

## **Teacher collaboration in IT project courses: resistance and success**

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Keywords: collaborative practices, project based learning, team process, co-teaching

## **INTRODUCTION**

Software development has changed drastically during the last decades. Individual coding or testing in large projects still exist, but most developers have to be able to co-operate in diverse teams and to apply flexible working methods. Therefore, universities have to change teaching methods to reflect the demands of software industry. A new curriculum in information technology engineering was planned to include a considerable amount of collaborative practices and project work. [1]

New influential trends such as virtual courses and multidisciplinary innovation have caused changes in university teaching. There has been a considerable increase in virtual courses, where MOOCs (massive open online courses) are only a tip of the iceberg. Secondly, the demands for collaboration within and between disciplines are

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challenging traditional education practices. One individual teacher may find these various demands overwhelming, if teacher quality is measured by all of them. Sternberg [2] emphasises that there is no one formula that works for every teacher. Instead, he recommends that teachers should recognize their own strengths and form teams where the weaknesses of individual teachers can be compensated.

This paper discusses the introduction of collaborative practices in the curriculum and especially demands for teachers and curriculum development caused by the inclusion of project work and the integration of subject domains. The data include feedback and opinions that were collected from teachers in training occasions before the implementation of the new curriculum. Moreover, formal teacher interviews have been performed and analysed. The paper introduces, first, current research on teachers' group processes, and co-teaching in particular. Second, the curriculum reform and alternative teaching arrangements are explained. Teacher views on the success of modules are also examined and compared. Finally, conclusions on differences in educational practices between teachers are presented.

## **1 BACKGROUND RESEARCH**

### **1.1 Group processes**

Groups play a critical role in people's lives, as the human species is fundamentally social. The major discipline that studies group processes is social psychology. Moreover, teams and teamwork are a subject of study by organizational psychology. In his review of current status of research in group processes, Levine [3] noted that the amount of accumulated research is enormous, and the interest has not shown signs of decline because of the great importance of social aspects of group processes in organizations. Some of the most important findings regarding group processes that are relevant to our study are summarized below.

According to Moreland [4], certain diversity factors influence the success of group processes, namely interpersonal attraction, and characteristics of group members such as openness to experience. Groups perform better when their members feel accepted and comfortable in the group. The degree to which the rest of a group agrees with each member about who he or she really is, is called interpersonal congruence. Transformational leadership improves group cohesion. It occurs where the leader takes a visionary position and inspires people to follow. Additionally, group performance is affected by a number of task related factors, such as the complexity or difficulty of the tasks, routineness or autonomy. In real life teams, the composition of a group is actually changing in one way or another, even when the members remain the same, which requires renegotiation of the interpersonal relations from time to time.

Paulus & Coskun [5] discuss synergy in creative groups noting that it is important to overcome the factors related to production loss in groups such as social loafing, evaluation apprehension, production blocking, and downward comparison. One of the means is to ensure that group members are held accountable for their individual contributions to the group. Moreover, group members should feel free to express their ideas as they occur without fear of others' criticisms, and members must be motivated to process information from other members. They agree with Moreland that factors, which enhance the benefits of diversity for creativity are a generally supportive social context, and a longer time working together as a team. Research has proven effectively that successful real-world collaborative groups have a common vision and set of values.

## 1.2 Co-teaching

There appears to be a lacuna concerning research in co-teaching in academia. Vangrieken et al. [6] summarized, based on a large number of studies, that “The long-standing culture of teacher isolation and individualism, prevalent conflict avoidant and non-interfering behaviour of teachers together with a wish to preserve their individual autonomy may withhold a more collaborative culture to rise in education.” They surveyed a large number (105) of higher vocational teacher teams but the teams had to be called entitativities because of their loose collaboration. However, the study suggested that teacher training and education should focus more on having (pre-service) teachers work in teams because of the perceived advantages of teamwork. They suggested that gaining teamwork experience by working regularly in teams should be part of teacher training programmes.

Kunnari and Ilomäki [7] on the other hand studied teachers at a university of applied sciences in Finland. The focus of their research was on research and development projects for business clients and innovation projects of students. They also found that existing rigid institutional structures and practices are a serious hindrance to efficient teamwork.

Teacher collaboration in project supervision is not an entirely new concept in engineering education. Industry–academia collaboration and innovation projects are a long-standing practice in engineering education. In the technical fields, teacher collaboration in R&D is well-established. Moreover, projects that have been done in international collaboration (such as Erasmus or other EU-funded projects) naturally require teachers from different universities to collaborate. However, these are exceptional cases where teachers are selected according to their interest in international co-operation, and they are not necessarily representative of general professor or teacher attitudes. Curricula at universities, including ours, often consist mainly of one-instructor courses, or courses run by a senior professor and young assistants or tutors. There is ample evidence that the resistance and unwillingness for curriculum changes is strong all over the world [8].

## 2 METHODS

### 2.1 Context: Curriculum development and alternative module designs

At the university of applied sciences under study, the curriculum reform in information technology education in the autumn 2014 divided the studies into four 15 ECTS modules per year. First general studies combined with basics of core studies were included in the modules, the second year consisted of studies in major options, and third year some elective modules. Each module in the first year had a unifying theme such as networks, mobile solutions, game development, programming and web-development, electronic devices and object-oriented programming. The project work in each module was supported by a varying amount of basic and theoretical studies such as mathematics. Each theme had an instructor team of 5 or 6 teachers who had a considerable degree of freedom when planning the implementation. Therefore, the ways that subjects were integrated varied a lot. Some implementations actually consisted of quite separate parts, whereas others had a larger unified project assignment. This was mainly due to the conditions for planning, because very few extra resources were allocated to the implementation of the reform. Some instructor teams simply decided to continue they earlier courses under a new umbrella. The reform and modules are described more in detail in earlier studies [9-10].

## 2.2 Data sources

During the spring 2015, team teaching was a topic on several training events organized for teachers of the UAS under study. During the sessions, the concept of multidisciplinary courses with some concrete examples was introduced. After the introduction, concerns on team teaching were collected from the audience with a digital idea mapping tool (flinga.fi). Some but not all teachers in the audience had personal experience in team teaching on a multidisciplinary course. Similarly, structured sessions were organized in faculty meetings during fall 2015 where the concerns and raised questions were collected, as well.

Additionally, teachers of all implemented modules had a couple of common feedback sessions where the solutions and problems were discussed and compared. The study advisor made notes on these sessions and wrote summaries of the conclusions and recommendations. Moreover, the teachers (7 people) participating, in varying combinations, in the implementation one particular set of modules were interviewed by an external researcher through a semi-structured group interview. The interview was recorded and transcribed verbatim.

Data about the modules was also collected through field ethnography and participant observation [11], [12]. One team of educators (including some of the authors of this paper) collected field notes of classroom practices, had numerous discussions on the successes and failures of pedagogical interventions, and videotaped a couple of classroom and planning sessions.[13] The study can be characterized as an explanatory building case study [14] where qualitative and descriptive methods are applied in data collection and analysis.

## 3 RESULTS

### 3.1 Teachers' reflections about the curriculum change

The concerns raised on the training events were classified in four categories: organizational set up, curriculum design, training & motivation and resourcing. The training & motivation and resourcing gathered largest amount of concerns. Below is a short summary of the teachers' comments in each category:

- 1) *Organizational setup related concerns*: All teachers on a shared course should participate the design process from the very beginning to the very end. It is very challenging in practice to deploy multidisciplinary courses that involve teachers and students from majors in different organizational units. Often on a team teaching course, it is hard to find a single person who would be responsible for the guidance of individual students in the course.
- 2) *Training and motivation related concerns*: Team teaching was considered to be a major change in the way teaching is conducted; therefore, it requires also a change in the teacher's way of working. Time allocation for course planning was considered to be inadequate. Having multiple teachers on the same course makes planning challenging as even just finding a common time for a design session may prove out to be almost impossible. Other big concern was that team teaching may mean more work for the same amount of allocated work hours as it is possible that too few hours are allocated for course design. This could lead to deterioration of motivation to develop team teaching.
- 3) *Curriculum design related concerns*: Team teaching courses are quite often built around a project and on such a setup, free riders among students are always an issue. Many respondents were concerned about the effect of team teaching to accumulated competence and knowledge of graduates. Common

understanding of pedagogical targets is a prerequisite for a successful course; the adoption of new way of teaching will require considerable amount of time. The integration of topics on a team teaching course should be much tighter than was achieved at present. Currently the courses may end up being too patchy.

- 4) *Resources related concerns*: The main resource related concern was the lack of resource hours for planning a team teaching course. The general feeling was that planning of such course would take more time and energy than planning a traditional course with one topic area and a single teacher. Also the scheduling of topics on a course may be challenging as teachers usually have multiple on-going courses.

In faculty meetings, the following challenges and areas for improvement were mentioned: Allocation of adequate time for planning the courses is important. There should be some best practices for creating and empowering the teacher teams. We should find ways to ensure the quality of learning as well as ways to make the content integrated courses visible and understandable also outside the university. Moreover, the question of how much freedom an individual teacher has on a team teaching course is important: What things are decided together and what kind of decisions an individual teacher can make alone.

### **3.2 Alternative collaboration patterns in the implemented modules**

The modules implemented according to the new curriculum structure had various designs and arrangements for teaching. Each theme had an instructor team of 5 or 6 teachers who had a considerable degree of freedom when planning the implementation. Therefore, the ways that subjects were integrated varied a lot. Based on the exploration of interviews, discussions and participant observations, the implementations were classified as follows:

1. *Separated parts*. Some implementations actually consisted of almost separate parts. Some instructor teams simply decided to continue their earlier courses under a new umbrella, and the 15 ECTS module was divided into three 5 ECTS disconnected parts that were assessed separately.
2. *Partially integrated module*. Many implementations had a separate unit for mathematics and/or physics, and the professional content was more unified, even though media and programming tools or laboratory measurements were taught separately. Usually, however, there was a common project for students. The evaluation consisted of several components that were summarized.
3. *Integrated module*. Apart from the separate science classes, all professional and language content (communication skills) was integrated, and teachers collaborated in theoretical subjects and project work. Deliverables such as presentations and project documentation, were assessed both from substance and communication aspects.

These three patterns included very different amount of co-operation, and co-teaching was present only in the third pattern. In the second and third pattern, some types of lessons always had more than one teacher present. These were also student team presentations where most teachers were listening, giving feedback and evaluating together.

Interestingly, the partially integrated pattern seemed to be the most burdensome for teachers, even though it was the most commonly applied. In Finland, teachers at universities of applied sciences have a considerable workload of contact teaching (20-25 hours per week), and therefore they have to shuffle from class to class daily.

They could not concentrate on one module at a time. In the partially integrated model, they had to spend quite a lot of time in coordination and planning meetings, which they found arduous.

In integrated modules, teachers were sometimes present in the classroom at the same time. Depending on the phase of the course, and student needs, there was one, two or three teachers advising and helping. Sometimes students wanted to work independently and required no teacher presence at all. This actually eased the workload, as all teachers were quite well aware of the situation in the classroom, and next steps in projects could be discussed during classroom sessions. Almost no extra meetings were needed, except for evaluation discussions. One additional advantage for students was the choice of instructors whom to approach. Because teacher teams included men and women, younger and older teachers, students could ask for help from the person they felt comfortable with.

### **3.3 Experiences of a teacher team collaborating in a set of modules**

A team of teachers participating in the same set of theme modules throughout the study year was interviewed. One part of the interview focussed especially on the teacher collaboration, but issues related to the benefits and challenges of team teaching were mentioned by the teachers also when discussing about the successes and challenges of the pedagogical implementation in general.

The teachers told that the planning of new modules was mainly done in the preceding spring with some joint meetings. When the modules started in autumn, separate meetings were not felt necessary because the teachers met often enough in the class where the common group of students worked full time. This solution of having a “home class” for the student groups throughout the module seemed to have eased also teachers’ collaboration without extra arrangements. However, one teacher (who was not in the interview) joined the team in the middle of everything, and had difficulties in getting involved in the collaboration, because there were not established common practices. The teachers’ roles changed somewhat from the first implementations of the module based on the experiences received. The integration of domains succeeded well between professional subjects and language teaching. For example, the students made some parts of the project work in the foreign language, which was felt as a good solution because now the language was used in a real context, not studied separately with arbitrary tasks. However, the integration of mathematics and physics teaching in the students’ project work did not actualize, and the interviewed teachers discussed whether it is even realistic to achieve such integration in the first year studies.

The interviewed teachers thought that teacher collaboration was beneficial for students for several reasons: e.g., students saw one model of professional collaboration, students received feedback and guidance from multiple teachers, and the progression of students’ project work was better taken into account in teaching when all teachers were aware of the situation and were able to negotiate next steps together on the fly.

Team teaching was evaluated mainly as a positive experience by the interviewed teachers. Language teachers described that it was very impressive and rewarding for them to finally see “what engineers really do”, and to participate in authentic project work practices. Teachers also mentioned that it was interesting and useful to see other teachers’ teaching methods, and to discuss about pedagogical problems and solutions together. One teacher thought that she learned also more from the students

in these new type of modules than in previous courses, because collaboration with them and presence in the classroom was more comprehensive.

#### **4 DISCUSSION**

As the implementation pattern was chosen by the teachers themselves, they were more or less committed to it. The teachers in the third pattern, integrated module, were most enthusiastic, as they felt that they can learn a lot from others and that way increase their professional competence efficiently. However, co-teaching incorporates certain challenges in teamwork and also emotionally [15]. As the English teachers of two paralleled modules reported, teaching together requires that one is able to pay attention to the other teacher, and gives up personal lecturing mode [13]. Lecturing inevitably becomes a conversational action. Teachers often have slightly differing views of requirements and discipline, i.e., and therefore small conflicts can appear. To avoid their escalation, a joking mode in classroom communication eases the atmosphere. What is more, co-teaching demands an ability to accommodate other views on practices, which is not necessarily easy for teachers who are used to being the person who is right in the classroom.

Student and teacher views on the implementations also highlight the need for better coordination between implementations and their contents. In particular the first year modules that were given in rotating order, caused some confusion in overlapping subjects. Most modules contained some programming in Java or Python, and the order of the introduction of these languages affected the study considerably. The orchestration of diverse approaches turned out to be challenging.

#### **5 SUMMARY AND ACKNOWLEDGMENTS**

In conclusion, the purpose of this paper was to analyse teachers' reflections on the curriculum change at a UAS. This paper also discusses different team teaching experiments during several IT projects. Teachers brought up several themes such as organisational set-up, training, motivation and resources allocated. Also many areas of improvement came up in faculty meetings. In some course implementations different subjects had been successfully integrated due to effective team teaching but in some cases there had been no integration at all. Although there was also strong resistance toward team teaching among the faculty members, the teachers interviewed for this study believed that teacher collaboration and team teaching benefitted both students and teachers.

The study was partially supported by the Lifelong Learning Programme of the European Union under Grant KA3MP-2013-4764/001-001 (Promoting Knowledge Work Practices in Education; the KNORK project; <http://knork.info>).

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