A Framework for Writing Learning Agreements

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Abstract—**Active learning is a popular concept for motivating learning. Learning agreements are one strategy towards this goal. They can be used to aid the students to take ownership of their learning and in becoming more active in a course. Learning Agreements are especially useful tools for scaffolding learning in courses with a focus on developing the professional competencies of students, such as in Open Ended Group Projects, Work Integrated Learning or other authentic learning contexts. Such educational contexts are complex and we have found it necessary to scaffold student learning using agreements based on professional competencies. This has led to a pedagogical framework, which has found successful application in a number of contexts. This framework has been built based on discussions with students, and has involved the development of a supporting wiki which contains descriptions of the different professional competencies involved in the learning agreement. The IT based framework has been iteratively developed together with the students taking the course in the fall of 2015. The development and assessment of this framework is contrasted in the context of two courses using learning agreements, one (in Sweden) with a focus on development of professional competencies and the other (in New Zealand) addressing a mix of professional competencies and subject knowledge in a work integrated learning setting.**

Keywords— Open Ended Group Projects; Global Collaboration; Distributed teams; Learning Agreements, Personas, Authentic learning

I. Introduction

Active learning techniques are seen as an important way towards improved learning outcomes [1-2]. This is in line with a constructivist view of how learning takes place where a learner is seen as actively constructing meaning rather than passively absorbing information [3-4]. The Open Ended Group Project (OEGP) pedagogy [5-7] is an example of a learning environment that builds on the idea of active learning. In literature it has been noted that in using an OEGP pedagogy, student 'motivation' can suffer due to the complex, messy and ambiguous setting [8]. More generally this is an issue for students who desire the comfort of tightly structured course designs and assignments and find themselves out of their comfort zones when dealing with more open ended tasks, as observed in [9-11]. In a database course context Connolly and Begg [12] phrase it in this way:

> *"students often have considerable difficulty comprehending implementation independent issues and analysing problems where there is no single simple, well known or correct solution. They have difficulty handling ambiguity and vagueness, which can arise during knowledge elicitation".*

The use of learning agreements is an example of how students can take ownership of their learning and become more active in these contexts. Learning agreements are especially useful when the pedagogical aims of the task concern the development of professional competencies such as communication skills, writing skills and intercultural communication, since this kind of learning is well suited for individual reflection and active learning. They can be seen as scaffolding towards the goal of becoming a reflective practitioner [13] as students become aware of issues to reflect on before, during, and after activities. This is especially the case if the learning agreement has a focus on personal development of professional competencies rather than being about learning the discipline based aspects of a subject.

We see the learning agreement as being an essential tool for making students active learners and helping them make their learning both more explicit and more personal to themselves, thereby increasing their commitment to their educational development. Making the learning more explicit is an essential part, since a student cohort might otherwise give lower priority and appreciation to this kind of activity due to the difficulty and unfamiliarity with observing progress in this regard, when compared with acquiring "pure" subject knowledge [6, 14]. Furthermore, a more frequent use of learning agreements could lead to more independent activity among the students and thus address the "learning to learn" competency.

Building on an ongoing action research programme [9], complemented by a systems development driven research approach [15], we have partly introduced a technology supported framework in the 2015 instance of the *IT in Society* course in Sweden [16]. The framework aimed to aid in making

the learning of professional, competencies more explicit by scaffolding the students in the use of learning agreements. We explore the framework in the context of the Swedish course and then compare and contrast this with a similar course in New Zealand. The course in Sweden has a focus on development of professional competencies while the one in New Zealand uses learning contracts to address a mix of professional competencies and subject knowledge in a work integrated learning setting.

The contributions of this paper are 1) presentation of a framework to facilitate the construction of learning agreements, and especially the novel use of personas in this context, and 2) the comparison of usage of learning agreements at two universities in courses based on Open Ended Group Project (OEGP) pedagogy.

II. BACKGROUND

The background section of this paper contains a description of professional competencies, Open Ended Group Projects and Learning Agreements. This is followed by an overview of the persona method as well as a presentation of the two courses that are investigated in the paper.

A. Professional Competencies

Acuna and Juristo [17] have noted a set of capabilities/competencies considered useful for software developers, among which analysis, independence, decision making, perseverance and stress tolerance were demanded. These are clearly additional attributes to the purely technical skills that are also needed, but may not be apparent or seen as important by students.

So how do we help clarify/make explicit for students our desire to develop these competencies as desired forms of learning in a course setting?

B. Open Ended Group Project

The Open Ended Group Project (OEGP) framework is a pedagogical approach that we have found to be suitable for addressing learning of professional competencies [5-7,9]. The basic idea is that the educational setting is based on students working in groups, or teams, addressing an open ended issue. There are several challenges for the students in this setting, e.g. to reach a common view of what the issue is and to form a strategy for addressing it. A pedagogical aspect is that the students will develop competencies suitable for functioning in the work environment and gain confidence in their ability to deal with situations where there is no right way to deal with it.

One challenge for the faculty is to find a balance between where all students get an understanding of what is to be done and where they work on their own and gain ownership of the project. On the one hand, helping them too much will move the learning environment to a more traditional faculty specified assignment and where they lose motivation, while on the other hand, providing too little support could lead to students becoming confused and disillusioned, as noted by Mayer [18] in a critique of pure discovery learning.

C. Learning Agreements

Learning agreements [19-20], or learning contracts, can be set up in different forms and can refer to many aspects of learning. When introducing such a concept in an educational situation it is essential to make it clear what the purpose is and between which parties the agreement is meant to hold. Some institutions prefer to circumvent the word 'contract' when supporting work integrated modes of learning, to avoid employer expectations of guaranteed task delivery, without a focus on the student's own learning goals or those of the academic institution [19].

D. Personas

Within the field of Human Computer Interaction, the 'persona' method was originally introduced by Cooper [21], who argued for hypothetical archetypes of real users in order to avoid designing systems that become too generic and in the end do not fit anyone. A persona is typically a short text describing a person including an image and a text that is relevant for understanding the person's needs. According to Cooper, personas should be based on actual users and should be precise and specific since it is more difficult to ignore a detailed persona than aggregated user data. The idea is that numerous personas are initially created through an iterative process, and then these are condensed, according to their goals, into fewer but more precise, examples.

The persona method has become a frequently applied technique and is used extensively in both industry and in research as a user centred way of representing users in situations where direct interaction with them are not available. The idea is that the overall focus and awareness of the users in development projects are heightened when working with personas [22].

However, their use is not restricted to this activity. For example, personas are described both as a communication tool and as a design aid. Nevertheless, Eriksson [23] argues that trying to separate the different ways the method can be utilized will both help the practitioner to more skilfully use the personas, as well as make them more open to alternative application. However, there has been some criticism of the persona method in which it is suggested that their misuse leads to designers distancing themselves from real users [24]. In addition, there is some research on personas that are used outside the project in which they were developed [25]. In that case the educational department adopted the personas as a way to introduce new employees to different clusters of customers.

III. LEARNING AGREEMENTS IN THE BCIS/BBUS COURSE

At Auckland University of Technology the model for the Bachelor of Computer and Information Sciences/Bachelor of Business (BCIS/BBus) Conjoint Cooperative Education course has borrowed heavily from that of the BCIS Capstone Project. But it contains the additional element that there is normally some level of work placement or project for a real client, which places the course in a work integrated learning continuum [26-27]. A student studying the BCIS/BBus conjoint course is expected to meet the outcomes of both courses of study. Therefore, an individual learning agreement is required in

which students define and negotiate their planned project assignment, addressing the three key dimensions of the cooperative learning model:

- the academic requirements (for both programmes of study)
- a student's personal and professional goals
- a student's workplace/sponsor's goals.

Each BCIS/BBus conjoint course of study normally involves undertaking a Project in a domain relevant to the Business major, in order to meet the needs of both programmes. Confirming the academic expectations of the Business major would occur as part of negotiating the initial learning agreement. The learning agreement assessment rubric is shown in Table I as an illustration of issues negotiated.

Table I: Learning Agreement Assessment Rubric

CRITERIA
Contract includes all required elements: Work assignment (BBus project), Discipline and capability goals, Contact arrangements with academic supervisor(s), Summary against graduate profile, proposal and letter of acceptance appended. Work assignment and learning goals cover all components
The components of the learning contract are appropriately linked: For example outcomes appropriate to goals, strategies appropriate to outcomes or objectives, demonstration / evidence and assessment appropriate to outcomes and strategies. Learning contract consistent with project proposal
Each component appropriately described. That is: Outcomes appropriately worded – can be preceded by "by the end of the assignment I will be able to…". Outcomes that can be demonstrated. Objectives as described in the "SMART" tool in supplementary appendix J1 Strategies are workable and give detail and depth about how the outcomes will be achieved. Demonstration/evidence and assessment is specific.
Overall contract provides a **course of study appropriate for full duration at level 7 and provides a sufficient level of critical analysis.** Most outcomes at the higher level of Blooms taxonomy.
Relationship of theory to practice is addressed in the agreement
Overall contract gives clear direction and guidance for the Coop assignment and addresses the needs of all three parties (workplace, student and AUT). The work to be undertaken is clear The discipline and capability goals are clearly expressed The focus for the semester is clear
Clear communication, presentation and format

An example of a specific capability [1]goal as expressed within such a learning agreement is given below:

Capability Goal 1

Objective

The objective of capability goal one is to improve my negotiation skills

The outcome

The ability to advise people when negotiating for functionality with clients will be provided.

Apply negotiation skills in different situations.

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[1] a 'capability' can be viewed as synonymous with the term 'competency' in this paper.

Strategy

To improve my negotiation skills I will observe and learn from workplace supervisors.

I will read up on negotiation skills.

Practice during different phases in the project like the user requirements phase where I can negotiate the amount of functionality within the available time.

Evidence

The workplace project manager will give feedback on my negotiation skills. I will also comment on this in my log book.

Assessment

Discussion of how I negotiated user requirements and functionality will be included in my Reflective report and will be assessed by AUT supervisors.

The learning agreement is a reasonably substantial document, typically in the order of 15 A4 pages in length, and is a summatively assessed item, with the rubric in table I above being applied. Assessment of the learning agreement is not a heavily weighted item, as the focus of the course is more on achievement of the goals committed to in the agreement.

IV. LEARNING AGREEMENTS IN THE IT IN SOCIETY COURSE

The *IT in Society* course at Uppsala University is open to students with a Bachelor degree. It runs during our fall semester and accounts for half the study time expected of the students during the semester. The course is a collaboration with students from two American sites; Rose Hulman Institute of Technology, Terre Haute, Indiana and Gannon University, Erie, Pennsylvania. The American students are enrolled in courses that only account for roughly a fifth of their expected study time during the period. We will focus here on the course at the Swedish site, since the changes are made by the Swedish faculty and primarily are intended for the Swedish students.

The course is based on an Open Ended Group Project [5-7, 9] and conducted in collaboration with a real customer, who for more than ten years has been in the health sector in the County Council. The students have substantial freedom in defining what the project will actually encompass, although faculty give some restrictions and their plans have to be presented for, and approved by, the client.

This setting, with an open ended project typically involving over twenty students from different countries and also residing in different time zones, offers a rich environment in which each student is able to find some aspect of professional competence development on which to focus. The learning agreement in the course at Uppsala University is intended to help the students meet the specific learning objective of developing professional competencies, by ensuring that the students get an explicit emphasis on relevant aspects of learning for that goal. In the document each student identifies the professional competencies on which to focus. The students chose three professional competencies from the nine graduate attributes promoted at Curtin University, Perth, Australia [28] and presented in Table II [29].

need to scaffold the students in writing these agreements although this very strategy was intended to scaffold them in developing professional competencies [29]. This has been done in lectures and workshops, but unfortunately without the desired outcome. Thus, in refining the process we have developed a framework for helping students to create meaningful learning agreements.

Table II: Curtin University Graduate Attributes

	Graduate Attribute	Descriptor
	1. Discipline knowledge	Apply discipline knowledge, understand its theoretical underpinnings, and ways of thinking; Extend the boundaries of knowledge through research.
	2. Thinking skills	Apply logical and rational processes to analyze the components of an issue; Think creatively to generate innovative solutions.
	3. Information skills	Decide what information is needed and where it might be found using appropriate technologies; Make valid judgments and synthesize information from a range of sources.
	4. Communication skills	Communicate in ways appropriate to the discipline, audience and purpose.
	5. Technology skills	Use appropriate technologies recognizing their advantages and limitations.
	6. Learning how to learn	Use a range of learning strategies; Take responsibility for one's own learning and development; Sustain intellectual curiosity; know how to continue to learn as a graduate.
	7. International perspective	Think globally and consider issues from a variety of perspectives; Apply international standards and practices within a discipline or professional area.
	8. Cultural understanding	Respect individual human rights; Recognize the importance of cultural diversity particularly the perspective of Indigenous Australians; Value diversity of language.
	9. Professional skills	Work independently and in teams; Demonstrate leadership, professional behavior and ethical practices.

The learning agreement consists of three parts and is typically a few pages long, incorporating:

- Identification and description of the chosen professional competencies
- Description of how the student will act (in the project) to develop the chosen professional competencies.
- Description of how the student and faculty will know that development has occurred.

The students are thus encouraged to reflect on their own knowledge, skills and abilities, and commit to the development of personally chosen competencies, which will suit their personal needs as exercised in the context of the course. This is in line with our vision that a good strategy to develop professional competencies is to build a reflective mind-set [28]. The notions of "reflection in action" and "reflection on action" as metacognitive activities [13], are powerful in helping build the conscious and unconscious professional competencies typified by Schön's "reflective practitioner" [13].

Over the years of our action research programme into OEGP pedagogies [9], students have shown considerable difficulties in writing their learning agreements. In our individual meetings with the students to discuss their learning agreement and progression, we have observed that the students were highly dependent on teacher guidance and that they had difficulties in reflecting on their learning and in defining their own educational goals. Also, the students seem to have difficulties accepting that there is no clear definition for the different professional competencies. We have thus identified a

V. A FRAMEWORK FOR WRITING LEARNING AGREEMENTS

The framework developed to support the students in writing learning agreements in the *IT in Society* course has been built on past cycles of experience in OEGP courses [9], theoretical insights from the HCI field [21] and based on discussions with students. The idea is to build an IT based system for this framework as an element of a research based development [15]. We have implemented this as a course Wiki [31] set of pages. These pages contain: 1) General information about the assignment of writing a learning agreement, 2) Descriptions of the different professional competencies involved in the learning agreement (the nine graduate attributes from Curtin University), 3) A template for writing learning agreements, 4) Resources for developing different aspects of professional competencies, 5) A reflection section with specific questions related to what has been developed for each of the professional competencies, and 6) A set of personas and scenarios.

The first three items are quite straight forward, but nevertheless seen as useful in giving the students some understanding of what to do when setting up their learning agreement. The fourth and fifth items are where we envision participation from the students, in a "contributing student pedagogy" model [32]. The fourth item allows new resources to be added and comments on existing material can be made. The fifth item allows new questions to be added and comments can be made on old ones. The idea is to make the framework something that evolves over time. Resources are intended to be anything that can support a student to develop a specific professional competence. The resources are currently listed in the following categories: 1) books, 2) articles, 3) TED talks, 4) video clips, 5) courses, and 6) web pages. Some examples of reflection questions associated with each professional competency are "How did you adapt your written communication for the audience and purpose?" with regard to the written communication competency or "Have you learned new or developed techniques for visualization of data?" for the visual communication competency.

The sixth item, the set of personas and scenarios, is taken from the human computer interaction field and is intended to aid students in identifying themselves with regard to the international collaboration project and with potential professional competencies involved. The intention with this is to help students identify with different roles in the project and understand which professional competencies might be relevant for those roles. Another goal is to introduce the students to challenging scenarios that might arise in the project and the professional competencies that might be valuable in such scenarios.

A. Focus Group Sessions

Towards the end of the 2015 course instance two focus group sessions were conducted, one with five students (one from Uppsala and the other four from the US) and the other with six students (three from Uppsala and three from the US). Participation was voluntary and included students visiting on site at Uppsala. The sessions were led by a guest researcher not involved in the course together with a former student.

These two sessions were intended to explore the design of the Wiki as a collaborative technology platform. From a research perspective, these sessions supported both observation and reflection on our design work in the field to date [15] and planning for action taking in the next semester's cycle of study, as inherent elements in our OEGP teaching practice and action research programme [9, 33]. The students were asked to give input into the needs for the platform, how it might best be designed to support student learning and the role of mechanisms such as templates, personas, and scenarios. All students present in Uppsala at the time, (some of the students from Rose Hulman Institute of Technology were still in the US), were involved in the sessions.

An example of the information the students were sent before the sessions is the following:

"As the usability expert Jakob Nielsen has observed in his Article on "The Use and Misuse of Focus Groups" [34]

> *Focus groups are a somewhat informal technique that can help you assess user needs and feelings both before interface design and long after implementation. In a focus group, you bring together from six to nine users to discuss issues and concerns about the features of a user interface. The group typically lasts about two hours and is run by a moderator who maintains the group's focus.*

In these focus groups, which will run for one hour only, the participants will …be guided through a series of questions and scenarios to gain feedback on the needs for the technology platform, and how it may best be designed to support student learning, including the role of mechanisms such as templates and personas...A focus group does not have the intention of reaching a consensus so all views are equally valid. We will work through the feedback received and hope that your ideas and suggestions will help us design a better system and set of learning experiences."

Four areas were discussed in the sessions: experience with the learning environment, improvements to the system, issues concerning the Wiki, and use of personas and scenarios.

1) Experience with learning agreement

The responses were varied, with the learning agreements having been explained variably and thus being viewed differently at the collaborating institutions. The comments below were drawn from the notes taken at the focus groups.

> *The student was really confused with the personal learning agreement and did not know what competencies were.*

> *A Swedish student says he has different thoughts than the American students. He passed the assignment the first time. He thought it was clear which competencies to choose and motivating them was easy.*

There were also comments about how students would know whether goals had been achieved.

> *Dependent on each competency there should be a way to know if you have achieved or improved the competency, like a task completed or question. "How will you know that this competence has developed during the course?" Is too vague.*

The students asked for a greater justification for doing the learning agreement and also to have the professional competencies better explained. About half of the students did not really follow up on the learning agreement, but some did.

> *The student used the personal learning agreement (PLA) to reflect on collaborating with people, also in a professional setting outside of the course, an internship.*

> *Two of the students used the PLA as a guide, others struggled; They need to know why the PLA is important and want more discussion. It was a long process to write it for the Swedish student, but it has been very giving/helpful.*

> *The PLA makes you self aware.*

> *One student used the PLA to pick assignments throughout the course that fit with the contract.*

2) Improvements

Suggestions for improvements came up at various stages of the sessions. Examples of what was noted from the sessions.

> *A student found it difficult to write the personal learning agreement. You have to look at yourself to know what to choose. The student would have changed some competencies now that he is more experienced of the personal learning agreement.*

> *… you should be able to change the personal learning agreement. There should be a feedback sessions about the personal learning agreement, maybe halfway through the course.*

> *…does not need to be more than three competencies. Would be possible to focus only on one competency, but with several aspects*

3) The Wiki in General

The responses were in general positive, e.g. one student pointed out the reflection part as looking really helpful. There were some suggestions for improvement, like adding more information about the competencies and "success" stories from previous year's students. They also suggested adding some sort of "self quiz" where they could learn more about themselves in relation to the competencies.

4) Personas and Scenarios

An introductory slide (figure 1) was used to frame the focus group discussion about personas and scenarios:

Figure 1: Slide for Focus Group on Personas and Scenarios

Two further slides, see figures 2 and 3, were used to introduce the idea of personas and scenarios:

Figure 2: Persona #1

Figure 3: Persona #4

Most students were new to the idea of personas and scenarios, but the discussions were still fruitful. The two personas presented for them were built by personal experiences of two students from two different previous instances. It was interesting that the students said that they could identify persons who were like the two personas. In general the students were hesitant about writing their own personas and scenarios. Some pointed out that writing personas and scenarios could be something to do over a period of time, e.g.:

They think you would know enough to write a persona by the end of the first week of the project. Would be better to write them, or revise them, midcourse. Would be good for reflection.

Some pieces of the persona can be done early and some later.

They think the personas would be very different in the start compared to the end.

Several had thoughts along the line of writing personas for each other, but they saw more drawbacks than advantages with that.

One student does not think they would note everything well about themselves in a persona. It would also be hard to write about someone else, do not want to bash them.

It was generally seen that personas and scenarios, such as those presented, could help them in writing their learning agreements.

Personas could help writing the personal learning agreement.

Personas should not replace the personal learning agreement. The personal learning agreement helped compare an international project vs a local.

The personas could help if you are struggling.

Could be good with examples like the given ones. Some think they would have no idea what to write with just a blank space.

There was a discussion about the value of seeing personas from previous course instances, although the opinions were divided about the value.

Would be good to see personas from previous years.

Having past students' personas would make it difficult to think freely, but that is different for everyone as some think it can also help.

Can be hard to write a persona because others perceive you differently. With help from other people it would help one to see which competencies to improve.

Much of the discussion of personas and scenarios diverged from being a support for writing a learning agreement, towards being something in addition, like being a scaffolding of its own.

VI. COMPARISON BETWEEN THE TWO USES OF LEARNING AGREEMENT

There are some major differences in how learning agreements are used in the two courses. The assessment is perhaps the most obvious difference, where in the Swedish

instance it is writing the learning agreement that is assessed, whereas in the New Zealand instance it is especially the fulfillment of the agreement that is evaluated. Another difference is that the client is involved in New Zealand whereas the learning agreement in Sweden does not involve the client at all. The content of the learning agreements are also different, where the one in Sweden only focuses on the learning of professional competencies and the one in New Zealand also covers the work assignment and concrete knowledge components. The freedom in how to write the learning agreement is higher in Sweden and both sites have seen the need to actively scaffold the students in writing them.

The differences stem to some part from the courses having different learning objectives, but there are substantial similarities and thus fertile ground for learning from each other. Things to consider on the Swedish side are to also include a clearer assessment regarding fulfilling the learning agreement at the end of the course. At the moment students are only assessed about their learning agreement in their final reflection assignment and there it is ok to come up with thoughts about what happened without a demand for living up to the agreement.

Raising the bar with regard to fulfilling their learning agreements would probably lead to students taking them more seriously than they do today. The counter argument is the question of scalability and the extent to which an instructor can actively work with multiple students in a mentoring role actively iterating drafts of the learning agreement at the busy start of semester period.

An assessment at the end of the project could involve use of a grading rubric which would increase transparency with regard to what is assessed, but also most likely restrain the students' freedom to be inventive in how they think they should show that they have developed with regard to their chosen professional competencies. Involving the client is another route to increase the seriousness of the learning agreement, but this is a rather big step away from the current version. A smaller step would be to include negotiations with other students in writing their learning agreements. We are currently considering which of these options to include in the next iteration of the course, and how far to spread that practice across sites.

VII. CONCLUSIONS

There are many different ways to use learning agreements in courses and they can be quite powerful tools in directing students learning. We have found that using them to scaffold, and assess, students development of professional skills is complex and have thus developed a framework for supporting the students. The support is intended both for writing the learning agreement and to function as a guide throughout the course.

We have developed a prototype of a Wiki based tool to support such a framework in collaboration with students and evaluated it through focus group sessions as well as observing and interacting with the students in the international student collaboration project. The results are positive, but have raised issues that we can only investigate through active experimentation with the framework in the field. Therefore we will continue our efforts in order to provide the students in the 2016 instance with a fuller version of the framework based on the Wiki platform. We will include the personas and scenarios, based on the balance of positive comments in the focus group sessions.

The use of learning agreements will be influenced by the comparison with the use of learning agreements in the New Zealand course in that a clearer follow-up of the development will be undertaken toward the end of the course. We will also probably introduce some form of negotiation with other students in the process of writing individual learning agreements.

Overall we believe the learning agreements have value for students and have the potential to contribute strongly to student motivation and in building both their awareness of and commitment to developing professional competencies. However their format and the types of support for their inclusion in a course is clearly an ongoing process for us. The introduction of the wiki and the personas as reviewed in this report, present one scaffolding strategy towards the more effective contribution of learning agreements in Open Ended Group Project courses.

REFERENCES

[1] G. Gibbs, "Learning by doing: A guide to learning and teaching methods," Birmingham: Sced, 1988

[2] C. E. Wieman, "Large-scale comparison of science teaching methods sends clear message," *Proceedings of the National Academy of Sciences,* vol. 111, pp. 8319-8320, 2014.

[3] R. Säljö, "Lärande i praktiken [Learning in practice]." *Stockholm: Prisma*, 2000.

[4] J. Piaget, Science of education and the psychology of the child. Trans. D. Coltman, 1970.

[5] X. Faulkner, M. Daniels, and I. Newman, "The Open Ended Group Project: A Way of Including," *Diversity in Information Technology Education: Issues and Controversies: Issues and Controversies,* p. 166-195, 2006.

[6] M. Daniels, "Developing and Assessing Professional Competencies: a Pipe Dream? Experiences from an Open-Ended Group Project Learning Environment," PhD, Department of Information Technology, Uppsala University, Uppsala, 2011.

[7] Å. Cajander, M. Daniels, and R. McDermott, "On valuing peers: theories of learning and intercultural competence," *Computer Science Education,* vol. 22, pp. 319-342, 2012..

[8] T. Clear, S. Beecham, J. Barr, M. Daniels, R. McDermott, M. Oudshoorn*, et al.*, "Challenges and Recommendations for the Design and Conduct of Global Software Engineering Courses: A Systematic Review," in *Proceedings of the Working Group Reports of the 2015 on Innovation & Technology in Computer Science Education Conference*, N. Ragonis and P. Kinnunen, Eds., ed New York: ACM, pp. 1-39, 2015.

[9] M. Daniels, Å. Cajander, A. Pears, and T. Clear, "Engineering Education Research in Practice: Evolving Use of Open Ended Group Projects as a Pedagogical Strategy for Developing Skills in Global Collaboration (Special issue on Applications of Engineering Education Research)," *International Journal of Engineering Education* vol. 26, pp. 795-806, 2010.

[10] J. Rick and M. Guzdial, "Situating Coweb: A Scholarship of Application," *International Journal of Computer-Supported Collaborative Learning* vol. 1, pp. 89-115, 2006.

[11] T. Clear, "Diagnosing Your Teaching Style: How Interactive Are You?," *ACM Inroads,* vol. 1, pp. 34-42, Jun 2010.

[12] T. M. Connolly and C. E. Begg, "A constructivist-based approach to teaching database analysis and design," *Journal of Information Systems Education,* vol. 17, p. 43, 2006.

[13] D. Schön, *Educating the Reflective Practitioner*. San Francisco: Jossey Bass, 1987.

[14] Å. Cajander, M. Daniels, R. McDermott, and B. von Konsky, "Assessing Professional Skills in Engineering Education," presented at the 13th Australasian Computer Education Conference (ACE 2011), Perth, Australia, 2011.

[15] J. Nunamaker, M. Chen, and T. Purdin, "Systems Development in Information Systems Research," *Journal of Management Information Systems,* vol. 7, pp. 89-106, 1990.

[16] C. Laxer, M. Daniels, Å. Cajander, and M. Wollowski, "Evolution of an international collaborative student project," in *Proceedings of the Eleventh Australasian Conference on Computing Education-Volume 95*, pp. 111-118, 2009.

[17] S. Acuna and N. Juristo, "Assigning People to Roles in Software Projects," *Software - Practice and Experience,* vol. 34, pp. 675-696, 2004.

[18] R. E. Mayer, "Should there be a three-strikes rule against pure discovery learning?," *American psychologist,* vol. 59, p. 14, 2004.

[19] T. Clear, "A place for learning agreements in capstone computing courses?," *ACM Inroads,* vol. 1, pp. 10-11, 2010.

[20] G. Anderson, D. Boud, and J. Sampson, *Learning contracts*. Psychology Press, 1996.

[21] A. Cooper, "The inmates are running the asylum: [Why high-tech products drive us crazy and how to restore the sanity]" (Vol. 261). Indianapolis: Sams, 1999.

[22] J. Siegrist, D. Starke, T. Chandola, I. Godin, M. Marmot, I. Niedhammer*, et al.*, "The measurement of effort–reward imbalance at work: European comparisons," *Social science & medicine,* vol. 58, pp. 1483-1499, 2004.

[23] E. Eriksson, Situated Reflexive Change : User-Centred Design in (to) Practice. (Doctoral thesis), KTH Royal Institute of Technology, Stockholm. Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-116403, 2013

[24] S. Portigal, "Persona non-grata." *interactions,* pp. 72-73, 2008.

[25] E. Markensten and H. Artman, "Procuring a usable system using unemployed personas," in *Proceedings of the third Nordic conference on Human-computer interaction*, pp. 13-22, 2004.

[26] T. Clear, G. Claxton, S. Thompson, and S. Fincher, "Cooperative and Work-Integrated Education in Information Technology," in *International Handbook for Cooperative & Work-Integrated Education*, R. Coll and K. Zegwaard, Eds., 2 ed Lowell, MA: World Association for Cooperative Education Inc, pp. 141-150, 2011.

[27] C. J. Pilgrim and T. Koppi, "Work integrated learning rationale and practices in Australian information and communications technology degrees," in *Proceedings of the Fourteenth Australasian Computing Education Conference-Volume 123*, pp. 25-32, 2012.

[28] B. Oliver, Graduate attributes as a focus for institution-wide curriculum renewal: innovations and challenges. *Higher Education Research & Development*, *32*(3), 450-463, 2013.

[29] R. McDermott, M. Daniels, Å. Cajander, T. Clear, M. Cullhed, and C. Laxer, "Student Reflections on Collaborative Technology in a Globally Distributed Student Project," in *42nd ASEE/IEEE Frontiers in Education Conference.*, ed Seattle, Washington: IEEE, 2012, pp. 365-370.

[30] Å. Cajander, M. Daniels, and B. R. Von Konsky, "Development of professional competencies in engineering education," in *Frontiers in Education Conference (FIE), 2011*, 2011, pp. S1C-1-S1C-5.

[31] B. Leuf and W. Cunningham, "The Wiki way: quick collaboration on the Web," 2001.

[32] J. Hamer, J. Sheard, H. Purchase, and A. Luxton-Reilly, "Contributing student pedagogy," *Computer Science Education,* vol. 22, pp. 315-318, 2012/12/01 2012.

[33] J. McKay and P. Marshall, "The dual Imperatives of action research," *Information Technology and People,* vol. 14, pp. 46-59, 2001.

[34] J. Nielsen, The use and misuse of focus groups. *Software, IEEE*, *14*(1), 94-95, 1997.