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Design, Implementation, and Evaluation of a Tutor Training for Problem Based Learning in Undergraduate Psychology Courses

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ABSTRACT

In this paper we describe a "Train the Tutor" programme (TtT) for developing the metacognitive skills, facilitator skills, and tutor skills of students in a problem based learning (PBL) context. The purpose of the programme was to train 2nd and 3rd year undergraduate students in psychology to become effective PBL tutors for "freshmen" (1st year psychology students). Based on the 3C3R concept of Hung (2006), various instructional problems have been designed and used in a 6 steps training programme. The programme has been evaluated both in a formative and summative approach through a quasi-experimental control group design with pre- and post-measurements before and after the training programme. The study was conducted as part of a curriculum re-design for promoting problem based learning in psychology courses for undergraduate students in a university of applied science. The results indicate the importance of metacognitive skills of the tutor for effectively facilitating the learning process in a PBL context.

Keywords: Problem based learning, tutor skills, metacognitive skills, tutor training, tutor effectiveness

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TUTOR COMPETENCIES IN A PBL LEARNING ENVIRONMENT

From our understanding, Problem-based Learning (PBL) is a group based learning approach, in which the learners engage themselves in research and problem solving activities in order to gain a deeper understanding of theoretical concepts and the practical relevance of the problem they want to solve. This learning process needs to be supported by tutors who monitor and "scaffold" the learning process through guidance, coaching and observation. They interfere and support the learners when these are stuck in the process or lose direction.

PBL tutors require a specific skill set and attitudes related to teaching and learning (Barrows, 1988; Smith & Cook, 2012). On the one hand, PBL tutors must stimulate the students to get involved in a collaborative learning process, on the other hand the tutor must ensure that the students articulate suitable learning objectives and follow a structured procedure while exploring the topic. This requires both excellent facilitator skills and metacognitive skills, i.e. the ability to observe and reflect the effectiveness of the learning process, the learning strategies applied, and the group dynamic within the tutorial group (Brown, 1978; Flavell, 1979; Kayashima & Inaba, 2011). Metacognitive skills need to be distinguished from cognitive skills (Veenmann, Van Hout-Wolters & Afflerbach, 2006). Cognitive skills refer to a person's declarative and procedural knowledge in a certain domain, while metacognitive skills refer to knowledge of problem solving strategies, the ability how to organize and structure learning activities, and the understanding and the application of appropriate and effective learning strategies (Brown & DeLoache, 1978; Veenman, 2005). Table 1 shows a list of relevant metacognitive skills for learning as described by Hattie (2009).

Table 1

Overview: Metacognitive skills in a learning context, definitions and examples (Hattie, 2009, p. 190)

Metacognitive skill	**Definition**	**Example**
Organizing and transforming learning	Overt or covert rearrangement of instructional materials to improve learning	Making an outline before writing a paper
Asserting self-consequences of learning	Student arrangement or imagination of rewards or punishment for success or failure	Putting off pleasurable events until work is completed
Using self-instruction	Self-verbalizing the steps to complete a given task	Verbalizing steps of calculation in solving a maths problem
Using self-evaluation	Setting standards and using them for self-judgment	Checking work completion before handing in to the evaluator
Goal-setting / planning	Setting of educational goals or planning sub-goals	Making a list of items to accomplish during studying a certain subject
	Planning for sequencing, timing, and completing activities related to those goals	

Self-monitoring	Observing and tracking one's own performance and outcomes, often recording them	Keeping records of study output
Develop task strategies	Analysing tasks and identifying specific, advantageous methods for learning	Creating mnemonics to remember facts
Imagery	Creating or recalling vivid mental images to assist learning	Imagining the emotional and behavioural consequences e. g. after having passed a difficult exam.

Effective PBL tutors "scaffold" the learning process in a way that guides the students without patronizing. (Smith & Cook, 2012). Through stimulating, probing, questioning, paraphrasing and providing feedback, the tutor stimulates the elaboration of the problem and directs the learning process rather than presenting the right answers to the problem at hand. Thus, the challenge for the tutor is how to steer and to guide the learners without lecturing or providing the students with predefined schemes or answers to the problem.

In addition to these more process oriented interventions, which focus on the way how the students' discussion in the tutorial is led and how the learning content is reflected upon, the tutor also needs to make sure that the students understand the content and the context of the problem they tackle.

The 3C3R model of Hung (2006) (Figure 1) provides a framework that depicts six elements of process and content/context orientation in an effective PBL tutorial. It describes three structural elements (content, context, and connection) and three process elements (researching, reasoning, and reflecting).

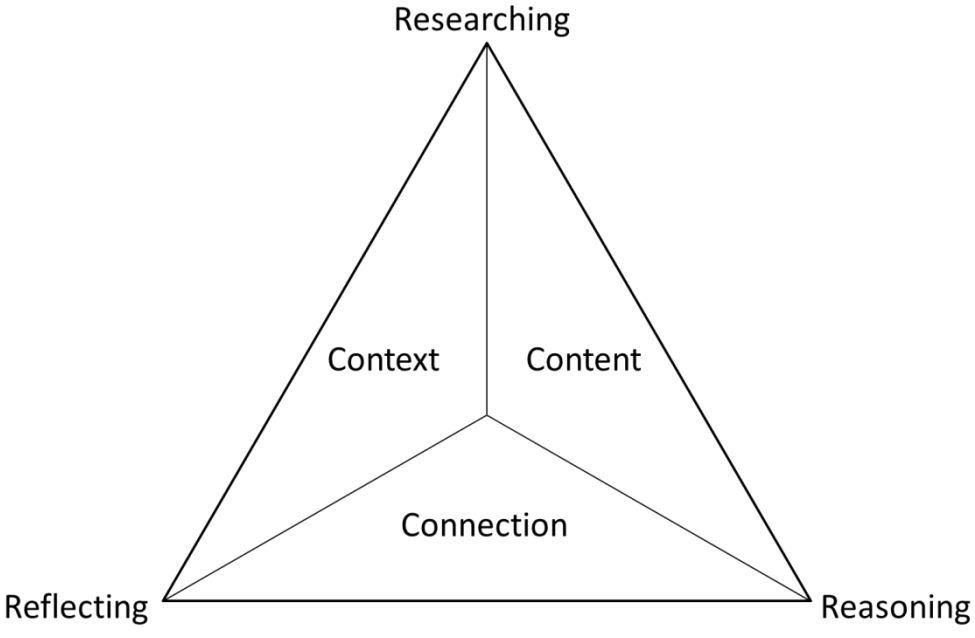

Figure 1.: 3C3R Framework for designing a problem space in a PBL learning environment (Hung, 2006)

Whereas "content" focuses on the scope and depth of the problem, "context" refers to the applicability to a specific field of practice, and "connection" represents the connection to other knowledge domains.

Considering relevant competencies of the tutor on the background of this framework, he or she should not only focus on *process* oriented questions that evoke *researching, reasoning* and *reflecting* among the students but he/she also needs to make sure that the *content, context,* as well as the *connections* with previous knowledge and related concepts are observed. Some researchers indicate that especially students with little or no experience need tutors with both high content oriented skills as well as process oriented skills (Davis, Nairn, Paine, Anderson & Oh, 1992; Dolmans, Gijselaer, Moust, De Grave, Wolfhagen & Van der Vleuten, 2002; Zumbach, 2011). Leary, Walker, Shelton & Fitt (2013) report in their recent meta-analysis of the relevance of tutor background, tutor training and student learning a meaningful and highly significant effect size (Hedge's $g = 0.27$, $z = 6.75$, $p < 0.01$, $n = 223$) for content expertise of the tutor. However, PBL tutors with high expertise and content knowledge need to be aware of the danger to direct and constrain the learning too much, thus stalling the students' self-regulated learning process (Silver & Wilkinson, 1991). Chng, Yew and Schmidt (2011) have investigated the effect of social congruence between tutor and students on achievement and learning. They suggest that the ability of the tutor to communicate informally with students and to create a positive learning climate that promotes a free flow exchange of ideas, has a greater impact on learning at each of the PBL phases as compared to the tutor's subject-matter expertise and the ability to explain concepts in a way that is easily understood by students.

As a consequence the rationale for using peer facilitation in PBL with advanced students as tutors was based on the idea that through peer learning in small tutorial groups the students should be challenged by socially congruent peers to deeply reason, reflect and research the topic (3R) while the content, the context and the connection with the curriculum was fixed and provided by the faculty resp. the curriculum. A more practical reason for using peer students as PBL tutors in this particular case was the lack of qualified teaching resources that were sufficiently familiar with PBL methods and concepts. Hence, there was a strong need for an efficient and effective way to provide training for prospective PBL tutors as part of the new PBL curriculum.

Training Rationale and Design

Based on the recognized importance of metacognitive skills, facilitator skills, and tutor skills for effectively "scaffolding" the learning process of students, a training programme for prospective PBL tutors has been designed and evaluated in this study. The training programme was part of a wider curriculum transformation process for undergraduate psychology courses in a university of applied sciences. Problem based learning should become an integral element of the new curriculum, and developing a sufficient number of

qualified and certified PBL tutors was one of the critical contributing factors to the overall goal. One central design principle of the training was to use PBL as a core element for the training process itself. This means, the tutors were challenged to deal with ill-structured problems as they often arise during the tutorial process, such as observing and understanding group dynamics, dealing with students who try to get the "right" answers to the problem, or tutorial groups who are struggling with the definition of suitable learning goals, etc.
The underlying assumption here was that the PBL methods should be learned at best in a context that resembles the learning settings which the tutors should create later for their own students (Sockalingam & Schmidt, 2011).

Considering the role of the PBL tutor described in the previous section and acknowledging the relevant literature about the competencies needed by tutors to be effective, three major skill domains for tutor effectiveness have been identified (see also Barrows, 1988; Bertola & Murphy, 1994; Walsh, 2005):

1. *Metacognitive skills*, such as reflecting the current learning situation, understanding the impact of own behaviour on student learning, and knowing and applying a variety of learning strategies.

2. *Facilitator skills*, such as structuring the tutorial, creating a positive learning atmosphere, and leading through questioning and probing.

3. *Tutor skills*, such as stimulating the learning process, re-stating the learning objectives, re-phrasing relevant learning content, and stimulation the discussion and interaction in the tutorial group.

Hence, the main objectives of the "Train the Tutor" (TtT) programme have been defined as follows:

1. Develop *metacognitive skills* for facilitating collaborative learning processes based on PBL principles.

2. Learn *facilitator skills* for structuring the tutorial session (visualizing, summarizing, time keeping).

3. Learn how to use appropriate *tutor skills* in order to scaffold and stimulate the learning process in a tutorial group (elaborating, directing, integrating, and constructively interacting with each other).

The full "TtT" ("Train the Tutor") programme took four months altogether. It was divided into six modules (each of which took between 0.75 and 2 days) and time in-between for preparation, documentation and follow-up. The total time invest for the training participants was 150 hours (60 hours seminars/workshops, 90 hours for self-study, preparation, follow

up). The programme was designed and facilitated by an experienced PBL practitioner and faculty member. Table 2 displays the structure and content of the training programme.

Table 2

Structure and content for the "Train the Tutor" (TtT) programme

Module No.	Duration	Training Objectives	Training Content
1	1.5 days (15 hours)	• Understand fundamentals of problem based learning (PBL) • Understand the role of the PBL tutor • Understand and practice basic facilitator skills	• History, goals and concepts of problem based learning • The role, the attitude, and the required competencies of PBL tutors • Basic facilitator skills (e. g. questioning, paraphrasing, stimulating, providing feedback)
		Follow up and preparation for module 2 (4 weeks) (Time invest: approx. 5 hours / week)	
2	1.5 days (15 hours)	• Understand how to deal with ill-structured problems • Understand der 3C3R model and its application	• Characteristics of ill-structured problems • Content oriented and process oriented interventions (3C3R)
		Follow up and design of a problem case for module 3 (4 weeks) (Time invest: approx. 5 hours / week)	
3	1.5 days (15 hours)	• Understand group dynamics in tutorial groups • Practice effective tutor interventions	• Stimulating the systematic elaboration of problems • Directing the learning process • Stimulating the integration of knowledge • Stimulating interaction and individual accountability
		Follow up and preparation for module 4 (4 weeks) (Time invest: approx. 5 hours / week)	
4	1 day (6 hours)	• Learning from observing a role model	• Observing an experienced PBL tutor in action (plus briefing/debriefing)
		Follow up and preparation for facilitating a PBL tutorial (4 weeks) (Time invest: approx. 5 hours / week)	
5	1 day (6 hours)	• Experience self-efficacy as a tutor • Practice acquired skills from modules 1 to 4	• Facilitate a PBL tutorial (plus observation and feedback by peers and master trainers)
		Follow up and documentation (2 weeks) (Time invest: approx. 5 hours / week)	
6	1/2 day (3 hours)	• Common reflection of the training process and outcome	• Reflect metacognitive skills, facilitator skills, and tutor skills acquired through the training • Certification as a PBL tutor
		Total: 150 hours in four months (60 hours seminars/workshops, 90 hours for self-study, preparation, follow up)	

EVALUATION OF THE TUTOR TRAINING PROGRAMME

The PBL tutor training programme has been evaluated both in a formative (during the training process) and summative way (at the end of the training process). The purpose of the formative evaluation was to modulate, test and adapt content, methods and process of the training procedure. In addition, the summative evaluation aimed at allowing for comparing the effectiveness of the training programme in comparison to another form of tutor instruction and a control group.
The major research question addressed in this evaluation study was:

To which extent can the PBL training for tutors support the development of metacognitive skills, facilitator skills, and tutor skills of the training participants, compared to other forms of instruction (control group 1) and no formal training or instruction (control group 2)?

In order to investigate this, a quasi-experimental research setting with repeated measures has been designed (Factor A: training group vs. control groups 1 and 2; Factor B: pre-measure and post-measure vs. post measure only). Factor A varies the intensity of training and instruction (1: PBL tutor training, 2: instruction through reading a tutor manual and guide, 3: no formal training or instruction), whereas factor B controls the influence of the pre-test on the post-test (1: pre- and post-test, 2: post-test only). The resulting evaluation design with the sample size of each cell is represented in table 3.

Table 3

Research Design: Factor A (Training group, Control groups 1 and 2), Factor B (pre- and post-test vs. post-test only)

		Factor B	
		B_1: pre-test and post-test	**B_2: without pre-test (post-test only)**
Factor A	**A_1: Training group**	Training group (A_1 B_1) (*n*=21)	Training group (A_1 B_2) (n=17)
	A_2: Control group 1	Reading the "McMaster PBL tutor guide" (Walsh, 2005) (A_2 B_1) (*n*=19)	Reading the "McMaster PBL tutor guide" (Walsh, 2005) (A_2 B_2) (n=21)
	A_3: Control group 2	No formal training or instruction (A_3 B_1) (*n*=20)	No formal training or instruction (A_3 B_2) (*n*=20)

Participants

119 individuals (undergraduate psychology students in their second and third year and master students in their first year) participated in the evaluation study. All participants had completed fundamental modules in psychology before at least with satisfactory marks. The participants in the training group had been selected based on academic credits, and personal interest/motivation for facilitating PBL tutorials immediately after completion of the six modules. The remaining participants were assigned to the control groups in order to be trained later. Figure 2 displays a flow diagram which describes how the participants were streamed to the various cells in the quasi-experimental research setup.

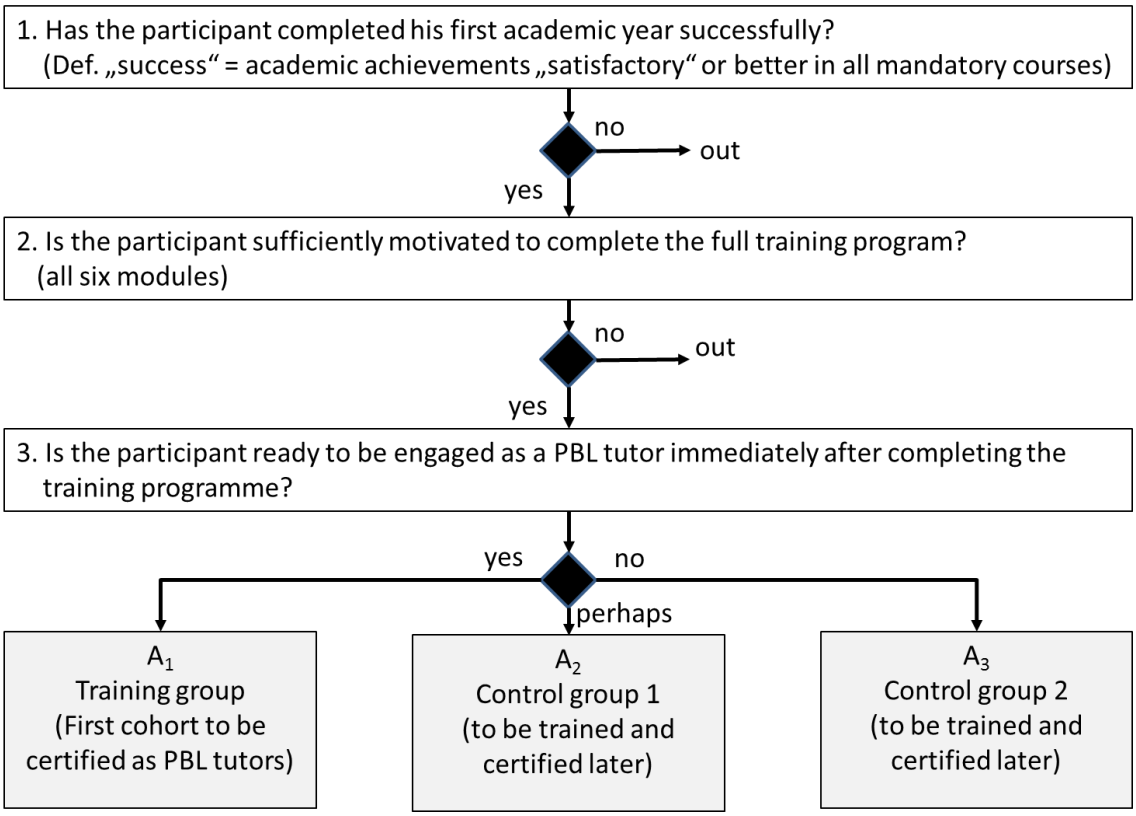

Figure 2. Flow diagram for visualizing the streaming of participants to the training group, control group 1 and control group 2 (own source)

Even though this controlled and selective allocation of participants to the training group and the control groups limits the internal validity of the research design, we decided not to push back participants who were interested in the training in favour of other students who were not available to be actively engaged in the fast deployment of the PBL curriculum. Later we will discuss the consequences of this decision regarding the validity and generalizability of the results.

The participants' average age was 22.2 years (SD = 4.2). 28 (25%) subjects were male, 85 (75%) were female, which is a usual gender distribution in psychology undergraduate courses in Germany. 43 (38%) of the sample participants had previous experience as a learning facilitator e.g. in junior school or as trainers in youth sports clubs. 52 (46%) explained their interest to be engaged as a PBL tutor in the psychology study programme for undergraduates immediately after completion of the training programme or later.

Tutorials

The tutorials were part of an undergraduate course (1st year) in personality psychology. These tutorials (90 min.) were accompanied by lectures once per week (90 min.). Based on the content of the lectures the students were assigned to discuss a specific problem or case thereafter and to formulate some learning goals as a preparation for the next lecture. This case was designed in such a way that it stated an ill-structured problem and triggered the discussion of the students related to the relevant concepts introduced in the lecture. Each tutorial group consisted of 10 to 12 students and was facilitated by a PBL tutor. Attending the tutorial was not mandatory for the students, however highly recommended by the faculty. On average, each group had one tutorial per week. Four to five tutorials ran in parallel.

Measures

The measures combined different sources of information by utilizing self-report measures of the tutor, behavioural measures of tutor effectiveness, as well as student satisfaction measures. Through this multi-method approach, a broader investigation into the effectiveness of the tutor training on metacognition, behaviour, and tutor effectiveness should be achieved.

Tutor Skills Self-report (Questionnaire)

In order to create a reliable and valid measure for self-perceived tutor skills, a questionnaire (28 items) with four scales has been designed. Each scale consisted of 7 items (see annex 1).

1) MCSL (Meta-cognitive skills related to guiding learning groups) (e.g. "I have a large variety of behavioural strategies how to steer group dynamics.")

2) MCSR (Meta-cognitive skills related to self-regulation) (e.g. "I have a clear mental model of how to plan, do, and check my actions and their behavioural and emotional effects.")

3) FAS (Facilitator skills) (e.g. "I can easily structure group discussions.")

4) TUT (Tutor skills) (e.g. "I can easily evaluate different levels of knowledge and subject matter understanding of students in a tutorial group.")

The psychometric analysis of the questionnaire revealed sufficient internal consistencies for all four scales (Cronbach'sα: .69 - .78). Each item had to be rated by the subjects on a 5 points Likert scale (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree).

The sum of the scales was used as a measure for the self-reported metacognitive skills related to guiding learning groups (MCSL), self-regulation (MCSR), facilitator skills (FAS) and tutor skills (TUT).

TIP (Tutor Intervention Profile)

The "Tutor Intervention Profile" (TIP) is a behaviour observation method and manual developed at the University of Maastricht (The Netherlands) in order to evaluate tutor behaviour effectiveness (De Grave, Dolmans & Van der Vleuten, 1998, 1999). It has been tested for reliability and validity and has been used as a method for tutor assessment in many cases. TIP encompasses four behavioural dimensions of tutor competencies regarding learning process-oriented interventions: (1) Stimulating elaboration, (2) Directing the learning process, (3) Stimulating the integration of knowledge, and (4) Stimulating interaction and individual accountability of the students.

Table 4 displays the four behavioural dimensions for tutor effectiveness of the TIP and shows two example items for each dimension.

Table 4

Dimensions of the Tutor Intervention Profile (TIP) (De Grave, Dolmans & Van der Vleuten, 1998)

Dimension	**Example**
1. Stimulating elaboration (SE)	• … stimulates a more in-depth brainstorm by, for example, asking questions, asking for clarification, and stimulating relations. • …stimulates the identification of gaps in students´ prior knowledge.
2. Directing the learning process (DLP)	• … stimulates generating learning issues with sufficient depth and width. • … draws the attention of students to gaps in prior knowledge while generating learning issues.
3. Stimulation the integration of knowledge (SI)	• … stimulates the integration on new acquired knowledge with knowledge acquired with previous cases. • … stimulates the students to apply the knowledge gained during self-study to explain the phenomena described in the case.
4. Stimulating interaction and individual accountability (SIINDACC)	• … stimulates students to make an inventory of the learning resources consulted during self-study. • … stimulates students to report out in their own words rather than reading from notes or photocopies.

14 PBL tutors, who had completed the training programme before, have been assessed through peers and trainers, who observed the interaction between the tutor and the students

during the tutorial on a five point scale (0: not effective, 1: fairly effective, 2: moderately effective, 3: effective 4: highly effective).

Learner Satisfaction Measures (Questionnaire).

As a third measurement, the students who participated in the PBL tutorials rated the effectiveness of the tutor at the end of the tutorial on three items (see annex 2):

1. Satisfaction with the learning outcome (SLO). This measure indicates overall student satisfaction with the learning outcome of the tutorial, directly at the end of the tutorial.

2. Satisfaction with the learning process (SLP). This measure indicates the satisfaction with the learning process (pace and structure).

3. Satisfaction with the learning content (SLC). This measure indicates the satisfaction with the relevance, depth and width of the learning content.

Each student rated his or her level of satisfaction at the end of the tutorial on a 5 points Likert scale ("0" representing total dissatisfaction, "4" representing maximum satisfaction).

Procedure

The training group (n=38) followed the training programme as described in table 3. Control group 1 (n=40) was instructed to read the PBL tutor guide of the McMaster University in Hamilton, Canada, which is available online (Walsch, 2005). The rationale behind this was to test whether the resources invested in designing and implementing the PBL tutor training programme was justified in comparison with less expensive and less time consuming methods for preparing and instructing novices as PBL tutors. Control group 2 (n=41) did not receive any instruction or training. All subjects were pulled from the same population of undergraduate psychology students. The training group was selected based on personal interest and academic credits (see "participants" section). Control groups 1 and 2 were compiled randomly. Half of the subjects completed the tutor skills self-report (questionnaire) before the start of the training programme and at the end. The other half completed the questionnaire at the end of the programme only. The aim of this procedure was to control if the pre-test had an effect on the post-test. Only those who actually completed at least steps 1 to 4 of the training programme were eligible as PBL tutors. Out of these, 14 tutors have been evaluated by peers and master trainer through observation and assessment with the TIP (Tutor Intervention Profile) and student assessment (see "measures"). Academic achievements, earlier experience as tutors in secondary school or clubs and motivation to become actively engaged as a PBL were recorded as control variables.

Research Hypotheses

The following hypotheses should be tested in this quasi-experimental study.

Hypothesis 1: The PBL tutor training should have significant positive effects on the facilitator skills, tutor intervention skills, and metacognitive skills of the training participants compared to the control groups 1 and 2.

Hypothesis 2: The pre-test should have no effect on the post-test results for self-reported tutor skills.

Hypothesis 3: Metacognitive skills, facilitator skills and tutor skills should be positively correlated with student satisfaction measures.

Hypothesis 4: Self-reported tutor skills (questionnaire data) should be positively correlated with effective tutor behaviour as measured by the TIP (Tutor Intervention Profile).

RESULTS

Table 5 shows the correlations for all measures: Tutor skills self-report (questionnaire), observation of tutor behaviour with tutor intervention profile (TIP), and student satisfaction at the end of the tutorial.

Table 5

Inter-correlations of all measures (Correlation Coefficient: Spearman-Rho)

		M (total)	SD (total)	MCSL (pre-test)	MCSL (post-test)	MCSR (pre-test)	MCSR (post-test)	FAS (pre-test)	FAS (post-test)	TUT (pre-test)	TUT (post-test)	SE	DLP	SI	SIN DACC	SLO	SLP	SLC
Tutor skills self-report [1]	MCSL (pre-test)	24.1	3.3															
	MCSL (post-test)	25.1	3.7	.42 * (n=33)														
	MCSR (pre-test)	26.8	3.1	.33 * (n=53)	.30 (n=34)													
	MCSR (post-test)	27.4	4.0	.17 (n =35)	.60 ** (n=36)	.54 ** (n=36)												
	FAS (pre-test)	25.8	3.3	.53 ** (n=49)	.18 (n=31)	.48 ** (n=50)	.33 (n=33)											
	FAS (post-test)	26.8	3.6	.33 (n=34)	.65 ** (n=33)	.19 (n=35)	.58 ** (n=35)	.53 ** (n=32)										
	TUT (pre-test)	24.1	3.0	.34 * (n=53)	.07 (n=34)	.21 (n=54)	.09 (n=36)	.54 ** (n=50)	.28 (n=35)									
	TUT (post-test)	24.2	4.0	.26 (n=35)	.61 ** (n=34)	.11 (n=36)	.40 ** (n=35)	.40 * (n=33)	.67 ** (n=35)	.40 * (n=36)								
Tutor intervention profile (TIP)	SE [2]	3.3	1.0		.68 * (n=14)		.43 (n=14)		.76 ** (n=14)		.70 ** (n=14)							
	DLP [2]	3.6	1.0		.73 ** (n=14)		.38 (n=14)		.71 ** (n=14)		.74 ** (n=14)	.55 * (n=14)						
	SI [2]	3.0	0.8		.61 * (n=14)		.20 (n=14)		.53 * (n=14)		.63 * (n=14)	.64 * (n=14)	.58 * (n=14)					
	SINDACC [2]	2.3	1.0		.66 * (n=14)		.26 (n=14)		.56 * (n=14)		.67 * (n=14)	.73 ** (n=14)	.69 * (n=14)	.55 * (n=14)				
Learning satisfaction measures	SLO [2]	3.0	0.6		.59 * (n=14)		.52 (n=14)		.66 * (n=14)		.44 (n=14)							
	SLP [2]	3.1	0.7		.01 (n=14)		-.08 (n=14)		.26 (n=14)		-.13 (n=14)					.63 * (n=14)		
	SLC [2]	2.8	0.4		.38 (n=14)		.20 (n=14)		.55 * (n=14)		.27 (n=14)					.65 * (n=14)	.66 ** (n=14)	

Notes:

(1) n is varying in the different cells due to missing values in the data; n is generally smaller than total sample size due to drop out and missing data.

(2) n = 14 (data only for training group available, control groups have not been evaluated as PBL tutors).* Correlation statistically significant ($p < .05$, two-tailed) ** Correlation statistically significant ($p < .01$, two-tailed)

MCSL: Metacognitive skills related to guiding learning groups, MCSR: Metacognitive skills related to self-regulation, FAS: Facilitator skills, TUT: Tutor skills, SE: Stimulating elaboration, DLP: Directing the learning process, SI: Stimulating the integration of knowledge, SINDACC: Stimulating interaction and individual accountability, SLO: Satisfaction with the learning outcome, SLP: Satisfaction with the learning process, SLC: Satisfaction with the learning content

The self-reported measures for metacognitive skills (MCSR, MSCL), facilitator skills (FAS) and tutor skills (TUT) are highly correlated. There are also strong correlations between the self-report (questionnaire) and the TIP ratings (observer ratings). Moreover, high correlations between student satisfaction measures (SLO, SLP, SLC) and self-reported facilitator and tutor skills are high. However, this holds true only regarding satisfaction with the learning outcome (SLO), not so much for satisfaction with the learning process (SLP) and the learning content (SLC).

The training group had higher scores on all four scales in the post-test compared to the pre-test (see Figure 3). The control groups had partly higher and lower scores. On the TUT scale there was even a drop between pre-test and post-test for control group 1.

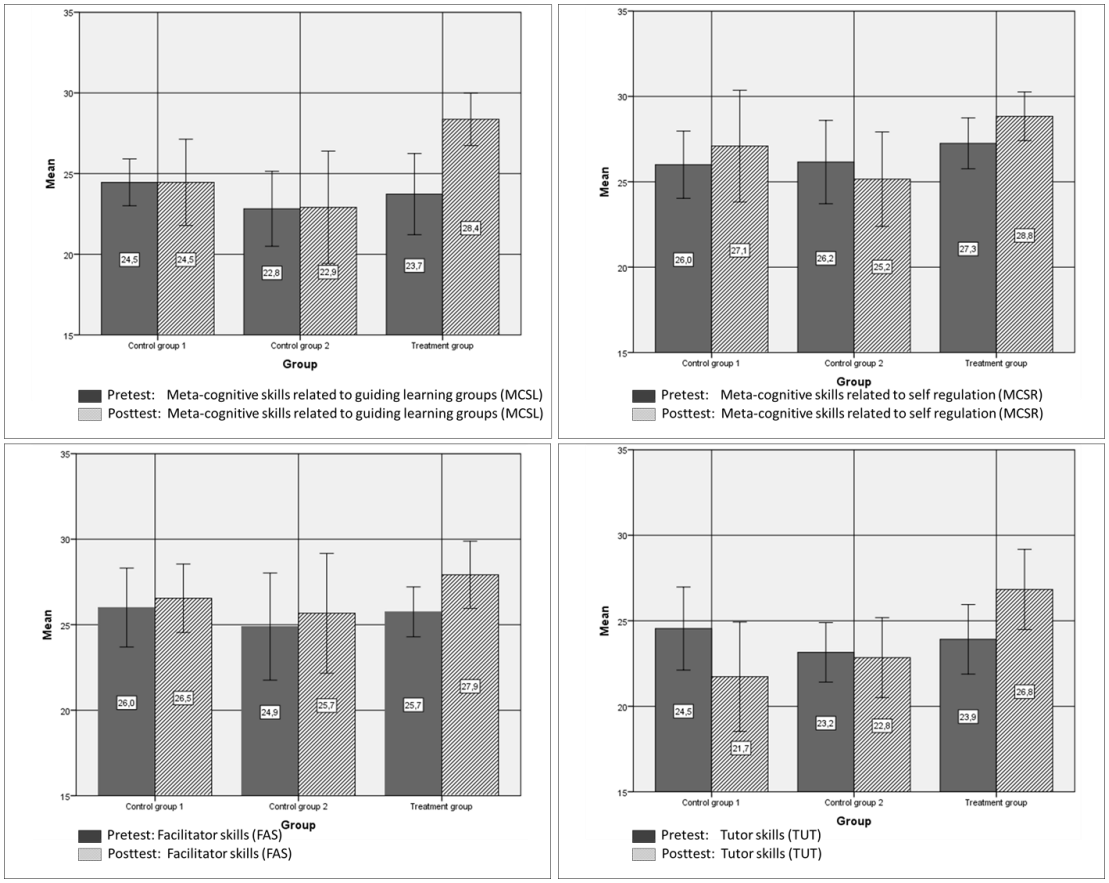

Figure 3. Tutor skills self-report (pre-test, post-test) (standardized scale values for MCSL (Metacognitive skills related to guiding learning groups) MCSR (Metacognitive skills related to self-regulation), FAS (Facilitator skills) and TUT (Tutor skills)

Applying a MANOVA procedure with factors A (training vs. reading the tutor guide vs. no formal training and instruction) and B (pre- and post-test vs. post-test only) for the four dependent variables MCSL, MCSR, FAS, and TUT showed a highly significant effect for

factor A, no effect for factor B, and a highly significant interaction between factors A and B for the dependent variable MCSL (Table 6).

Table 6

Multivariate Analysis of Variance (MANOVA) – Statistics for dependent variables MCSL (Metacognitive skills related to guiding learning groups), MCSR (Metacognitive skills related to self-regulation), FAS (Facilitator skills), TUT (Tutor skills)

Source of Variation	Dependent Variables	Sum of Squares (Type III)	Df	Mean of Squares	F	Sig.	Partial Eta^2
Adjusted model	MCSL	305.40[a]	5	61.08	5.75	.000 **	.213[a]
	MCSR	160.91[b]	5	32.18	2.22	.058	.095[b]
	FAS	146.49[c]	5	29.30	2.81	.020 *	.117[c]
	TUT	300.62[d]	5	60.12	4.48	.001 **	.175[d]
Constant term c	MCSL	67807.27	1	67807.27	6384.08	.000	.984
	MCSR	81695.18	1	81695.18	5631.16	.000	.982
	FAS	78002.21	1	78002.21	7466.72	.000	.986
	TUT	63794.01	1	63794.01	4757.66	.000	.978
Factor A (training group vs. control group 1 vs. control group 2)	MCSL	156.25	2	78.13	7.36	.001 **	.122
	MCSR	113.62	2	56.81	3.92	.023 *	.069
	FAS	131.52	2	65.76	6.30	.003 **	.106
	TUT	199.15	2	99.58	7.43	.001 **	.123
Factor B (pre- and post-test vs. post-test only)	MCSL	7.24	1	7.24	.68	.411	.006
	MCSR	34.55	1	34.55	2.38	.126	.022
	FAS	16.73	1	16.73	1.60	.208	.015
	TUT	20.20	1	20.20	1.52	.222	.014
Interaction (Factor A * Factor B)	MCSL	146.09	2	73.04	6.88	.002 **	.115
	MCSR	36.58	2	18.29	1.26	.288	.023
	FAS	4.26	2	2.13	.20	.816	.004
	TUT	75.64	2	37.82	2.82	.064	.051
Error	MCSL	1125.86	106	10.62			
	MCSR	1537.82	106	14.51			
	FAS	1107.34	106	10.45			
	TUT	1421.32	106	13.41			
Total variation	MCSL	71631.40	112				
	MCSR	85877.03	112				
	FAS	81396.83	112				
	TUT	67342.67	112				
Adjusted total variation	MCSL	1431.26	111				

MCSR	1698.72	111
FAS	1253.83	111
TUT	1721.94	111

a. R^2 = .213 (adjusted R^2 = .176)
b. R^2 = .095 (adjusted R^2 = .052)
c. R^2 = .117 (adjusted R^2 = .075)
d. R^2 = ,175 (adjusted R^2 = ,136)

* F value statistically significant (p < .05, two-tailed) ** F value statistically significant (p <.01, two-tailed)

The effect size for the training group between pre- and post-test was largest for metacognitive skills of the tutor related to guiding learning groups (MCSL). Smaller effects could be observed for metacognitive skills of the tutor related to self-regulation (MCSR), facilitator skills (FAS), and tutor skills (TUT) (Table 7).

Table 7

Effect sizes (Cohen's d) for the training group with pre- and post-test (n=21)

	M **pre-test**	***M*** **post-test**	***SD*** **pre-test**	***SD*** **post-test**	**Cohen's d**
MCSL	23.7	28.4	5.67	5.76	0.84
MCSR	27.3	28.8	6.86	5.66	0.24
FAS	25.7	27.9	10.50	9.61	0.22
TUT	23.9	26.8	8.18	13.69	0.27

MCSL: Metacognitive skills related to guiding learning groups, MCSR: Metacognitive skills related to self-regulation, FAS: Facilitator skills, TUT: Tutor skills

CONCLUSIONS

The data indicate and support the effectiveness of the training programme for pbl tutors for developing metacognitive skills related to guiding and steering learning groups in a pbl tutorial. However, there were only small effects for the development of facilitator skills and tutor skills. We conclude from our date that the training should include more exercises for building these skills in the future. It also needs to be considered that the newly trained and certified PBL tutors have completed the questionnaire right at the end of the training programme. Many of them have had no or very limited experience with facilitating tutorials outside the training programme. In follow-up measures we need to evaluate the mid-term and long-term effects of the training programme on tutor effectiveness.

There are strong correlations between self-reported metacognitive skills related to guiding learning groups and self-regulation on the one side, and both facilitator and tutor skills on the other side. This supports the conclusion that a PBL tutor training programme should not only cover the technical aspects of problem based learning (e. g. instructing, stimulating, probing questions, elaborating) but also support the development of reasoning and reflection skills as described in the 3C3R framework of Hung (2006).

Our study demonstrates the added value of intensive training for prospective PBL tutors compared with other methods, e.g. self-study of a PBL tutor guide only without complementary training, coaching or advice. This does not conclude that the available tutor guides are not helpful or supportive. However, self-study of these training materials might not be enough to develop the critical metacognitive and behavioural skills in order to achieve best performance as a PBL tutor.

SUMMARY, DISCUSSION AND OUTLOOK

Overall, the "Train the Tutor" Programme has shown satisfactory effects on the development of metacognitive skills related to guiding learning groups (*Effect size (Cohen's d) = .84)*. The effects for other dependent variables (MCSR; FAS, TUT) was still measurable, but smaller (*Effect sizes (Cohen's d) = .22 - .27).* In order to reach a stronger effect size for metacognitive-skills related to self-regulation and facilitator skills the training needs to be modified and should include more specific exercises for developing these competencies in particular.

For example, the training participants could be challenged more with difficult group situations (e. g. low participation, active or passive resistance of the group members to tutor interventions), in which they need to reflect first how these negative stimuli affect their self-regulation (cognitive, emotion, motivation) and then choose and execute appropriate interventions. This conclusion is supported by the low score on the item "I have no problems to deal effectively with "difficult" participants in a group setting (e. g. very dominating people)." (Mean = 3.62; SD = .91) (ANNEX 1). In comparison, the overall self-assessment after the training through the participants was higher on facilitation skills (Mean = 26.81; SD = 3.55) rather than tutor skills (Mean = 24.24; SD = 4.03) (ANNEX 1). This indicates that in the next run the training needs to be adjusted in a way that intensifies PBL tutor skills as described in the Tutor Intervention Profile (TIP).

In addition, the prospective tutors should be trained better how to construct appropriate and challenging problems for themselves before presenting problems to others. This is concluded from the comparably low score and part-whole correlation of the item "I find it easy to design

PBL cases for students to share, discuss, and learn." (Mean = 3.07; SD = .98; r_{tt} = .27) (ANNEX 1). One way of doing this is the opportunity to assign the training participants to define and describe task-related problems and let them work through the process. Later they should reflect their learning process and report back to others about their observations and key learning points. More than that, the empirical data supports the importance of active learning and group based learning for an effective PBL "Train the Tutor" (TtT) process compared to self-study (control group 1) or no training at all (control group 2).

The pre-test vs. pre-/post-test condition had no effect on the post-test results for self-reported tutor skills; except, there was a strong interaction effect between the factors A (training group vs. control groups) and B (pre-/post-test vs. post-test only) for the dependent variable MCSL. The subjects who had completed the pre-test before and took part in the training had the highest scores on this scale. This indicates the possibility that the awareness of the items in the pre-test has focussed and primed the training participants with pre-test experience more than those in the post-test condition only.

Metacognitive skills of PBL tutors were positively correlated with student satisfaction measures for the learning outcome, not so much with the learning content or the learning process. Facilitator skills were positively correlated with both student satisfaction with the learning outcome and content.

More experimental and better controlled studies should investigate the cognitive, affective and behavioural mechanisms of effective PBL tutorials in detail. Especially the quality of the relationship between the tutor and the students might be relevant for both student satisfaction and the learning outcome. This conclusion is supported by other research results which describe that the development of effective tutor behaviour is an effective way to improve the learning process and achievement of the students in a PBL curriculum (Chng, Yew & Schmidt, 2011; Schmidt & Moust, 2000, Wetzel, 1996).

Another way for elaborating this study further could be to videotape the interaction between tutor and students and to interview the tutor later while showing him/her the video. He/she then might verbalize his observations, intentions and metacognitive strategies during the various phases of the tutorial.

Problem based learning has a lot of potential for improving the learning effectiveness of self-regulated learning groups in secondary and higher education (Azer, 2008; Weber, 2004). Well trained and capable tutors play a crucial role in this setting. The more we want to shift from teaching to learning in the curricula the higher becomes the importance of creating supporting organizational structures for learning and development. Developing and training a sufficient number of effective PBL tutors is one critical element of such a learning architecture.

LIMITATIONS

The data gathered in this study are limited in terms of reliability. While the questionnaire for self-reported tutor skills shows acceptable though not excellent values of internal consistency (Cronbach's α 0.69 – 0.78), the reliability of the TIP data can be challenged due to the limited number of observations and observers (n=14). There is also a lack of qualitative data, e.g. from interviews with participants before, during, and after completion of the training programme. In an improved "mixed methods" design, the combination of qualitative with quantitative data should be pre-considered in order to cross-validate the data. Due to these limitations it cannot be clarified definitely how large the effect size of the training programme on the dependent variables really was, and to which extend other factors like maturation over time or the self-selection of training participants have influenced the observed behaviours of the PBL tutors and their effectiveness.

The strong inter-correlations of the four scales of the questionnaire (MCSL, MCSR, FAS, TUT) indicate a strong common factor underlying the data structure. A confirmatory factor analysis of the data has shown a rather inconsistent image. More research is needed to increase the psychometric quality of the questionnaire applied in this exploratory study.

The non-randomized allocation of participants to the training group has limited both the internal validity and the generalizability of our conclusions. Therefor it is necessary to repeat this study in a more controlled experimental setting with completely randomized groups in order to test potential effects of selection or self-selection of training participants on the results.

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ANNEX 1
Questionnaire for measuring self-reported meta-cognitive skills, facilitator skills, and tutor skills

1) MCSL (Meta-cognitive skills related to guiding learning groups)

Item No.	Item	Mean	SD	r_{tt}	Cronbach's α if item deleted
1	I have a large variety of behavioural strategies how to steer group dynamics.	3.50	.78	.47	.67
2	I know how to deal with difficult situations in group settings (e, g, interpersonal conflicts).	3.70	.77	.41	.69
3	Before engaging in a group situation I have plan what to do in order to reach the (learning) goals of the tutorial.	3.53	.85	.59	.64
4	I can judge in advance how a tutorial group will react to my questions, guidance, and interventions. (*)	3.47	.86	.27	.72
5	I can easily reflect and understand the reasons when a tutorial group is not collaborating effectively.	3.85	.90	.44	.67
6	I find it easy to integrate different types of people in the collaborative learning process.	3.53	.98	.44	.68
7	I know how to evaluate the effectiveness of the collaborative learning process in a tutorial.	3.51	.88	.37	.70

(*) item deleted due to unsatisfactory r_{tt} and higher Cronbach's α if item deleted
Scale statistics

Sample size (valid cases): n = 90	Number of items: 7	Mean: 25.11	Min: 17	Max: 34	SD: 3.66	Cronbach's α for standardized items: .72

2) MCSR (Meta-cognitive skills related to self-regulation)

Item No.	Item	Mean	SD	r_{tt}	Cronbach's α if item deleted
1	I can easily judge alternatives for my actions at any time.	3.80	.74	.53	.69
2	Especially in stressful situations I can verbalize my feelings and emotions very well.	3.69	1.05	.39	.71
3	I have a clear mental model of how to plan, do, and check my actions and their behavioural and emotional effects.	3.85	.87	.33	.72
4	I am able to think through various alternatives for action paths and evaluate their consequences.	3.79	.90	.49	.69
5	I am aware of my emotions when doing things.	4.14	.98	.51	.68
6	I reflect my actions regularly and ask others for feedback.	3.78	.96	.39	.71
7	If I do not know the answer to a problem I am able to admit that, and I know whom to address to for support.	4.34	.86	.50	.69

Scale statistics

Sample size (valid cases): n = 94	Number of items: 7	Mean: 27.39	Min: 16	Max: 35	SD: 3.95	Cronbach's α for standardized items: .74

3) FAS (Facilitator skills)

Item No.	Item	Mean	SD	r_{tt}	Cronbach's α if item deleted
1	I am good at active listening.	4.38	.82	.53	.61
2	I can easily structure group discussions.	3.65	.82	.38	.65
3	I am able to summarize the results of group discussions.	3.84	.88	.43	.64
4	I am able to visualise ideas and concepts on a white board or flip chart.	3.68	.97	.32	.67
5	I have no problems to deal effectively with "difficult" participants in a group setting (e. g. very dominating people).	3.62	.91	.40	.65
6	I am able to manage and keep the time in group settings.	3.66	.83	.31	.67
7	I keep friendly and treat everyone respectfully, especially in difficult group situations.	3.98	.80	.39	.65

Scale statistics

Sample size (valid cases): n = 92	Number of items: 7	Mean: 26.81	Min: 15	Max: 34	SD: 3.55	Cronbach's α for standardized items: .69

4) TUT (Tutor skills)

Item No.	Item	Mean	SD	r_{tt}	Cronbach's α if item deleted
1	I find it easy to design PBL cases for students to share, discuss, and learn. (*)	3.07	.98	.27	.80 (*)
2	I can easily evaluate different levels of knowledge and subject matter understanding of students in a tutorial group.	3.34	.85	.54	.74
3	I can easily integrate people with different learning skills in a learning group.	3.37	.86	.50	.75
4	I have always an idea how I can support a learning group that is struggling with a task.	3.16	.85	.62	.73
5	I am able to create a positive atmosphere and learning climate in a group.	3.74	.93	.64	.72
6	I am able to stimulate interaction and individual accountability in a learning group.	3.57	.78	.54	.74
7	I find it easy to provide feedback to a group regarding the effectiveness of their learning process.	3.98	.90	.45	.76

(*) item deleted due to unsatisfactory r_{tt} and higher Cronbach's α if item deleted

Scale statistics

Sample size (valid cases): n = 94	Number of items: 7	Mean: 24.24	Min: 12	Max: 33	SD: 4.03	Cronbach's α for standardized items: .78

ANNEX 2
Questionnaire for measuring the satisfaction of students at the end of the tutorial

1) SLO (Satisfaction with the learning outcome)

Item No.	Item	0 very dissatisfied	1 dissatisfied	2 neutral	3 satisfied	4 very satisfied	Mean	SD
1	Overall, I am satisfied with the learning outcome of this tutorial.						3.0	0.6

2) SLP (Satisfaction with the learning process)

Item No.	Item	0 very dissatisfied	1 dissatisfied	2 neutral	3 satisfied	4 very satisfied	Mean	SD
1	Overall, I am satisfied with the learning process of this tutorial regarding pace and structure.						3.1	0.7

3) SLC (Satisfaction with the learning content)

Item No.	Item	0 very dissatisfied	1 dissatisfied	2 neutral	3 satisfied	4 very satisfied	Mean	SD
1	Overall, I am satisfied with the learning content of this tutorial.						2.8	0.4