COLLABORATIVE PROBLEM BASED LEARNING
IN DISTANCE AND MOBILE EDUCATION

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ABSTRACT
Since the early 1970s, Problem based Learning (PBL) in small groups is a prominent and innovative didactic approach with multiple facets, good practices and demonstrated effectiveness in many countries, for many different subjects and education/training programs, and in various settings (primary, secondary and higher tertiary education) (see e.g. Edens, 2000; Savery, 2006; Ertmer, Hmelo-Silver, 2015). However, this concept is not so much perceived in distance learning programs even though new technologies allow for better real-time collaboration in virtual classrooms and workspaces, mobile access to electronic learning resources via smart phones, and digital learning content like videos, podcasts or simulation tools. One reason for this might be the lack of conceptual frameworks and appropriate models for PBL in distance education. In this article, one prominent concept for designing PBL learning settings will be presented and its application in practice discussed: the 3C3R-Model of Hung (2006) defines a framework for Content, Context, and Connection (3C), which are interlinked through learner activities such as Researching, Reasoning and Reflecting (3R). Practical implications and examples for the design of appropriate distance learning designs based on this model will be presented and discussed with the audience.

KEYWORDS: 3C3R model, Collaborative learning, Distance learning methods, Instructional designs, Problem based learning (PBL), Theory-practice transfer

1. BRIEF INTRODUCTION TO PBL

Over the last four decades, Problem based Learning (PBL) has evolved as a new way of teaching and learning, promoting and encouraging self-directedness, creativity and collaboration between students. Starting in the early 1970s in the medical school at McMaster University in Canada, PBL has been adopted in many other educational institutions all over the world (see e.g. Barell, 2006; Ertmer, Hmelo-Silver, 2015).

Savery (2006, p. 12) defines this educational approach as follows:

PBL is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem. Critical to the success of the approach is the selection of ill-structured problems (often

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interdisciplinary) and a tutor who guides the learning process and conducts a thorough debriefing at the conclusion of the learning experience.

PBL as a teaching and learning concept is characterized through at least the following elements (Savery, 2006, p. 12):

- **PBL is a learner-centered approach.** Students engage with the problem with whatever their current knowledge/experience affords. Learner motivation increases when responsibility for the solution to the problem and the process rests with the learner.
- **The problem simulations used in problem-based learning must be purposefully defined and ill-structured and allow for free inquiry.** “Ill-structured” means that the students need to cognitively de-code and re-construct the structure of the problem and to identify the relevant information and interconnections of the problem with its context.
- **Learning should be integrated from a wide range of disciplines or subjects.** The students should be able to access, study and integrate different information from all the disciplines that might be related to understanding and resolving a particular problem.
- **Collaboration is essential for the social learning process.** Hence, PBL is organized in small groups who are supported by a tutor who should be especially trained for this task (see also Barrows, 1988).
- **Self-assessment and peer assessment should be carried out at the completion of each problem and at the end of every curricular unit.**

Given these characteristics it becomes evident that PBL is a very intensive learning experience which requires specific resources (e.g. qualified tutors, training rooms, learning materials) and a high degree of self-regulation and social skills from the students. Due to limited communication between students in distance education programs, additional challenges need to be addressed in such a remote learning setting.

### 2. Challenges for PBL in Distance/Mobile Education

Distance education is characterized through limited interactivity between both teacher and students, and students and peers due to the fact that there is no fixed timetable or a defined classroom setting and a restricted face-to-face communication. Mobile education takes advantage of internet devices for enabling the students to access virtual classrooms, learning materials and assignments wherever they are. 24h/7d services provide the students and lecturers the opportunity to customize the learning process to their preferred learning style and learning habits.

The challenges for utilizing PBL in such a learning setting are:
a. How to reduce the communication gap between students and peers, and students and tutors due to geographic separation?
b. How to encourage collaboration between students who do not know each other and who have limited exposure to informal communication and team building?
c. How to define ill-structured problems which are suitable for distance learning?
d. How to install opportunities and “quality gates” for self-assessment and peer assessments?

At the beginning of the PBL learning process the students lack shared problem recognition and understanding of the expectations what they need to achieve. They can easily feel lost given the ill-structuredness of the problem, the abundance of (internet) resources and information that might be relevant or irrelevant for solving the problem, and the discomfort to collaborate with other students who they do not know in a virtual team.

For the course designer, the main challenge is how to set up the learning space in such a way that it encourages learner self-regulation and motivation, communication and collaboration between students. For this purpose he needs to design ill-structured problems which are suitable for distance and mobile learning programs. In the following chapter, this paper explains a didactic framework for designing PBL processes in such programs.

3. The 3C3r Model for Designing Collaborative PBL in Distance and Mobile Education

Hung (2006) has seen the necessity to draft a generic framework for designing problem spaces in a PBL context. Such a framework allows the educational program designer to check if his didactic approach comprises all relevant elements for an effective PBL learning experience. Hung’s model is split in three structural elements (Content, Context, Connection) and three process elements (Researching, Reasoning, Reflecting) (see Figure 1).

Figure 1. 3C3R Framework for designing problem spaces in a PBL learning environment (Hung, 2006)
The inner segments of the triangle describe the content of the problem, the context of the problem, and the connection of the problem with relevant theories, subjects, and other problems. The outer corners of the triangle describe which data, models and concepts need to be researched by the students, what how they should reason and how they should reflect the learning process and outcome.

In a distance and mobile learning program there is a need for explicating some essential PBL rules and processes. The 3C3R model can help to clarify the content of the problem the students should work on. The boundaries and the scope of the problem need to be specified. Also the context in which the problem is embedded must be clear. The connection of the problem with previous learning experiences and relevant theories, models, and subjects should be specified, too.

The students should also explicitly instructed, what and how they should research. A list of relevant literature should be provided as well as access to relevant databases and experimental tools.

The challenging task of this process is how to instruct the students to reason about the learning content, the learning goals, and the learning process. The tutor needs to install frequent and regular feedback mechanisms which show the learner’s progression over time, indicate strengths and weaknesses, and trigger reasoning mechanisms. In addition, regular collaborative reflection sessions e. g. in virtual classrooms, facilitated by PBL tutors, will support the students to develop a shared understanding of the problem and relevant activities to solve the problem.

4. **APPLICATION OF THE 3R3R MODEL FOR DESIGNING A PBL MODULE IN BUSINESS PSYCHOLOGY**

In this research of designing an academic program, Hung’s model is used to specify a PBL module in a business psychology program for bachelor students. This academic program aims to develop knowledge, understanding and application of psychological concepts and methods in a business context (e. g. recruiting, talent management, performance management, organizational behavior, training and development, assessment). In this particular introductory module the students should grasp the breadth and depth of psychological models related to organizational behavior and job satisfaction. Table 1 illustrated the didactic rationale for this PBL module based on the 3C3R concept.
<table>
<thead>
<tr>
<th>Level</th>
<th>Criteria</th>
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| Content | The problem should contain the following elements:  
• Psychological concepts such as motivation, commitment, job satisfaction, job performance  
• Business concepts such as productivity, return on invest, company performance |
| Context | The problem should be embedded in a small and medium sized business context. This would focus on the role of human resources in small companies. |
| Connection | The problem should be connected with motivation theory, organizational design, and task design. It should also be connected with economic models for business performance such as the EFQM model for business excellence. |
| Research | The students should research relevant psychological and economic theoretical models such as:  
• Job characteristics model (Hackman and Oldham, 1975)  
• Job satisfaction (Spector, 1997)  
• Resource-based view of strategic management (Penrose, 1959)  
• Organizational Excellence (EFQM, 2012) |
| Reasoning | The students should explicate how they would approach the problem, divide the research into subtasks, collect the data, and document their findings and open questions raised during the learning experience. |
| Reflecting | In bi-weekly reflection sessions in a virtual classroom the students present their results and share their reflections about what they have learned until then, and what they still need to learn and understand. A PBL tutor facilitates the reflection session, provides feedback and stimulates the learning through probing questions. |

Table 1. Application of the 3C3R model for design PBL module as an introduction to business psychology.
The exemplary problem has been carefully drafted as follows (Table 2).

**Problem description:**
A small company with currently 65 employees has experienced a high turnover of people over the last 6 months. Out of 100 people at the beginning of the year, 35 have recently and voluntarily left the company and have found a job elsewhere. The employer is very unhappy about the current situation. He says “I don’t know why people are leaving. The salary is on the same level as the competitors. The same holds true for working hours, extra-legal benefits such as social insurance, medical insurance or holidays. The supervisors reporting that the employees are not very satisfied with their job content. Some of the employees find it boring to work here; others feel that they cannot fully utilize their skills in the current job. Overall the company performance is severely suffering from that high turnover rate. The motivation of the remaining people is also negatively affected through long overtime and a lot of operational problems in the work processes. On the long run this will also have a negative impact on our strategic goal for business excellence.”

The employer is seeking some advice from a professional business psychologist. He is employing you as an external consultant in order to find out what the reasons for the high turnover rate are, and what can be done in order to increase job satisfaction, motivation and organizational commitment of the employees.

**Instruction**
1. Describe the problem in your own words, using concepts from business psychology such as motivation, job satisfaction, and commitment.
2. Brainstorm various ideas how this problem has been triggered and evolved over time. Which psychological factors might have had an impact on this problem?
3. Which economic factors might have had an impact on this problem?
4. Research various psychological and economic models which deal with job satisfaction, motivation, retention, and business excellence.
5. Reflect your findings through discussing your results with a peer student via Skype.
6. Prepare a presentation and be ready to present and discuss your findings in a virtual classroom which will take place on the [insert day] at [insert time].

| Table 2. Exemplary ill-structured problem for an introduction course to business psychology |

The exemplary problem fulfills the criteria for ill-structuredness through introducing some relevant concepts like e.g. “job satisfaction”, “commitment” and “business excellence” without providing definitions. It is up to the students to find relevant bibliographic resources and sources which define and explain these terms. They also need to research relevant theory in order to find possible solutions for the problem. Through phrasing the need of the employer to “have professional advice” the students are challenged to develop professional expertise in this knowledge domain, and to transfer this knowledge to practical methods.

**4. Evaluation**

Evaluation of the effectiveness of PBL in a distance/mobile learning programme needs to consider both the characteristics of PBL as described in paragraph 1 and the challenges for applying PBL in distance/mobile education as pointed out in paragraph 2. Relevant criteria to be evaluated as well as evaluation methods are listed in Table 3.
### Table 3. Evaluation criteria, methods and example scales for self-assessment, peer assessment and assessment through experts

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Evaluation Methods</th>
<th>Example</th>
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<tbody>
<tr>
<td>Level of self-regulated learning</td>
<td>Self-assessment (weekly)</td>
<td>% of completion of self-determined learning goals</td>
</tr>
<tr>
<td>Level of collaboration between students, students and tutor</td>
<td>Peer assessment (students) Assessment through PBL tutor</td>
<td>Frequency and quality of collaboration</td>
</tr>
<tr>
<td>Level of knowledge</td>
<td>Knowledge tests (repeated)</td>
<td>% of max. achievable credits</td>
</tr>
<tr>
<td>Level of understanding</td>
<td>Situated application of knowledge and reflection (oral/ written assessment)</td>
<td>Expert ratings (0: no understanding, 1: limited understanding, 2: good understanding 3: excellent understanding and transfer)</td>
</tr>
<tr>
<td>Level of student engagement and motivation</td>
<td>Self-assessment (weekly) Assessment and feedback from the tutor (weekly)</td>
<td>0: no engagement 1: little engagement 2: high engagement 3: extraordinary engagement</td>
</tr>
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</table>

6. **Summary, Conclusions and Outlook**

Problem Based Learning (PBL) is a widely recognized didactic approach, which enhances learner engagement, motivation and self-directed learning. There are some challenges that need to be overcome in a distance/mobile learning context which have limited opportunities for face-to-face interaction, communication and collaboration between students - students and students - facilitators. One of the key elements of PBL is challenge in designing purposefully crafted ill-structured problems. The 3C3R model of Hung (2006) allows for the definition of meaningful content, context and connection of problems, while keeping in mind that the students need to actively do research, reason what they are doing, and reflect the effectiveness and outcome of their learning activities.

Due to limited communication in a distance/mobile education program, didactic elements that require student collaboration must be carefully defined and built into the learning process. Students will need some time to get to know each other and to develop cohesion and team spirit. A trained PBL facilitator can support the students to overcome feelings of discomfort and provide guidance and orientation. A regular and repeating evaluation of the learning process and the learning outcome in terms of knowledge, understanding, the application of the knowledge needs to be implemented in the education programme.

Given the opportunities and possibilities of advanced internet technologies, smart mobile devices, and the growing free amount of digital learning materials available on the web for distance education, it will be easier than ever before in the past for the 21st century learner to freely access data, scientific information and knowledge. However, in order to enhance meaningful student learning outcomes and to direct the learning process, it is still the responsibility and the accountability of the course builder to apply best practice in educational design. Utilizing PBL in distance and mobile education is just one approach for achieving this.
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