can witness that alongside a traditional lifespan of a content item, new life cycle paths emerge, as part of the control over content is transferring to students and teachers. Furthermore, this emerging discourse is concerned with further innovations, revenue models, content enrichment, the digital rights management, open-access models, marketing, new sales channels, legal frameworks, formats, pricing, the rise and the possibilities of self-publishing and so on. And this all need to be researched and developed together with emerging educational visions and technological developments.

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