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Individual Reflection Paper – Supporting Students' Learning in the Critical Phase of Self-directed Learning in PBL

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ABSTRACT

Supporting and assessment of students' preparation and learning process in problem-based learning (PBL) tutorials has long been a challenge. We present a modified PBL model focussing on the specific critical phase in the PBL process, the self-directed learning phase in between tutorial meetings. The modified seven step PBL model including an Individual reflection paper (IRP) is presented as well as students' perspectives on the implementation of IRP and information literacy, knowledge gathering, and PBL tutorial work. The assessment of PBL work is complex, and the ways in which IRPs support the tutor's role as an examiner is beyond the scope of the current study. However, it seems that the students experienced assessment of the IRPs as part of their as a positive driving force in their learning process.

INTRODUCTION

In a modern society, we need to educate students who are able to manage complexity and uncertainty, not least regarding environmental and sustainability challenges (Barnett 2012). Students must develop certain skills, including interdisciplinary professional skills, technical and analytical abilities, and cognitive abilities such as critical thinking (Bedrow and Evers 2011; Boud and Molloy 2013; Dolmans et al. 2015). Contemporary pedagogical theory advocates student-active and student-centred education which should scaffold the development of the student's cognitive competences including creativity, academic writing, critical thinking, and reflection skills (Ramsden 2003; Biggs and Tang 2011). Nevertheless, the effectiveness of different pedagogical concepts is strongly dependent on how they are implemented and applied in education. Problem based

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learning (PBL) is a well-known method to manage complex scenarios and cases with no or little information, and reflection and critical thinking are natural parts (Savin-Baden and Howell, 2004a; Savin-Baden and Wilkie 2004). PBL is in many aspects a suitable pedagogical method in higher education, but needs careful design and well-thought-out implementation (Hung 2011).

One challenge in the PBL context is to provide instruction design and instruments to support creativity, deep learning, and motivation for self-directed learning and development (Joham and Clark 2011). Implementation of PBL can vary among educational settings, but commonly involves the seven steps where the initial steps to identify define the problem and formulate learning needs are covered in the first tutorial followed by individual studies before the discussing the findings again at the next tutorial group (e.g. Moust et al, 2005). In PBL, students take the full responsibility for their studies and learning in PBL *between* the meetings and thus this is a critical phase in PBL to achieve fruitful discussions and learning at the tutorial meetings. Despite the emphasis on student-active learning, studies have revealed problematic issues related to instruction design and self-directed learning (Dolmans et al. 2001; Moust et al. 2005; Hung 2011). Earlier studies have shown that some students don't spend enough time on self-studies and searching literature, which results in a superficial and substandard preparation for PBL work (Hung 2011). Thus, the groups collective learning ability as well as the individual learning might be at risk. There are also studies on the importance of knowing how instructions in PBL settings can influence the time students allocate for self-studies to improve the quality of teaching (Ruiz-Gallardo et al, 2016). The interdisciplinary bachelor's programme in environmental science at Linköping University, Sweden has implemented a new instrument, Individual reflection paper (IRP) (in Swedish: Individuellt basgruppsunderlag [IBU]), in the PBL process to support students learning process in the specific critical phases between the tutorial meetings. The tool has been used in PBL at the Environmental Science programme at Linköping University since 2005 and has thereafter also been implemented successfully at other educational programmes for instance at the Faculty of Medicine and Health Sciences at Linköping University. Almost twenty years of instructional experience in this programme have led to the increased awareness of students' self-studies and assessment challenges related to PBL and tutorial work. Grading and assessment of students' contributions in PBL tutorials is a well-known challenge and have been analysed and written about in pedagogical literature for a long time. Today, we recognize a variation in assessment formats; it is not only the control of content knowledge that is in focus, but also performance and the learning process (Dreissen and van der Vleuten 2000; Eva 2001, Hung 2011). We will here describe the modified PBL model and the response from the students on how IRP are influencing their learning process and regular tutorial work.

MODIFIED PBL MODEL WITH INDIVIDUAL REFLECTION PAPER

The work in tutorial groups is based on PBL, which in the literature is often referred to as a model of seven steps (e.g. Moust et al, 2005), and a modified model is used in the present programme, (see Figure 1). A scenario is distributed to the tutorial group (6-8 students), and the students formulate their learning needs and questions for their self-studies until next meeting. Each student is asked to compile and document their learning of and reflection on the jointly-formulated questions or tasks in an individual reflection paper (IRP) prior to each meeting. The student's engagement and contribution in tutorials are assessed and graded by the tutor, with one criterion being "active participation"; this includes both preparation and contribution to learning through discussions during the tutorials. Thus, the introduction of IRP also enabled more rich material for assessment of how well-prepared the individual students to the tutorial meetings.

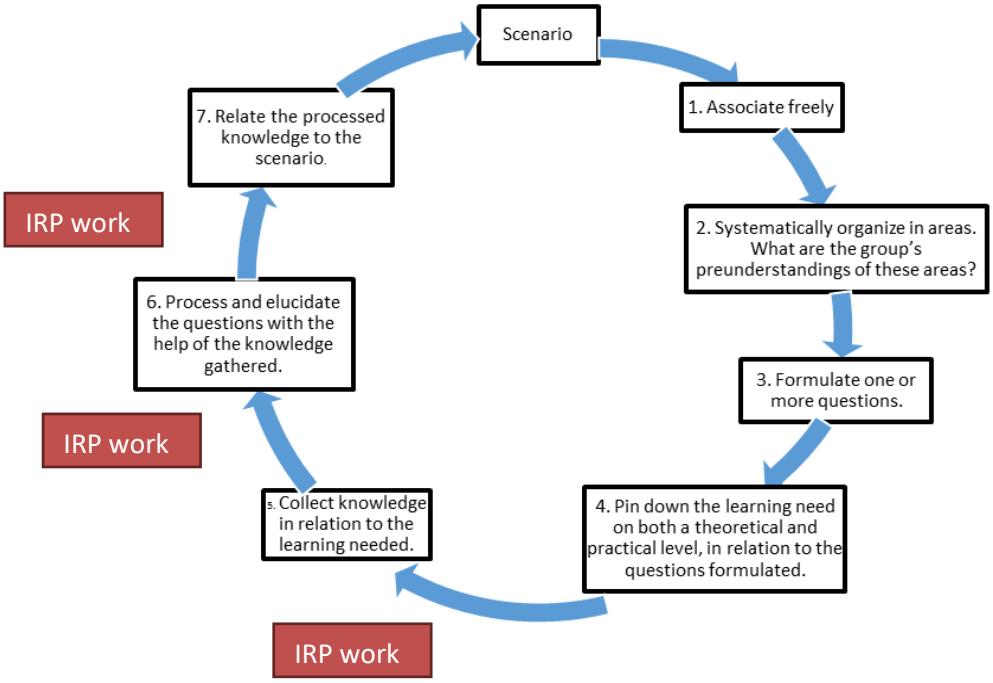

Figure 1: The problem-based learning model that describes the learning process used in the tutorial groups (6-8 students) at the Linköping University environmental science programme. The IRP work is the preparation of the students themselves. The IRP process consists of three steps: 1) At the end of a tutorial meeting, the students agree on their learning needs on both a theoretical and practical level in relation to the questions formulated, and start seeking information. Each student then writes their own IRP on the basis of their individual studies and reflections on new knowledge. As the IRP is restricted in length, the student has to choose and then formulate what they think would best summarize a response to the group's common issues. Students also often formulate discussion questions for the upcoming tutorial meeting in their IRPs. 2) Before the next tutorial meeting, the students all read each other's IRPs. 3) At the following tutorial meeting, the students discuss the gathered knowledge. In conjunction with this, they discuss their IRPs and how the new information gathered relates to the scenario.

Students are informed about the IRPs at the start of the first course of the programme, both in a written document and in a lecture, and are repeatedly reminded via written course guides during all courses. The information provided includes the statements that the IRPs are "…aiming to support your own learning while working in tutorial groups", and that the most important function is that "…every student should individually summarize and document their gathering of knowledge and reflection". The outline of the IRPs is restricted to a certain limit — "The appropriate length of an IRP is approximately one page" — but there is also plenty of freedom: "The tutorial group has a lot of freedom to choose how the IRP should be designed…". The students are assessed through student-active participation in the tutorial group work, and the IRPs are an important part of this. The assessment is made on a three-level scale (fail, sufficient, good) and is divided into two parts: preparation and constructive participation.

MATERIAL AND METHODS

The study design consisted of two parts: a questionnaire distributed to all students in programme and three focus group interviews with selected students from the first, second, and third years. The questionnaire and focus group interviews focused on the following areas; IRPs supporting students' learning, IRPs supporting the regular work in tutorial groups, and possible influence of assessment of IRPs and time spent on IRPs. The questionnaire was distributed online to all students in the programme; 152 students answered, giving an answering frequency of 78% among all students. In addition to the questionnaire, we chose to use focus groups and take a qualitative approach since we were interested in the students' experiences of using IRPs in teaching. A benefit of focus group interviews in relation to the more traditional group interviews is that the participants have increased opportunities to give feedback on each other's thoughts and experiences (Barbour and Kitzinger 1999). We selected 6 students from the first year, 5 students from the second year, and 5 students from the third year. We separated the students by the year of study, and all focus group interviews lasted 0.5-1 hours. The interviews were performed at the end of the spring semester; that is, at the end of a study year.

FINDINGS

The majority (>90%) of students of all years stated in the questionnaire that they thought the IRPs supported their regular tutorial work. The students in years 1 and 2 seemed to draw more support from the IRPs than students in year 3. When we asked in what ways the students thought the IRPs supported the tutorial work, the most important aspects were support for better discussions, and providing all students with the opportunity to show participation. This can be interpreted as meaning that the IRP is an instrument that

discourages the type of dysfunctional group interaction identified by Hung (2011), namely problems related to preparation and contribution. One of the students expressed the driving potential that IRPs might have:

- "Without IRPs, the level of discussion would become too low and some people wouldn't prepare properly." (Questionnaire, year 2)

The students also described use of the IRPs as an iterative instrument that support their own understanding of other students' perspectives and thoughts, and even reduce conflicts:

- "there are far fewer misunderstandings if we all spend time on the IRPs, because then you realize that a lot of what you think are differences are actually the same thing. Reading each other's IRPs can let you bypass a lot of the everyday fuss." (Focus group, year 3)

The students thought the use of IRPs as part of the assessment of tutorial group work had a substantial effect on the IRP process (average 77%). However, this effect was not a negative one, but instead more positive. When asked what primarily influenced their work on IRPs, many of the students answering the questionnaire stated that IRPs being part of the assessment increased their ambition level. It therefore seems that using IRPs as part of the assessment of the students' tutorial work led to a positive motivation for the learning process.

IRPs SUPPORTING STUDENTS' LEARNING PROCESSES

Based on the questionnaire, it was clear that working with IRPs supported the students' information literacy competence (Table 1). Information literacy is an important part of the PBL process; students must be able to search, identify, and evaluate information about the problem/question at hand. The students mainly referred to the relevance and quality of the sources and expressed that their usage of sources had developed over time. The development over the years seemed to be linked to scientific anchoring, and the students' having reflected on the information they had gathered.

- "I also think of referencing, good referencing with good sources and reflection [...] that it's relevant, not just a reflection throwing out words, or that the IRP looks better than it is [...] so I don't see a direct difference in the number of words when it comes to the quality of the IRP, as it were." (Focus group, year 2)

IRP work supports my own information literacy		**Agree fully**	**Partly agree**	**Do not agree**	**Do not know**
	Years 1-3	74%	18%	2%	
	Year 1	72%	19%	2%	
	Year 2	84%	13%	0%	
	Year 3	66%	22%	0%	
I gain insight into my own skills and knowledge gaps	**Years 1-3**	**34%**	**53%**	**1%**	**6%**
	Year 1	32%	60%	0%	2%
	Year 2	44%	45%	0%	7%
	Year 3	24%	54%	2%	8%
IRP work supports me in gaining a deeper understanding of the subject	**Years 1-3**	**43%**	**40%**	**1%**	**8%**
	Year 1	55%	34%	0%	4%
	Year 2	45%	38%	2%	9%
	Year 3	28%	48%	2%	10%
IRP work supports me in contributing constructively to the discussions at the tutorial meetings	**Years 1-3**	**59%**	**31%**		**3%**
	Year 1	57%	34%		2%
	Year 2	64%	29%		4%
	Year 3	56%	30%		2%
IRP work supports me in seeing multiple perspectives	**Years 1-3**	**56%**	**33%**	**4%**	
	Year 1	51%	34%		9%
	Year 2	71%	25%		0%
	Year 3	44%	40%		4%
IRP work supports me in formulating relevant questions	**Years 1-3**	**37%**	**45%**		**9%**
	Year 1	45%	45%	0%	4%
	Year 2	33%	51%	2%	11%
	Year 3	34%	40%	4%	10%

Table 1: Questionnaire responses to the question: Do you consider that your own learning has been enriched by the IRPs? If yes, how?

There was a clear progression among the students from year 1 to year 3 in what they described as characterizing a *good* IRP. First year students in the focus groups said that good IRPs should include relevant content and one's own reflections, while the third-year students spoke about reflection at a more metacognitive level; for example:

- "[...] in a way, it helped me to write down how I think, in a way I didn't see when I collected my facts; I needed to reflect on where I found it, and yes, it helped in a way to think, you write down how to think about the facts you see." (Focus group, year 3)

It was clear that the content was of most importance, meaning that one should report the information gathered. The second-year students had developed this further, and more frequently described the importance of scientific anchoring of the IRPs and using relevant sources in their reflections. The students in years 2 and 3 also stressed that the content of the IRPs should be related to the questions agreed upon in the tutorial group meetings. It seems that the students at the beginning of the programme used a more or less reporting-strategy for the IRPs, including descriptions of everything they had found on the topic as well as the questions agreed upon from previous meetings. In later years, they also relate, reason about, and synthesize the information. This is corresponding to prior studies highlighting that factors influencing the students independent learning may change over the years of studies from more strict content driven studies in the beginning to more own learning needs at the end of their studies (Dolmans et al 1995). The students stressed in the interviews that how good an IRP would be also depending greatly on the type of questions formulated in the group. In a previous study, Abrandt Dahlgren and Öberg (2001) found that questions formulated by students in the tutorial process could be separated into five different types (encyclopaedic, meaning-oriented, relational, value-oriented, and solution-oriented) and that the students mixed all these questions as part of a dynamic process. Our results reveal that the students become aware of how different questions affected the tutorial discussions and their learning process by the use of IRPs. If students become aware that the more encyclopaedic questions will lead to more surface learning, they might actively add questions at a higher level to stimulate a deeper approach and stress the importance of citing and discussion of sources.

Reflection and critical thinking are skills that have been stated in several different contexts to be something that a graduate student should have achieved after completing higher education (Phillips and Bond 2004; Biggs and Tang 2011; Swedish Higher Education Act). In one of the focus groups (year 2), a student posed the question of whether the IRPs had supported their reflection processes and another student in the focus group answered, saying:

- "[…] maybe not just my own IRP, but when I read other people's and find out how they reflect on their own, then I reflect on what others see too […] I think it feels like a little piece of a puzzle in a larger puzzle at the meeting, when you meet, then you sort of get the whole thing."

The students in the later years of the programme expressed that there could also be difficulties when the writing of IRPs felt like a routine. In both the focus group interviews

and the questionnaires, the students brought up factors that influenced their work with IRPs, such as time, assessment, instructions, the role of the tutor, and students ambition level. Some of these factors seemed to have a stronger influence than others. The time allocated for the students to work with the IRPs seemed to be the aspect most commonly brought up, which is in line with earlier studies pinpointing the need for balance between workload and time allocated for the tasks (Ruiz-Gallardo et al, 2016, Hung 2011). The students explained how the quality of the IRPs become lower when there was only a short time in between the tutorial meetings. In addition, the students expressed that there was a risk of moving into a repetitive mode of learning, where they more or less only reported facts rather than summarizing and reflecting; and not have time to reach a higher level of reflection. There was also a risk that students with less time to prepare would take, what Marton and Säljö (2005) identify as, a surface approach, instead of the deeper approach required. When the students experienced that there was enough time to prepare, the students appreciated the IRPs:

- "It requires a lot of the student to make the IRP good, but if the student spends the time required, it is a very effective learning activity…" (Questionnaire, year 3)

FINAL CONCLUSIONS

The implementation of IRP in the critical phase of self-directed learning seems to fit well into the PBL process. The students primarily stressed that the IRPs were a way of being aware of the information they had gathered, and that they helped them further develop this through the discussions in the tutorial groups. In addition, the students could become more reflective in their learning processes, as they could see a progression in how their IRPs had developed over their years of study. An analysis of students written IRPs, is beyond the scope of the current study but would give more information on how the progression is formed. Assessing PBL work is complex, and the ways in which IRPs support the tutor's role as an examiner. However, it seems that the students experienced assessment of the IRPs as a positive driving force in their learning process, but further studies is needed.

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