Investigating collaboration among university professors for the production of course material

Jean-Marc Robert[1], Gracia Gingras[2]

[1,2]Dept. of Mathematics and Industrial Engineering, École Polytechnique de Montréal, P.O. Box 6079, Station Centre-ville, Montréal, Québec H3C 3A7. CANADA

jean-marc.robert@polymtl.ca[1], gracia.gingras@polymtl.ca[2]

Abstract

In this paper, we describe different forms of collaboration and we review research works on collaboration between professors. Then we present three studies we realized on indirect and asynchronous collaboration between professors (or equivalents) for the production of course material. In the first study, four university professors, working by themselves, were asked to produce course material with an easy access to their own material, to that of a peer and to Internet. In the second study, 10 graduate students, a majority with teaching experience and also working by themselves, were asked to produce course material with an easy access to their own material, to that of their peers, to a collection of selected material, and to Internet. In the third study, 26 subjects, a majority with teaching experience, some working by themselves and some working in dyads, were asked to produce exercises to be done in class in the same conditions as those in the second study. Main results show that subjects are interested in others' material when it is easily accessible, they prefer material of peers belonging to the same discipline, they use different criteria to evaluate material, they import much material into their course and more material from peers than from the collection, they use their course as a ground to transplant new material, they use the latter to complete, correct and adjust their material, and they report appreciating indirect collaboration. In the conclusion, we indicate how our results could help to better support collaboration among professors.

Introduction

University professors do collaborate together for different types of activities such as planning, defining programs and policies, writing papers, creating training programs, defining course contents, preparing exams, supervising students, hiring and evaluating colleagues, etc. They also collaborate with students, research assistants, technicians, administrators, and with other individuals inside or outside academia for research, faculty and curriculum activities. Even though collaboration may sometimes be tense depending on the issues under discussion or on the people involved, it is seen as necessary and normal, and a result of the "culture of discussion" in universities where many tasks and decisions require the inputs of different stakeholders. However, the attitude towards collaboration might be different, even negative for some professors, when collaboration deals with producing and sharing course material. Indeed, for such sensitive tasks, several professors are reluctant to work together, even though proximity or collaboration technologies would allow them to do so. The reasons are numerous: for instance, the effort to get coordinated with others, the frustration to wait for them, the time to search, evaluate, select and adapt new material, the fear to contribute more than others, the lack of confidence in others' material, the lack of authorship recognition, the estimated commercial value of course contents, one's superiority complex, the embarrassment to show material to colleagues, the lack of encouragement from the management, and the competition between professors.

In this paper, after describing different forms of collaboration and reviewing research works on collaboration between professors, we present three studies we realized on indirect and asynchronous collaboration between university professors (or equivalents) for the production of material intended for lecture courses and the production of exercises to be done in class. We analyze the professors' output, their attitudes and behaviors towards others' material, and their evaluation and use of the material. The goal of this research is to unveil the characteristics of human collaboration for a sensitive and complex cognitive task and to help designers of repositories of educational material to define the best conditions of use.

Forms of collaboration and collaboration technologies

Several authors will make a difference between cooperation and collaboration (13). Goals, tasks and level of interdependence are used to define these terms. In a cooperative task, each individual in a team works to attain a common goal by taking actions yielding results that will contribute to the achievement of the goal. In a collaborative task, each individual seeks to attain individually an objective making consensus in a team, resulting in several individual results and a collective result. We conclude that cooperation entails greater interdependence than collaboration. However that may be, in this paper we use the term collaboration. There are several terms to qualify collaboration: synchronous vs. asynchronous, co-localized vs. at distance, mediated vs. non-mediated, free vs. imposed, active vs. passive, direct vs. indirect, planned vs. spontaneous (or ad hoc). Some terms are self-explanatory and do not require explanations whereas others are not evident and deserve explanations. Collaboration is mediated when it occurs through the use of one or several media such as telephone, e-mail, chat, videoconference, e-room, shared applications, etc. Active collaboration means that people involved in collaboration take positive actions to support collaboration in order to have good team performance; it is passive when they take no positive or negative actions for or against collaboration, accepting it without taking initiative to make it work. Finally, collaboration is direct when the n persons involved in collaboration interact with each other directly, i.e. without an intermediary person or object of interest. On the other hand, collaborative technologies can be defined as applications in assistance of any group processes, namely communication, collaboration, sharing and learning, and management of groups through information exchange (1). They can be used to work synchronously or asynchronously, face to face or at distance. Notice that with the never ending possibilities offered by the technologies, the difference between face to face and at distance is less and less clear since, for instance, telepresence gives the illusion of being in presence of people when they might be far from us.

Collaboration between professors

Several authors have identified common activities of collaboration between professors that basically deal with professional development, teaching and research (7). In these activities, variables such as the gender, the number of years of experience, and the belonging to a discipline appear to be relevant when investigating collaborative work among professors (11). In a survey on collaboration conducted with 56 university professors (15), the subjects reported that most of their collaborative experiences, meditated or non-meditated by technologies, were for content development. They expressed their satisfaction at working collaboratively and wished to reiterate their experience. Collaboration appears to be prevalent among science and engineering professors, a situation that could be explained by the fact that knowledge is considered atomic in these fields (17) and that professors are accustomed to developing material that is intended for courses that do not consist only in lectures (16). Several professors mentioned the following advantages of collaboration for the production of course material: reduction of conceptual errors, enrichment of the content, improvement of their professorial practices, and introduction of pedagogical innovation. A study (6) revealed that when collaborating asynchronously, professors perceived a focus on content and when collaborating synchronously they perceived a focus on practice.

For years collaborative technologies have made inroads into education through repositories of materials. Thus professors have the opportunity to use educational material found in repositories for teaching and learning purposes as well as they can contribute to them. Researchers or organizations such as UNESCO list numerous general or subject-specific national, regional and individual repositories (18). CITIDEL, CTSC, DLESE, EEVL, iLumina, NSDL, SMETE digital libraries or NEEDS are examples of repositories of educational material in science and engineering.

Because of space constraints, we cannot cover all the scientific contributions made in recent years on collaborative work between professors by authors of different disciplines. Thus we chose to present some significant issues that are raised by those interested in the use and deployment of collaboration technologies (14) such as repositories (table 1).

Table 1. Issues that are discussed in various studies on collaboration between professors

Issues	Objects of discussion

Accessibility	- Validity or non-validity of annotations and other means to facilitate accessibility to educational resources - Design of software and computing tools to manipulate educational material - Access given and provided by specific groups, e.g. novices vs. seniors, to a profession
Costs	- Sustainability of collaborative production of educational material and means to ensure it - Cost of collaborative production and technological infrastructure - Economies of scale when producing in collaboration
Content development	- Process of producing educational material - Reusability according to the type of material : e.g., Lecture vs. Exercises - Forms of reusability: e.g., reusing an entire document, part of it, ideas, etc. - Reusability according to textual, non-textual, referred or non-referred sources
Authorship and production	- Design of software required to control versions of production - Diverse impacts of collaborative production such as alignment of content and practices, plagiarism, vandalism or creativity
Evaluation of educational material	- Definition of evaluation criteria such as content quality, usability, etc. - Design of evaluative instruments - Relevance of evaluation or evaluative committees - Judgment by peers (visibility of one's content and work practices)

To improve the access to educational material, researchers have designed various means of annotating content and professorial practices (2). Some have expressed concerns about the fact that access may vary according to demographical variables such as the gender, the number of years of teaching experience, the discipline, etc. (9). For instance case studies and focus groups made by authors of reputed repositories revealed that novices in an academic profession are more inclined to access educational material found in repositories and more willing to provide access to their content and practices than seasoned professionals (9). This is seldom looked upon in studies.

As for costs, it is believed that the creation of repositories will generate economies of scale as well as it will contribute to create a vast amount of free and open-access academic resources. However, several collaborative initiatives among professors have proven to be difficult to implement and sustain (4).

Protection of authorship and threats of plagiarism and vandalism have also been investigated with their potential impacts on the collaborative production of educational material (12). Scientific work has been carried out regarding these impacts; for instance, developers have built software tools for version control (8) of documents.

With the aim of improving the collaborative experience, evaluation of educational material has been paramount for researchers. Authors have gathered data from focus groups composed of education representatives, they conducted empirical studies on evaluation of educational material and they designed evaluation tools (5). They have rarely explored the workload of evaluating and selecting material for professors having access to large amounts of information in academic libraries, institutional repositories, small collections and Internet.

There still remain several questions about the production and reuse of material by professors working collaboratively (3): What is reused? Are parts of material more reused than others and why? How is the material reused? Is the material intended to lecture courses more easily reusable than exercises? We investigate these questions in the rest of the paper.

Three studies on collaboration for the production of course material

Goal. We realized three studies to investigate indirect, mediated and asynchronous collaboration between professors for the production of course material. Indirect because collaboration with others is only through shared course material, not through direct communications with peers. In our opinion, this form of collaboration will remain the most widespread for the preparation of course material. Mediated because collaboration is done through electronic material that allows easy importation of material from others and easy transplant into one's course. Asynchronous because collaboration-though-material was done with material that was ready in advance, not in construction during the study. The three studies pursue the same general goal, they differ on specific goals and on variables that were controlled. The first study is empirical, it was done in the field with very few subjects and very little control on variables; its goal is to give an overview of indirect and asynchronous collaboration between university professors for

the production of course material. The second study is experimental, it was carried out in a laboratory with a larger number of subjects, a much better control on variables and full data collection. The third study is also experimental, with the same advantages as those of the second study; here the subjects were asked to prepare exercises instead of material meant for lecture courses.

Methodology. A summary of the main parameters of each study is presented in table 1. In the three studies, the subjects were asked to prepare course material on usability testing and describe their pedagogy for this course, knowing that their material would be anonymous and made accessible to peers. They were said that the course would be given in a presencial mode (where the professor and the students are present in a classroom) to a group of 25 university students in human factors engineering.

Empirical study (#1). Four university professors took part in the study. Their task consisted in preparing material for a 1-hour course on usability testing, a topic for which they could be considered as experts and for which they already had material. Their task was done in two phases: in the first, they were given two weeks to prepare or review their material; they worked freely, at the time and location of their convenience, and could use any source of information. In the second, they were given 2 weeks to prepare or reconsider their material, this time with access to their material, to that of their peers and to Internet. We collected their production, their description of the pedagogy they would use in the course, their opinions about this form of collaboration, and some biographic data.

Experimental study (#2). Ten subjects participated in the experiment. They were all graduate students in human factors engineering and familiar with usability testing; several of them were working full time or part-time and had work experience in engineering; six had teaching experience. Their task was the same as in study 1. It was also done in two phases: phase 1 is identical to that of study 1; phase 2 last a maximum of two hours and was done in laboratory. Here the subjects had access to their own material, to that of their peers, to a collection of high quality selected material and to Internet. The subjects were videotaped and their verbal comments were registered.

Experimental study (#3). Twenty-six subjects participated in the experiment; their profile was similar to that of subjects of study 2. Fourteen subjects worked in dyads and 12 worked in solo. Their task consisted in producing one or several exercises. It was also done in two phases, like in study 2. The subjects had access to their own material, to that of their peers (a collection of 28 exercises), to a list of 14 educational repositories and to Internet. The subjects were also videotaped and their verbal comments were registered.

Table 1. Main parameters of the three studies.

Study	Number of subjects	Number of groups	Number of phases	Type of study	Form of collaboration	Material or access provided to subjects	Type of material
1	4	1	2	Empirical	Indirect and asynchronous	- Their own material - Peers' material - Internet	For a lecture course
2	10	1	2	Experimental	Indirect and asynchronous	- Their own material - Peers' material - A collection	For a lecture course
3	26	3	1 or 2	Experimental	Indirect and asynchronous	- Their own material - Peers' material - Educational repositories - Internet	Exercise

Results

Results are based on several types of data, namely the subjects' production, the subjects' description of the pedagogy used for teaching, and the subjects' opinions about indirect asynchronous collaboration (10). Furthermore, for the

two experiments, results are also based on video recordings of the sessions, on recordings of subjects' verbal comments at work, and on notes taken by the experimenter. Results are concerned with five themes.

Access. In every study, subjects accessed others' material in a dynamic and recursive manner. They perused and tagged information throughout peers' material, the collection of selected material, Web sites and/or repositories. Hence, they began their activity by accessing familiar sources, for instance their own material, and afterwards they consulted other sources. We noted that subjects accessed others' material on the basis of three criteria:

- Years of teaching and other professional experience;
- Engineering discipline corresponding to a lecture or an exercise;
- Personal choice.

For example, when holding more than five years of teaching and other professional experience, subjects were less willing to access course material of peers and non-referred sources than those with less experience. In Study 2, subjects with a software engineering background limited their access to peers' material, repositories and Web sites belonging to the same discipline. In contrast, four subjects who had been educated in more than one engineering discipline would access material from different sources. In addition, in every study would figure a singular subject who would choose to access others' material solely at the beginning or at the end of his/her production, in a dilettante manner, and with very few imports from others.

Imports and contributions. Subjects provided material to others (they knew that the material produced in phase 1 would be made available to others for phase 2) and they imported material from others. As a rough measure of their production, we counted the number of PowerPoint slides (PPS) or text pages.

- In Study 1, one professor provided only for 16 PPS whereas another one provided more than 300 PPS. So major individual differences can be observed in the amount of material provided to others. In Studies 2 and 3, the subjects contributed on average for the same amount of PPS or text pages.
- As a rule of thumb, to develop the second version of their course in phase 2, subjects took 60% of PPS or text pages from a previous version of their own course developed in phase 1. When they did not have such material, they took at least 75% of their material from peers' contribution and the remainder from Web sites.
- Once exposed to others' material, subjects who already had in hand a first version increased the content of their course by at least 40%. Without a first version, they would contribute more material than what was provided to them in peers' repository, i.e. at least 20% more.
- Subjects were much more interested in peers' material than in the collection of high quality selected material. The former is organized as a real course whereas the latter is not.

Content development. The subjects imported material from different sources for developing theirs. A large majority of subjects, 79%, used their first version of the course as a field to transplant the material imported from others. Very few subjects developed exclusively their course from peers' material or another source. In the three studies, subjects made the following manipulations:

- Resort to the structure of their educational material (large majority), to that of their peers or to that of other sources. This structure could consist in headings of a text, in a sequence of activities or, as in the case of dyads, in a form (fact sheet) describing the educational material.
- Extract canonical material such as definitions, standards, principles, figures, illustrations, bibliographic references or material from reputed authors in HCI.
- Reuse content such as definitions, listings, methodological principles, etc. without visible signs of others' expertise.
- Complement lecture notes or an exercise with non-textual content consisting of illustrations, animations and interactive components.
- Import an underlying idea or concept from the perused material. These extractions are not tangibly traceable to an initiating document. However, comments and video recordings allowed us to closely witness this type of

extractions.
- Place reused material in an expanding folder or adding a component to another one.

Authorship and Production. Subjects were informed that their material would be presented anonymously to their peers. In Studies 1 and 2 some subjects expressed reservations concerning their anonymity. They wanted their teaching and work experience be clearly perceived by others. While this concern for anonymity was not found in Study 3, in every study, at least 50% of the subjects were interested in knowing the name of the author hiding behind an alphabetic code. Either they questioned us about the identity of the authors or they used the search engine Google to type excerpts from a lecture or an exercise in order to trace back the material to its author. As for production, of the 19 subjects who participated in a two-phase study, only 4 or 12% evoked the opportunity of creating educational material anew. Of the 21 subjects who participated in a one-phase production, 18 or 86% created their own exercise even if they resorted to material produced by others. In the three studies, we noted the following marks of authoring on their final educational material:

- No or little edition of lecture notes or exercises they had extracted from others.
- Modifications of titles, headings, words and expressions in paragraphs and listings. Thus, they edited structures and sub-structures of contents.
- Disappearance of visible marks of others' expertise after it had been copied and writing of the new content in their own words. Thus, subjects would crush text they had previously pasted, once their production finished.
- Alignment of their content and practice with those found in peers' material, repositories or other sites. For example, in the first phase of Study 2, six subjects had produced a lecture course comprising of an exercise; in the second phase, nine subjects were proposing an exercise.
- Extraction and transformation of ideas taken from others, instead of preserving the initiating concept of an author.
- Emending canonical content only after consulting more than one referred source.

Evaluation of educational material. Table 3 shows the list of criteria that were used for evaluating different materials, and the number of subjects in each study who mentioned they had used them. Our results have reproduced some criteria employed in rating reputed repositories, such as content and ease of use. Subjects' material was at times negatively evaluated by their peers because they claimed that it did not look professional, or it did not correspond to a usual way of structuring content, or it was not associated to their engineering discipline, or it was contrary to their teaching practices.

Table 3. Number of subjects in each study who used these criteria for evaluating peers' material.

	Evaluation criteria					
Study	Content	Ease of use	Professional experience	Group affiliation and composition	Structure	Teaching methods
1	3	-	-	2	-	1
2	3	8	2	6	4	-
3	10	-	-	-	6	2
Total	16	8	2	8	10	3

Conclusion

In this paper we have described different forms of collaborative work. We have presented three studies on indirect and asynchronous collaboration between university professors (or equivalents) for the production of course material. Comprehending authorship and the manner in which we share content and practices helps to structure repositories of material so as to attract and suit more users. People involved in the preparation of material put emphasis on content quality and ease of use when evaluating and selecting material from different sources. They look for canonical mate-

rial (e.g., definitions, norms, principles, references) because it can easily be reused. They need very fine granularity of material to be able to import elements of the size of their choice. They are highly interested in graphical material (e.g., figures, photos, tables, illustrations) because it is rich and attractive in a course. They are keenly interested in exercises to be done in class because these are difficult to compose, they greatly enrich a course and they correspond to a more active pedagogy. Finally they are also more interested in material prepared by people having a similar background or coming from the same discipline.

References

01. Andriessen, J. H. E. (2003). Working with Groupware: Understanding and Evaluation Collaboration Technology. London: Springer.
02. Brase, J. & Nejdl, W. (2003). Annotation for an Open Learning Repository for Computer Science. Annotation for the Semantic Web, (pp. 212-227), New York, IOS.
03. Carliner, S. & Shank, P. (2008). The e-learning handbook [electronic resource] : Past Promises, Present Challenges, Pfeiffer, San Francisco.
04. Carroll, J. M. (2007). Learning in Communities: Introduction to the Special Issue. Computer-Supported Cooperative Work, 16, (4-5), 373-537.
05. Chesney, T. (2007). An Empirical Examination of Wikipedia's Credibility, First Monday, 11, (11), URL: http://www.firstmonday.org/issues/issue11_11/chesney/
06. Conley, S., Fauske, J. & Pounder, D. G. (2004). Teacher Work Group Effectiveness. Educational Administration Quarterly, 40 (5), 663-703.
07. Creamer, E. G. (2004). Collaborators' Attitudes about Differences of Opinion. The Journal of Higher Education, 75 (5), 556-571.
08. Cross, T. (2006). Puppy Smoothies: improving the Reliability of Open, Collaborative Wikis. First Monday, URL: http:///www.firstmonday.org/issues/issue11_9/cross/index.html.
09. Fitzgerald, M.A. & Mc Clendon, J. (2003) The Gateway to Educational Materials: An Evaluation Study, Year Technical Report submitted to the US Department of Education ERIC Clearinghouse on Information and Technology.
10. Gingras, G. (2007). Étude expérimentale du travail collaboratif entre producteurs de matériel de formation. Dissertation Thesis, École Polytechnique de Montréal, 310 pages.
11. Heywood, J. (2005). Engineering Education: Research and Development in Curriculum and Instruction, Wiley-IEEE Press.
12. Johnson-Eiola, J. & Selber, S. (2007). Plagiarism, Originality, Assemblage. Computers and Composition, 24, (4),375-403.
13. Kock, N. F. (2008). Encyclopedia of e-collaboration, Hershey, PA, URL: Information Science Reference http://www.books24X7.com/marc.asp?bookid=13882.
14. Palmer, S. R. (2002). A Review of Strategic Issues in Using the Internet for Teaching and Learning, Australasian Journal of Engineering Education, 2002-01, Information Science Reference, URL: http://www.aaee.com.au/journal/2002/palmer02.pdf.
15. Robert, J.-M., Viera, R., Noel, S. & Santos, N.D. (2005). A Survey on Collaborative Work between Professors. IASTED International Conference on Education and Technology, July 4-6, 2005, Calgary, 190-195.
16. Roth, W.-M., Tobin, K., Critobal, C. & Dalland, C. (2005) Coordination in Coteaching: Producing Alignment in Real Time, Science Education, 89, (2) 675-702.
17. Shulman, L. S. (1998). Course Anatomy: The Dissection and Analysis of Knowledge through Teaching. P. Hutchings The Course Portfolio: How Faculty can examine their Teaching to Advance Practice and Improve Student Learning (pp. 5-13). Washington, D.C.: American Association for Higher Education.
18. 18. UNESCO (2009). OER Useful Resources/Repositories, URL: http//oerwiki.iiep-unesco.org/inder.php?=title=Repositories.