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Problem Solution Processes of Musicians and Engineers: What do Their Approaches Look Like?

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ABSTRACT

PBL is learning through becoming conscious of practical and abstract problems and finding ways how to solve them. It can be a pattern which doesn't follow traditional divisions of disciplines. In this article the material was collected from two, in the first sight, very different groups. One was music students (N = 62) who had to learn to solve various practical and theoretical problems in preparing a program for a series of concerts as collective and individual action. The method used was the 7-step method which divides learning into seven phases proceeding from creating the social frame of reference and mental models (steps 1–4) through actual work (steps 5–6) to the evaluation of the outcomes (step 7). Another group consisted of international, multicultural business leaders in engineering (N = 6). In using earlier the 7-step method, the approaches resembled those of the music students: deepening their professional competences. To engage their ability to use imagination and connect reality with brainstorming and mental flexibility, the creative PBL method 635 was used. Three practical problems were solved so that the solutions included new viewpoints which would be applied to meet the real needs in the near future. The results show that not only were the learning targets of both groups reached but, with reflection included, the processes widened the professional competences of the participants.

Key words: 7-step method, 635-method, creativity, rationality, innovation

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INTRODUCTION

The purpose of a higher education system is to foster and encourage scientific competencies and promote progress. In the terms of creativity and expertise this is a hard challenge. Undertaking teaching activities in higher education requires competence, flexibility and future orientation (Ellström, 1998; Ellström & Kock, 2008; Karjalainen & Nissilä, 2011).

The source of complexity in teaching comes from the concept of learning. The level of learning always varies and the teacher should be able to reflect on the variations. How to teach in such a way that the students' learning outcomes surpass the knowledge of the teacher? This conception may be the eventual aim of higher education. The central mission of teacher education in Finnish schools over the past 30 years has been that of research-based professionalism (Westbury, Hansen, Kansanen & Björkvist, 2005).

Reflection is aimed at helping students and teachers to develop multiple goals and encourage transformative development. Transformation is not one significant emotional event; rather it is a series of experiences which teach critical thinking whereby reciprocal processes enable the students and teachers to construct meanings (Mezirow, 2009; Nissilä, 2006, p. 237–239).

Learner and teacher autonomy and pedagogy may be seen as interrelated and interdependent concepts, if their meanings are deeply analyzed and interpreted. There are two assumptions: first, that there cannot be any 'real', genuine pedagogy, in the proper sense of the word, without the autonomy of the teacher, without his/her freedom in decision-making and action; and second, autonomy of a teacher does not lead to what is educationally worthwhile or educative, unless it is backed by pedagogy, by a teacher's pedagogical consideration and tactfulness (Lauriala, 2002, p. 131–132; Nissilä, 2002).

Problem-oriented education emphasizes dealing with the learning targets so that a learner can integrate the necessary theoretical and practical knowledge into the learning processes. As the outcomes of integration they will gain experiential knowledge which is permanent by nature when compared to rote learning separated from practice or to experiences without theoretical basis (Savery, 2006). It is a teacher's duty to find challenges which are relevant, interesting and sufficiently many-sided from the viewpoint of the student's learning, (Barrett & Moore, 2011), to facilitate learning and develop learning environments which support reflective learning (Andreasen & Nielsen, 2013).

In various studies the importance of a student's participation has been underlined in planning, implementation and evaluation of the outcomes (eg. Andreasen & Nielsen, 2013; Barrett & Moore, 2011; De Graaff & Kolmos, 2003; Illeris, 2009; 2011; Savery, 2006). Consequently,

Bridges & Hallinger (1992, p. 9) emphasized three conditions created within PBL environment. They are linked to subsequent retrieval and appropriate use of new information, these being: 1. activation of prior knowledge; 2. encoding of knowledge in a specific context and 3. opportunity to elaborate on that information.

In addition to cognitive rationale, social-psychological theory also provides conceptual support for inquiry links between modes of instruction and the learning of various skills. Social comparison of ability is prevalent in and central to group members' assessment of self and the others (Bridges & Hallinger, 1992). Social consideration is also needed when using PBL in administration. There is an ethical perspective that needs attention. Especially in the case of multicultural administration the culturally bound practices and ethics must be understood. Ethics is about our relationships with others (Singer, 1994). It can also be viewed as a 'philosophy of morality' as it deals with ought and ought not (Mahony 2009, p. 983). It can be seen as prescriptive rather than descriptive, since ethics is concerned with what we ought to do. According to a research (Helton & Ray, 2005) ethical dilemmas can arise from administrative decisions conflicting with personal and professional ethics.

Because of the responsibility for ethical dilemmas which are present in HE teachers' and students' as well as engineering management's daily work, careful preparation for a PBL design is necessary. PBL is expected to provide also for this aspect in its cognitive, social-psychological, open and group-oriented approach.

PBL SEVEN STEP -METHOD

The aim of the seven steps PBL method was in the present cases to promote the students' learning through real-world problems. A special attention was given to the context of learning, to activating the students to promote their learning and to an opportunity to elaborate on their knowledge (Schmidt, 1983, p. 15).

According to De Graaff & Kolmos (2007) in a stepwise process the experiential and cooperative are followed by reflective evaluation and assessment. Learners observe work situations, pay attention to the contents and quality of working and, on the other hand, assess their own roles in the outcome of action. In addition to substance matters, PBL requires the learners' communication and good cooperation to serve the shared goal.

The seven steps method has been applied for example in the fields of educational medicine and health science (Eitel & Steiner, 1999; Matheson & Haas, 2010; Yun Du et al., 2013), teacher education (Murray-Harvey, Pourshafie & Santos Reyes, 2013), engineering (Lai et al., 2004; Nuutila et al., 2005; O'Shea et al., 2013) and hospitality management (Zwaal & Otting, 2010). In the research results (e.g. Dolmans et al., 2005, p. 732–733; Maudsley, 1999;

Nowrouzian & Farewell, 2013; Savery, 2006; Schmidt, 1983) the characteristics of PBL in general appeared to be learners' activation and motivation, goal-oriented working both individually and communally, real-world problems, lifelong learning skills and the change of the supervisor's role from a traditional lecturer to facilitator. Learning was not sought by sharing information but activating students to do many-sided learning tasks and reflect on their action.

Problem solution is based on a stepwise process which proceeds from the definition of the problem to analyzing, solving and reflecting on what happened. According to Schmidt (1983, p. 13) the seven phases of problem-based learning are: 1) clarifying the terms and concepts which are not readily comprehensible, 2) defining the problem, 3) analysing the problem, 4) inventory of the explanations inferred from step three, 5) formulating learning objectives, 6) collecting additional information, 7) synthesizing and testing the acquired information.

The method has later been reinforced by emphasizing the importance of learning in the process. Central additions have been the reflection of the problem cooperatively, defining individual and joint goals of learning as well as the evaluation of learning outcomes and assessing the problem solving process from the viewpoint of learning (e.g. Maudsley, 1999; Savin-Baden, 2007; Wolff, 2000).

PBL 635-METHOD

635 projects are often a path to smaller or larger innovations, on the way to something that is somehow new. In organizations and groups of learners there are barriers that stop creativity. These barriers are to be discussed and efforts made to remove them (Kanter, 1983). 635 is connected to the use of human resources, quality management, risk management, planning and sometimes control. The aim of removing barriers is to increase creativity in everyday practices.

What is actually creativity? Robbins and Coulter (2007) defines it as the ability to combine ideas in a unique way or make unusual associations between ideas. The essential characteristic is newness. Anyone can be creative, if the attitudes are not too critical. The techniques of creativity 635 method are often referred to as brain writing. To release one's creativity may be risk-taking. The process can be as figure 1 shows:

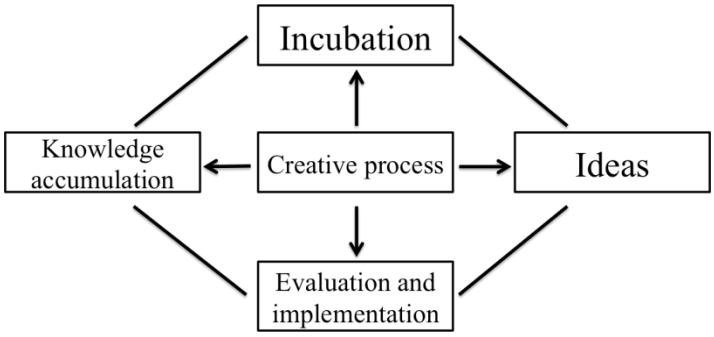

Figure 1. Kuratko and Hodgetts's (1995) description of creative thinking process.

In the brain writing process, in 635, something incremental is sought for, for instance a new way of perceiving something that was already in existence and can still be highly profitable. The intention may be to improve the quality of service and respond to the customers' expectations. It is understood that innovation usually leads to better performance (Kanter, 1983).

According to Czikszentmihalyi (1996, 6) creativity results from the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognize and validate the innovation. All three are necessary for a creative idea, product or discovery to take place. Gardner (2006) identifies four levels in creativity: sub-personal level, which is made up of genes and the structure of nerves, individual level (i.e. intellectual ability), extra-personal level, which refers to the factors outside the person, and multi- personal level (i.e. context linkages which may limit creativity).

Creativity (Czikszentmihalyi, 1996, 8–9) is a process by which a symbolic domain in the culture is changed. Because these changes do not happen automatically, we must consider the price we must pay for creativity. It takes effort to change traditions, i.e. memes (units of information that we must learn if culture is to continue). A musician must learn the musical tradition, the notation system, the way instruments are played before s/he can think of writing a new song. Consequently, if we want to learn anything, we must pay attention to the information to be learned (see Figures 1 and 2). And attention is a limited resource.

As cultures evolve, it follows that specialized knowledge will be favored over generalized knowledge. Cropley & Cropley (2009; also Cropley, 2015) specifies that this trend toward specialization can easily lead to a cultural fragmentation. Also, creativity generally involves crossing the boundaries of domains. Creative individuals, on one hand, are often considered odd and even arrogant, but on the other hand the traits are attributed to them on the basis of our perceptions. It is the demands of their role that push them towards specialization.

The purpose of using 635 in this study was to enable the participants in continuing HE to explain their conceptions of change management at their levels of competence. Earlier they had solved professional problems connected to their work using the 7-step method and deepened their professional knowledge through it. At skills level they were expected to develop and apply techniques and tools for change management in a new way. A hoped for outcome was that they would develop their competences to create new perspectives (c.f. Brockman, 2010). As 635 is one of the creative problem solving methods which can be used in teams, it appeared to be suitable for meeting professional challenges that demanded totally new solutions.

Creativity, creative problem solving and decision support contribute for instance to leading and project management. Especially, in the contexts of advanced methods, 635 is strongly linked to decision support. In these situations there are usually many options, but at the end one is chosen (Brockman & Dirkx, 2006).

RESEARCH METHOD, DATA COLLECTION AND ANALYSES

The processes took place in the University of Applied Sciences (UAS), in the School of Vocational Teacher Education. Music students (N = 62) from ages 17–24 represented the local music conservatory education program in 2003–2011, and the business engineers (N = 6), with academic degrees, were the leaders of an international firm on three continents. They came from several European countries, the USA, China and its neighboring countries and participated in the "training for trainers" –course in teachers 'continuing education department of Oulu UAS between August and December 2013. The PBL 7-step and 635 processes were strictly documented. The documents consisted of written outcomes of the practices, interviews and observation notes. In 635 there was also a key of pseudonyms.

The research questions were:

1. What does the 7-step PBL method reveal about music students' learning?
2. How do international business engineers process the problems by the creative method of 635?
3. What similarities and differences can be observed in two different professional groups and their problem solving processes?

The research paradigm follows that of case studies (Yin, 2009). The results were analyzed with qualitative contents analysis (Berg & Lune, 2012; Schreier, 2012). The data sources were complementary and yielded detailed experiential information vocalized by the participants. Each relevant passage was read and statements were isolated which captured the meaning expressed by the participant. Thematic patterns were developed, individual conceptions of the

experiences were given attention to and the descriptions were arranged to give meanings to the themes.

The trustworthiness was developed through multiple sources and two researchers who interpreted the respondents' statements together. Through prolonged engagement with the participants and the incorporation of member checks in the seven-step method, the truth value was sought to be established (Moschovich & Brenner, 2000; Patton, 1990).

The Method – in details

The realizations of PBL took place in the research groups in the ways described below. The processes were not identical, but the aim of adopting/ adapting PBL was the desire to make the processes systematic and analyzable.

In ***music education*** research, 11 pop and jazz music workshops were organized according to the PBL seven steps method. The throughput principle was to take professional musicians along to the work context, to practice and perform with the students. The workshops (Fig. 2) were started with joint planning and goal setting in which the music theme and challenges in respect with the students' skills were discussed. After choosing the theme further tasks and preparation work were agreed on. The students defined their personal developmental tasks in the workshop and wrote them in structured target forms.

The next phases were periods of music exercises in which the students worked on the workshop material independently supervised by their own instrumental teachers and as an ensemble under the supervision of the teacher in charge of the workshop. Independent exercises were daily, and ensemble exercises 2 or 3 times a week. The intensive period after the workshop was carried out so that the professional musician came on Monday and started practicing with the students. Typically the days were 6–7 hours. At the end of the week they had a performance which was followed by cooperative evaluation through discussion. Personal workshop feedbacks were written down and assessed in respect to the set goals (cf. Nuutila et al. 2005, p. 126).

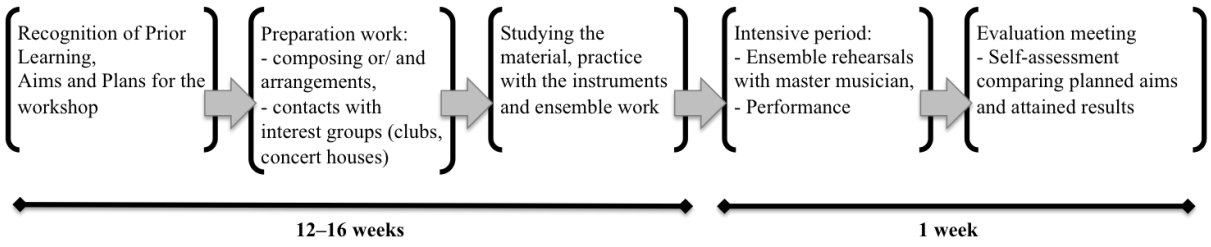

Figure 2: The steps of progress in the workshops (see Virkkula, 2015).

The research material concerning music students was collected in two phases. At the beginning of workshop work *(phase 1)* the students (N = 62) wrote structured workshop plans

setting their learning goals. The plan proceeded according to the questions: ”How did you participate in preparing the workshop?”, Describe the theme of the workshop, for instance the style of music?”, ”How do you intend to prepare yourself to the workshop?” “What do you want to learn in workshop work?” ”What other expectations do you have concerning workshop work, working with a professional musician, workshop concert?”

After the workshop *(phase 2)* the students (N = 62) reflected on their experiences of the workshop and answered the following open questions: ”Describe cooperation with a professional musician?”, ”What did you learn in the workshop?”, ”What could you have done in another way?”

Among ***engineers*** some basic characteristics of creative problem solving were discussed first and the usage of the method explained. It was remarked that there was a distinction between creativity and innovation. Creativity is the generation of novel and useful ideas, while innovation is a deliberate implementation of ideas. It makes money or value out of creativity. Innovation is more than invention. It is the specific function of entrepreneurship, the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth (see Drucker, 1985).

The engineering enterprise connected to the present study was analyzed from several points of view. The multicultural continent leaders who were engaged in this study were willing and able to use also the seven steps –method. It was noticed that in their enterprise there is a rather low hierarchy, the culture is risk-taking, work design is team work, management/ leadership supports the ideas if introduced well and made understood, and networks and collaboration with universities, suppliers and competitors are well taken care of (cf. Kanter, 1983). The enterprise tries to balance technology with customer service.

The way of applying the 635 method in this presentation was the following. First the rules of brainstorming/ brain-writing were explained. 635 stood here for 6 participants, 3 problems and 5 changes of papers during one “round”. The time allowed to each participant started from two minutes and increased to five when the work proceeded.

After defining the problems together the “owners” of the problems, one owner per problem, were nominated. No owner was allowed to suggest solutions to his/ her problem, since s/he was to choose the best solution to his/ her problem at the end. The problems were written on sheets of paper, one problem on one sheet. Everyone in the group read one problem at a time, wrote his/her suggestion on the paper and signed the suggestion with a pseudonym, moving the paper to the next person.

The session ended when the participants had worked on three problems during three rounds. In the last phase called “objective criticism” the ideas were to be examined. The owners of the

problems suggested the best solutions giving their reasons for them. The solutions were talked about and evaluated together.

The participants of 635 may experience creative stress: they have to come up with great many ideas while working against the clock. It can spur to mental productivity or in some cases inhibition. Especially important it is to understand that the PBL process is not only a mental game but can be continued in real-life contexts dealing with similar kind of practical problems as in the exercise. 635 is also an example of productive team work.

The engineers produced research material during the session. After the session they gave oral or / and written evaluation and reflected on their experience. The comments were written down and used for explaining the data obtained.

The data from both *music students and engineers* were transcribed and tabulated into categories which represented the characteristics of problem based learning (Schreier, 2012, p. 2–5; also Krippendorff, 2004; Marshall & Rossman, 2011; Miles & Huberman, 1994). The categories of music students were: 1) motivating the learners, 2) goal-oriented working both communally and individually, 3) contents of learning, and 4) role of a supervisor. Tabulation made it possible to examine the material widely from the viewpoints of students, workshops and categories. The engineers' material was categorized first into the classes of structure, technology and people according to the main contents and then, after a closer analysis, into 1) goal and planning, 2) cooperation, 3) skills and competences and 4) people concerned. Thus the categories of both music students' and engineers' research material are very much alike.

OUTCOMES

First the outcomes of the 7-step method among music students are reported, next those of the 635 are described. Then the results will be examined as one set of data according to the core contents of both outcomes.

Music education

The starting point of music education is to prepare a student to meet the challenges of his/ her future work and find relevant solutions to them. The studies must include elements that direct the student to solving professional problems autonomously and cooperatively (cf. Savery, 2006, p. 13).

The research showed that preparing a concert or a gig program in a workshop was a seven-step problem solving process in authentic work situations for students. They met the problems with visiting professionals and learnt to solve them by seeking for knowledge, analyzing, evaluating and applying it to practice. Table 1 describes how the workshop work appeared in respect to the seven step model and to the categories of results (motivating students, goal-

oriented work both individually and cooperatively, contents of learning and role of a supervisor).

Table 1. The seven steps of PBL in the workshops of music students.

	The seven steps model of PBL (Schmidt, 1983; Savin-Baden, 2007; also Savery, 2006; Wolff, 2000).	**PBL in workshops**
Step 1	Setting the problem	The theme of the workshop is reflected on cooperatively (teacher, students, professional musician)
Step 2	Defining the problem	Delimiting the chosen theme of workshop together
Step 3	Analysing and clarifying the task	Analyzing the contents of the workshop theme, e.g. the challenges of learning in respect to the skills of students (Recognition of prior learning) ⇨ Analyzing the student's skills (teacher and student) ⇨ Completing the skills before the workshop
Step 4	Suggestions for the solution are gathered and compared and the alternative solutions are gathered	Decision of the workshop theme, choice of music, the choice of location
Step 5	Individual and collective goals and tasks are decided about	Division of the tasks, preparation work, setting the learning goals: ⇨ Planning and goals - Written goals of the workshop *(the 1st part of the research material)*
Step 6	The implementation of the tasks individually or collectively	Instrumental and ensemble exercises, connections to interest groups, informing and marketing, performance.
Step 7	Reporting and evaluation of the results in the discussions of the participants	The cooperative examination of the workshop work's outcomes in relation to goals, as well as the reflection of individual attainments and experiences literally. *(The 2nd part of the research material)*

In the seven step -method the first steps (1–5) had a great importance on the learning outcomes. Defining the problem, analyzing it and the aims set for working had influence on motivating *(data category 1)* and connecting the students to the joint project. The student statements after the first five steps describe the awakening of interest towards the workshop and exercising playing, which also refers to taking responsibility on their own learning (cf. Savery, 2006, p. 12–13).

> "Of course I want to learn new pieces, but also ideas of how to realize them with the band. I also want to measure my skills and see if I am able to work with a professional musician. (…) I hope that I will get a lot of new ideas of my own during the workshop." (A35)

Problem-based learning is goal-oriented; for that reason it must have defined goals (e.g. De Graaff & Kolmos, 2007, p. 7). Students found the performance connected to the workshop an important part of working for two reasons: it motivated them to practise their own part carefully and acted as a spur to do their best *(data category 2).*

> "In a concert everyone wants to give his/ her best; so s/he has to work for attaining it." (A3)

"Concert is a good culmination for the workshop and it also gives punch to rehearse." (B22)

From the viewpoint of developing musicianship (PBL step 6) workshops were connected to the development of the student's musical skills, self-motivation, and activity and in general to the core skills of lifelong learning *(data category 3).* Preparing for a performance appeared to be a problem solving process which required the student to take responsibility and initiative. Goal-oriented striving through individual instrumental exercises and communal ensemble work seemed to guide students to notice the importance of engagement in the work of a musician.

> "(The workshop) told a lot about a musician's everyday life, and the practical experience taught how fast a performance repertoire can be put together, what pre-preparations must be done." (A60)
>
> "When my own parts are well under control before the ensemble practice, everything is easier. The artistry in music can be brought out." (A55)

Students' statements reveal how problem-based work influenced on understanding the role of contents in a musician's work, for instance how to act to get relevant outcomes. Cooperative dealing with the experiences and writing the feedback (PBL step 7) immediately after the performance organized the students' view on the musician's work.

> "In the beginning I was dubious of my ability to perform the large vocal ranges and also the stylistically different songs. Still I went through the challenges to victory, and it felt really fine. I learnt again to believe in my abilities throughout the workshop and in fact that concentration and practice ensured the successful result." (A23)

The role of a professional musician proved to be significant in the learning process, but different from the tradition *(data category 4).* He was maybe expected advice and control of learning, but along the time the students became more active and asked and explained things autonomously. The musician's task in relation to students seemed to be an encouraging supervisor, the facilitator of learning and a partner.

> "The (workshop's) atmosphere was really relaxed, which helped working and the adoption of tunes. The pieces were really jamming / improvisation based, so we used a lot of time to find the right mood and the same wavelength." (A43)

> "The professional musician did not give so much feedback as I had hoped for, but on the other hand he confirmed in that way that the students became active to listen to themselves." (A49)

The students' skills were challenged widely. Skillful working was based on planning the items to be learnt. Action models were expected to become internalized with the help of reflection of learning experiences. In acquiring professional action and skills in music communities, social interaction and cognitive processing were observed to be important (cf. Dolmans et al., 2005, p. 732–733).

Acquiring learning experiences in the duties of a musician had influence on the development of the students' musical skills and problem solving abilities. Workshops directed the students towards responsible and initiative working, creating joint spirit and critical evaluation of oneself and the group.

Multicultural engineers

The blocks of the participants in the 635 method were removed by trying to strengthen their self-belief and individuality, by accepting mistakes and imperfection in their experiences, suggesting them to have fun and positive attitudes and accept criticism as an item of learning. The rules of brainstorming were also repeated. In the planning session the managers talked about the problems that would be waiting for them in a few weeks' time because of Christmas holidays and the need of support from the side of customers. They decided to concentrate on solving acute real-life problems connected to travelling and full-time on-call of their service departments.

The problems to be solved were:

1) The suitcase has not arrived with the passenger. It contains important material for training. What can you do?
2) Holiday time is coming. How do you take care of customer service support during the holidays?
3) An important service person is going to leave the organization. How can he be made to change his mind and become motivated to stay in the organization?

The suggestions (N = 33) were mainly realizable. A common idea in the first problem was to ask the imagined audience to tell their expectations and then proceed in training according to their expectations and use situational sensitiveness. How to do this varied according to the persons. Typical suggestions were:

> "Try to be creative at the training."
> "Act according to the situation."
> "Make the training more interactive."
> "Try to fill the training as much as possible with Q's and A's (questions and answers)."

In question number 2 the suggestions went further apart including monetary solutions:

- ample financial compensations to engineers, and
- demanding extra payments from customers.

Also suggestions were made to arranging

- phone service from the holiday resorts,
- varying days-off during Christmas,
- a back-up machine provision for customers during holidays,
- help from partner companies on "scratch my back and I will scratch your back" – principle.

Suggestions to problem number 3 were the most imaginative: all contained some golden grains. Examples of suggestions were:

- making a needs assessment study of the person in question
- offering more money and higher position
- telling that the grass is not greener on the other side of the fence
- researching the weaknesses of the other company.

Many suggestions pointed at making the person in question feel empowered through various, even imaginative arrangements at work. The next quotation comes from the most realistic ones:

> "Study his interests; offer him interesting tasks and new challenges, also a better future image and personal development".

To evaluate the produced ideas the following questions concerning all suggestions were presented, especially about the problem owners' choices:

1. Why is the chosen solution the most promising?
2. Which realities prevent the solutions possibly from coming true?
3. What kind of breakthroughs would be needed to realize the solutions?
4. Could the idea be developed on in this session?

The exercise with 635 was the first that the participants had ever met in creative problem solving. It caused a certain kind of restraint in the suggestions. In general their action was not pure brainstorming, as they gave a lot of attention to practical implementations. There are limits to what a manager can change, and the participants stayed mainly inside the limits. Their ideas fell into three categories:

1. *Structure* which concerned mainly job redesign, chain of command and work specialization (problems 3 and 2).

2. *Technology* concerning work processes, methods and equipment. This was the greatest concern of the participants understandably, since it was their main specialist area (especially problem 2).
3. *People* who caused the concern of concentrating on finding out attitudes, expectations and behavior (problems 1, 2 and 3).

Although the present PBL exercise didn't bring out anything completely new or any revolutionary services or processes with higher uncertainty or risk, it opened a new way to solving everyday problems which can later be developed and made better especially in the enterprise concerned. The value of the present method of 635 lies in its future applications.

The outcomes compared

Having a look at the outcomes of both musicians and engineers does not bring too many similarities at first sight (see Table 2). A deep analysis provides differences and similarities in thinking and attitudes. They are evaluated from the perspectives of goal-orientation, planning, skills, competence, people and collaboration.

Table 2. Comparison of the music students' and engineers' results.

	Music students in Conservatory	**Multicultural business leaders in engineering**
1) ***How were the goals defined?***	- General goals were defined through collective reflection, personal aims based on recognition of prior learning were defined individually.	- The shared goal was tied to the business enterprise and its success. Individual goals were parallel, but varied because of the situations in different continents and the everyday needs of each respondent to solve practical problems.
2) ***How was the action planned?***	- The problems were defined first and then the action was planned to be in harmony with the aims and means.	- The problems were defined through collective dialogue (see Senge, 1990), first introducing a lot of possible problems facing the enterprise and then limiting them to three most obvious and acute ones.
3) ***What skills became apparent either in action or in goal setting?***	- The music students analyzed the contents of the workshop theme and the challenges in respect to their skills. The students made plans how to complete the skills before the workshop's intensive period.	- Engineers technical skills were up-to-date, but their human relations skills were defective and they were not able to motivate and supervise their workers sufficiently. This was the greatest difference between the groups: music students needed especially practicing their technical and instrumental skills, the engineers their human relations skills.
4) ***What competences appeared significant in the process?***	- Besides instrumental skills the students had to decide about the theme, choice of music and set their learning goals. They included more than technical performances: to understand the music to be played and find the ways of expression.	- Engineers talked about motivating the staff before they started the PBL task. The technical competence was seen the most important, but gradually they noticed that it is the staff motivation that makes the profit. During the PBL task they tried to settle in an employee's position. The difference appeared again between the technical and mental proficiencies.
5) ***What aspects or human characteristics were considered?***	- The Music students were greatly motivated by the 7-step method workshop. They felt that the process proceeded in the way that is also met in musicians´ everyday life. Another motivator was the professional musician and the cooperation with him/ her. The possibility to build the whole process from the first planning to implementation and evaluation was not only inspiring but also very instructive.	- The understanding of human characteristics of the staff was relatively scant among engineers. It may possibly depend on their restricted vocabulary (they didn't speak their mother tongue) and the lack of familiarity when talking about people's attitudes and expectations. They moved outside their comfort zones and could not express that which they possibly indirectly understood. This difference between the students and engineers is in connection to the two earlier ones.
6) ***What role was given to collaboration****?*	- The Music students praised cooperation in ensemble exercises, connections to interest groups,	- Engineers trusted on collaboration in all that they did in their work. While professionals in music are both individualistic

	collaboration with fellow students, teachers and professionals, which all spurred them to reach individual goals. Thus the workshop served both collective and individual learning.	and team persons, engineer are first team workers and, secondly, individuals. They must have individual competence and knowledge first, but they share the aims in the team and they have to master team work. They have also to understand systemic organization to be able to act as continent leaders in an international business enterprise. This difference follows from the characteristics of the jobs of a musician and leading engineer.

In both cases processes were based on planning and stating the aims and goals partly by joint planning and reflection, partly by individual reflection and recognition of skills. PBL emphasizes the constructive nature of the process, which means that in the starting phase it is important to make a careful charting of competences and planning of action (e.g. Nowrouzian & Farewell, 2013). In this study, through the above mentioned policies, efforts were made to ensure the active participation of the research persons from the very beginning of the process.

The problem connected to the process was exemplified, and the action models to solve it were dealt with and accepted cooperatively. This kind of expert dialogue led to the demonstration of the problems as work processes. Both musicians and engineers had to take stand to technical and contents matters, evaluate their skills in them and learn new concepts. The problem stimulated learning, when the participants had to make choices and efforts towards the aims they had defined (e.g. Dolmans et al., 2005).

Learning took place in the real world contexts dealing with and solving authentic problems (e.g. Savery, 2006; also Dolmans et al. 2005). The experience illustrated the problem solution process at practical level, which helped the learners to develop themselves towards autonomy.

The outcomes reveal how important it is to reflect on the gained results cooperatively and individually. In collective dialogues the shared understanding of the group was constructed concerning both the contents and learning processes (cf. Nonaka & Takeuchi, 1995). In individual reflection the respondents assessed their levels of present competence and their future expectations. In the future, learning processes will be based on earlier, through reflection recognized experiences (cf. Kolb, 1984). Problem-based learning processes will help the learner adopt critical reflection as part of his/ her working method and general professional practices. This is how s/he promotes the development of his/ her competence according to the principles of lifelong learning (e.g. Dreyfus & Dreyfus, 1986).

CONCLUDING REMARKS

The results show that not only were the learning targets of music students reached but, with reflection included, every step of the process widened their professional competences remarkably. In the group of engineering business leaders the 635-method raised them to give attention to human-centric viewpoints in problematic situations. The methods appeared complementary: creativity was needed in the 7-step method and organized knowledge of the basic factors was necessary in the 635.

When comparing the results of these two experiments, there are more similarities than differences. The supposition was that there should be differences between music students and business engineers in creativity and/ or rationality. Instead, both groups could act systematically and creatively. Music students concentrated on deeply professional issues and the skills needed in performing music and marketing it both rationally and creatively. Engineers opened the gates to human-centric ways of thinking and seeing the world when they tried to create personally satisfactory ways of solving practical problems.

Earlier in musicians' education the projects resembling workshop work emphasized the attainment of a concrete purpose (to realize a performance, to make a product etc.). In them reflecting on learning usually received less attention (e.g. Savery, 2006, p. 16). Reflection has, however, an essential role as part of goal-oriented PBL learning as well as the 635 method. The starting points of action, process, contents (e.g. the solutions and conceptions) are evaluated critically, which promotes the construction of shared understanding, learning from others and questioning everyday beliefs and issues taken for granted (see Mezirow, 2009). Critical evaluation serves cognitive reasoning. Individual and collective reflection are utilized both in the 7-step and 635 –methods (cf. Wenger, 2009, p. 210–211; Jarvis, 2009, p. 25; Senge, 1990).

A freely constructed PBL-method (7-steps) appears functional, applicable and recommendable in higher education (e.g. Savin-Baden, 2000). Enthusiasm and positive atmosphere are highly important factors in real life, leading to collective responsibility and caretaking. The support of learning communities and individuals' willingness in professional growth are the prerequisites of empowerment (e.g. Arneson & Ekberg, 2005). In creative problem solving (635) cognitive reasoning is put aside at first and the hidden powers of mind are let free. Accumulation of knowledge and incubation come out as ideas which are evaluated and then possibly implemented. Letting one's mental powers free may lead to unusual associations between ideas. They are needed in everyday life of individuals and communities (see Kietzmann et al., 2013).

The key to successful implementation of PBL lies in designing a learning environment that stimulates students towards constructive, self-directed, collaborative and contextual learning and in consistency in or alignment between all aspects of the curriculum, such as the problems used, the tutors' guidance and the assessment employed (see Savin-Baden, 2000). Problem-based learning will raise the level of learning in higher education by introducing a systematic way of approaching problems through the seven steps method and trying to encourage academic people to let their creativity loose towards creative brain-writing and innovation. Lateral thinking promotes creativity in its ability to make connections. The success of an organization is determined by the quality of new ideas, since the competitive edge comes from creative thinking. Equally important is to understand that knowledge grows from cognitive commitment and exchange with others. It will lead to transformation.

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