A flow based approach to authentic learning in social oriented teaching

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Keywords: University-industry: Cooperation and inspiration, Curriculum development

1 INTRODUCTION

There are huge expectations to engineers as the providers of solutions to many challenges in society both at a local level and also at global level. Future engineers need to be co-creative in the processes of ensuring employability and exploit growth opportunities. They are expected to provide new solutions to present and coming problems. Traditionally the focus in higher education, as well as in Engineering Education, has been centred on teaching the students the disciplinary content knowledge. We also find that higher education usually put universities as research centred institutions. A solid knowledge foundation is important in an education but an increased acknowledgement of that many students will leave university after graduation is also required. University need to prepare the students for a life as professional engineers in industry and the above calls for new views on how the future engineers are and will be educated [1]. Students need to develop competences that support their active use of the disciplinary content knowledge and to use it in novel ways and contexts. The students must be supported in their learning in order graduate on time and to develop lifelong learning capabilities. They require support to learn efficiently and to develop the generic competences they need as future engineers. Hence, it's crucial for Engineering Education to develop new teaching methods and philosophies that support this venture. Active learning methods have long been used to enhance learning. The recent discussion on providing the students with skills and knowledge within innovation and entrepreneurship during their education, calls for a development of those methods so they to a higher extent embrace also real-life situations where the students can learn to work with complex, multi-dimensional problems, which show them how they can contribute to create value [2]. Self-efficacy and self-awareness are also abilities that might to a higher extent need to be executed among the students in their education

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[3]. Engineering Education must be effective on many levels and embrace (i) learning of both general competence and deep disciplinary knowledge, and (ii) address the aspect of personal development among the students. A long with this development also the teacher role must develops and include more aspects than just being the expert in a disciplinary field.

In this paper this broader perspective on teaching and learning in Engineering Education is explored by describing the underlying teaching concepts, supplemented by a case study of the students' experiences in a senior course in the Mining Engineering Program at Pontificia Universidad Católica de Chile (PUC). The course is built around an open-ended project, fully developed during a one-week immersion in an actual mining site. That kind of setting implies a high challenge for students who must show different kinds of expertise and skills in order to achieve the intended deliverables. The Flow concept is used as the bearing teaching philosophy in order to make the students meet the challenges in the course in a constructive way. The course design builds on the acknowledgment that learning is a process also very much dependent on feelings and affections as well as a well-structured knowledge base and relevant learning activities [4]. If a "passion mode" can be switched on in the students and their intrinsic motivation towards the subject triggered, the students are more likely to be deeply involved in their own learning, and thereby perform better. The result from a former study made on the course indicates that flow can be achieved by this so called "Fast-Track-On-site Project-Delivery" (FTOSPD) [5]. The learning strategy helps the students to develop a broader range of general competences and a deep disciplinary content knowledge within the same time frame as an ordinary term long engineering course.

The learning process in the course is highly social and exploits concepts from the communities of practice theory [6] and much of the work is done in groups of students. In a course setting like this it's crucial to understand how, and if, flow also works in groups [7]. In this paper we discuss about flow as a tool to enhance learning. The scope of the paper focus on the social dimension of learning and flow, and how team based learning and social aspects of teaching can be used actively in education of engineers. Empirical data from an investigation among the students in the course that pose the case in this paper is presented and discussed.

2 FLOW AS A STATE OF MIND

Flow is a mental state characterised by an experience of peak performance and total concentration when we are engaged in a task. It is mainly described within the paradigm of positive psychology. The concept is mainly used to understand how people experience quality in their everyday lives and to investigate strategies that can be used to help people live a more fully life and also how to find balance in order to experience more joy and happiness [8,9].

2.1 Prerequisites for flow and it's applicability on learning

Flow occurs when a person perceive clear goals and get immediate feedback just when needed in a process of doing, performing or discover. The main prerequisite to enter a flow state in performance is an experienced balance between the levels of the challenge we are exposed to and the experience we have of our skills to meet this challenge. In flow, all our psychic energy is directed towards the task and towards our performance. Due to the high level of concentration there is no room in our consciousness for irrelevant and distracting thoughts. Working in flow state creates through concentration and motivation a sense of value and balance that is essentially worthwhile for the individual [8] [9]. Flow is central for high performances in any situation where we need to perform on a high level and challenge ourselves. Learning can be included in this. Another central concept in the theory of flow, relevant for a learning situation, is psychic entropy. Psychic entropy can be described as feelings of boredom, worries and unproductive anxiety, which consume mental energy and prevent us from focusing on a tasks and good performance. In order to experience flow and be able to perform efficiently, using all our resources and experience joy in our work, we need to strive for reduction of psychic entropy. Important to remember in teaching as another parallel to flow is that joy in itself is also a driver for motivation and deep involvement in tasks. The quality of our work and performances are also dependent on our feelings, positive or negative, towards the task and the situation in which the task is situated [8,9]. Central in flow and the processes that lead to it is how the surrounding social context responds to us. The consequences of our activities and doings for others and the feedback we receive are important. Basically, we want to create value for greater purpose than just to satisfy ourselves. When this happens and positive feedback is returned to us, both our motivation and the experience of flow are enhanced. This reveals the importance of understanding flow also as a collective and social process.

To sum up the similarities between flow and what we know that creates effective learning is that the deep approach to learning which is central here is to some extent supported by the same traits as flow. To motivate the students towards the content is crucial to obtain deep approach to learning. Feedback on our learning performances, given in the right time and continuous during a course contributes to student motivation. By getting feedback the students can be in control over their own learning process and progress and know in which direction to go. Clear learning objectives are important as well as to give the students suitable challenges that are not too easy and not too hard, so the students perceive them as possible to meet and solve, and also trigger their curiosity [10]. In addition to this it's important to remember that learning is human process that involves the whole range of mental process from logical thinking abilities over to what research shows, namely that the emotional aspect of learning might be the most powerful and important [4]. Also here the social aspects must be emphasised as effective learning is dependent likewise as flow on the traits in the social environment where it takes place.

2.2 Social and collective aspects of Flow

An investigation of flow in small groups, and the affective experiences of flow as a social and collective construct have used studies about flow by Csikszentmihalyi and Bandura's Social Cognitive Theory as sources. It was found that the same processes that create flow in and individuals also create flow in smaller groups. Collective efficacy beliefs in a group can make the quality of flow even higher than in an individual [7]. The study by Salanova et. al. also shows that the feeling of collective flow also predicts how efficacious a group regard its self over time. There seems to be a positive spiral of developing flow in groups that can be enhanced under the right circumstances. Hench, group processes are critical for group performances and for how the group affect us as individual group members. There are many studies made on group development processes and the most of them come to the same conclusions about how the impact of group processes have on its members and that there are stages in a group development that seems to follow the same pattern [11]. One of the more well-known models to understand and handle group development processes and the impact those processes have on group performances is the Tuckman's Stage Model [12]. Accordingly to Tuckman groups are going through the stages of Storming, Forming Norming, Performing and Adjourning.

A development of Tuckman's model suggests that there are two major barriers that a group need to overcome in order to develop to in the stage of Performance. This suggestion is based on a studied where the purpose was to find out how a group can develops in to a high-performance team that can come up with outstanding and creative solutions [13].The first barrier a group will meet and need to overcome is occurring after the Forming and Storming stages where the group will develops in to the Norming and Performing stages. Most teams manage to overcome this barrier and find a procedure and a shared standard for performance. The second and stronger barrier is between the Norming and Performing stages and the High-performing stage. This barrier we consider to be central to the group efficacy beliefs which also are related to the experience of flow in groups [7]. Only few teams manage to overcome this barrier that seems to be a major hindering for an outperforming process and thereby flow in a group [13]. Consciousness about group development processes in general and about the importance to specifically help students to overcome this second and strong barrier in order to use teams in teaching more efficient is essential for teachers. How a team develops and works is also dependent on the culture that is created through the leadership and by the leader's perception of the group. The teacher takes the responsibility as the leader.Richards and Moger suggest seven important factors of leadership that enhance creativity and high-performances: 1) Platform of understanding: The leader explains and the team explores shared knowledge and assumptions to create a common base of knowledge. 2) Shared vision. 3) Climate: Emphasizes a positive climate. 4) Resilience: Emphasizes the principles of alternative perspectives. 5) Idea owners: Efforts to build common ideas. 6) Network Activators: Reaching out and use knowledge from others. 7) Learning from Experiences: Experiential learning is important for creative leadership interventions. Social relations and social processes consume a lot of mental energy during different stages in a group development process and have a strong impact on intellectual performance and its quality. Thus, it has an impact also on learning, creativity, problem solving etc. [13]. Collective flow and the group development processes are important aspects to work on when using teams in teaching and flow as methods to enhance learning. Those aspects are exploited in the case study in this paper.

3. A CASE STUDY USING A FLOW BASED APPROACH AND TEAM WORK TO ENHANCE STUDENTS' PERFORMANCES

We illustrate how the theoretical framework described above by using a senior course of the mining engineering program at Pontificia Universidad Católica de Chile (PUC). PUC can be considered as a medium-size research-oriented university (~20000 undergraduate students and ~5000 graduate students). The university ranks as 1st in Latin America in the 2014 QS ranking (167 worldwide).

Our case study has been used previously as a test for active learning concepts [14] [15] [5] [16]. (Pascual, 2010; Pascual & Scheele, 2011; Pascual & Andersson, 2012, Pascual & Andersson, 2014). Here we describe a learning tool denominated "Fast-Track-On-Site Project-Delivery" (FTOSPD). It focuses on "facilitating the students to achieve flow to enhance their learning processes and to give them an opportunity to learn some strategies to handle also other situations in life" [5]. FTOSPD considers the development of an on-site, open-ended industry project. Flow theory is exploited to increase creativity and motivation to deliver the best attainable project results. The hypothesis is that if all the traits that lead to flow and high-performances in teams can be set to place through activities embed in an Engineering Education course, new possibilities will appear to let the students to develop their full potential as young engineers.

3.1 The course design

Students develop their project during a 9-day immersion in an actual mining site. The week occurs during week 12 of a 16 week-long term. A typical immersion includes four processes: (i) problems recognition, (ii) creative solutions proposals, (iii) selection of suitable pairs of problem(s) and solution(s), (iv) building of associated business case(s). The FTOSPD setting avoids the stress of the exams, which occur by the end, and at the same time, occurs as late as possible in the term, to be sure that the students have gained the required skills and attitudes. The professional setting during which the project is developed implies a major challenge for students. They must show different kinds of skills in order to achieve optimal results. As example, the social interaction between the students and the practitioners is intense during the immersion. Authentic peripheral learning is sought [6]. FTOSPD implies an important level of effort both the students and also to the teaching team. During the first 11 weeks of the term, students must attain high-level cognitive and affective skills in order to achieve original solutions to most promising improvement opportunities. They need to observe problems and opportunities where insiders do not, as, often, it exists a “can't see the forest for the trees” phenomenon in industry. This creates opportunities for the students who lack professional experience. To attain that, a strong collaborative effort, mutual support and collective intelligence are required to facilitate the achievement of the initiative. To develop these attitudes and skills, several outdoor team-building activities are programmed during the semester.

3.2 Investigation of Flow in the course setting

To measure flow state, a survey was designed. It is based on the well-known Experience Sampling Method [8]. Students rate their learning experiences embed in the course in accordance to the trait that signifies a flow experience. The teaching methods included in the survey were lectures, exercises, laboratory work and workshops, wiki-collaborative group work and oral communication, FTOSPD and the public seminar where the students present the results of their projects. The survey rates on a 1-7 Likert scale how they felt during the different course activities with respect to being feeling happy, concentrated, motivated, how great the challenge was to them and how they judged their skills to perform well during the specific activity. As a supplement to the rating of feelings towards the different teaching activities and to unfold some off the experiences behind their ratings the students were asked to mention the three most important things they learned from the course [5]. The results of the survey indicates that active learning methods support the traits that leads to a individual flow experience and that students show enhancement in their learning. There are also other specific aspects of FTOSPD that can be significant to achieve flow according to the theory. Students interact directly with practitioners. It is a main driver for learning and shows positive impact on students' motivation [16]. Feedback from practitioners which loop back to the students can strengthen their experience of flow by making them know that the result of their work is innovative and satisfying, and if not, they may take actions to obtain better results. The intense feedback loops in FTOSPD show relevance to strengthen a flow experience, and likewise meaningful learning. Since team-work is an essential part of the course the next thing to investigate is what role the group activities in the course play for the students performances and if the students experience also collective flow during the immersion week. The positive results from the first study indicate that this is the case and this study focus only on the group activities in order to find out more about collective flow and what creates it.

Figure 1. Outdoor team building activities.

Figure 2. Students during the immersion week.

4. RESULTS

Figure 3 shows the results of our survey to former students (n=8) who experienced the immersion week and delivered improvement projects. Results are impressive as they show true appreciation of the experience as a professional flow-inducing activity.

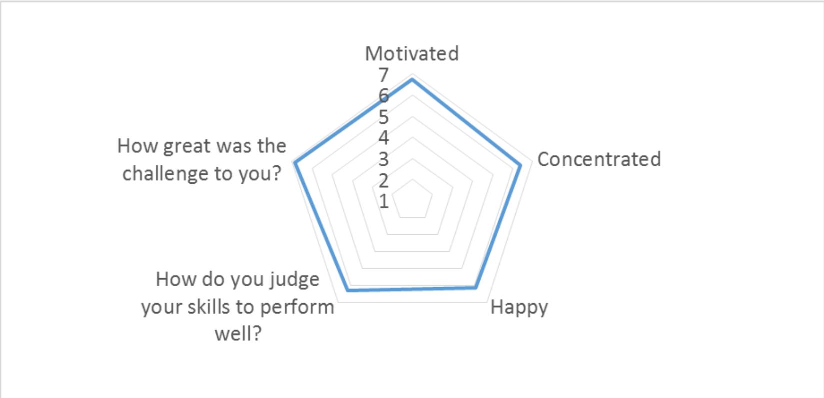

Figure 3. Results of the survey regarding the immersion for alumni, autumn 2015

Figure 4 shows the average results of the experience survey for the second team building activity (10K run) of autumn 2015. For this kind of physical activity, mental focus is not really required and explains the lowest level in the results. It is also an activity that does require physical training to perform well, and some of the students are not used to run. This affects their judgement regarding their skills for the activity. Anyway, the perception of motivation, happiness and challenge are high. Motivation and happiness are central for flow and thereby for outperforming.

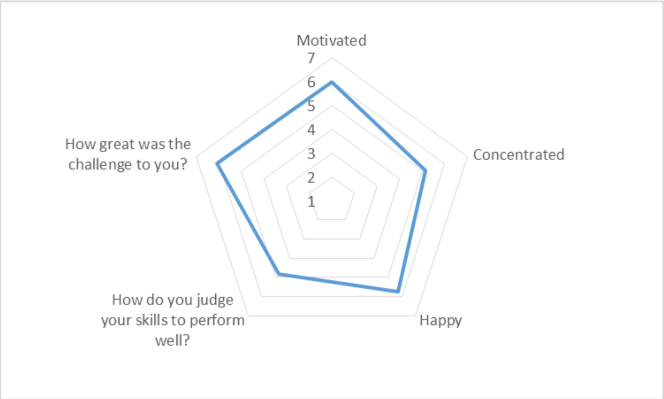

Figure 4. Results of the survey for the second team building activity (10K run), autumn 2015

Creativity important for innovation projects like in this course and need to have student groups developed into high-performance teams. As a teacher to actively work with the social dimension in a course can as this study implies have a positive effect on student performances.

5. DISCUSSION AND SOME CONCLUSIONS

In the previous investigation of the students learning experience in the course used in this case study it's clearly that the on-site-immersion-week to a higher degree than the other teaching methods used in the course fulfil the prerequisites of flow. The conclusion can be drawn that this way of using authentic learning and real-life cases combined with the engagement of students in a "fast –track-on-site-project-delivery" (FTOSPD), this flow-based approach to learning can be used to enhance student learning in Engineering Education. The students also in the recent study also report flow from working the immersion-week were also the social engagement in learning is high. This indicates that there seems be an experience of flow also on team-level in this course. The conclusions from this case study imply the importance of (i) acknowledge the affective and social dimensions in learning (ii) allocate time to work with team development and to create a social good environment (iii) use authentic learning (iv) exploit leadership as a teacher in order to enhance team performance and student learning. In order to take the leap in Engineering Education towards a teaching and learning context that truly prepares the students to their working life and embrace the complexity in the role of an engineer this case study point out some highly relevant methods to use. Evidence shows that FTOSPD is highly valued by alumni. The survey shows that all elements associated to flow are present. It is very interesting to receive evidence of flow in a quasi-professional context, as the immersion is. It is very motivating for the teacher, as it is hoped that our alumni will act as agents of change for the industry. If flow is present in their professional lives, then it is more likely that they will achieve personal and corporate success.

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