PROBLEM-BASED LEARNING: DIVERSITY AND FLEXIBILITY OF STUDENTS’ EXPERIENCE

E. Misiūnaitė – Bačiauskienė
Kaunas University of Technology (LITHUANIA)

Abstract
Postmodern discourse treats the current conceptual confusion as a sign of a contemporary super complex world. This conceptual confusion penetrates the "pure" shape of the university, affects its strategies for action, forms, and curriculum. In the context of the powerlessness of traditional educational paradigms, universities try to conceptualise novel techniques of knowledge construction. Problem-based learning (PBL) strives to respond to the intellectual needs of the creative society, i.e. to enable a personality to function in society together with others, despite mental chaos, ethic gaps and excess opportunities. The research on problem-based learning reveals the complexity and contextuality of the PBL phenomenon arising not only from the philosophical paradigm, conceptual problem-based learning attitudes, but also from its application context (study field, interdisciplinarity, etc.). The aim of this research is to reveal the essential PBL experience of students in constructing an interdisciplinary knowing. Qualitative data is collected from anonymous written reflections of the surveyed students depicting their everyday PBL experience, construction of new knowledge and its change in different learning stages. Students' written narratives represent one PBL cycle the aim of which was to perform a particular module task. Different borderline PBL experiences highlight a multidirectional search for the relations among different ideas, concepts, theories and methods.

Keywords: problem-based learning, experience of problem-based learning, interdisciplinary knowing, interdisciplinary learning, higher education.

1 INTRODUCTION
Postmodern discourse treats the current conceptual confusion as a sign of a contemporary super complex world. This conceptual confusion penetrates the "pure" shape of the university, affects its strategies for action, forms, and curriculum. In the context of the powerlessness of traditional educational paradigms, universities try to conceptualise novel techniques of knowledge construction. PBL strives to respond to the intellectual needs of the creative society, i.e. to enable a personality to function in society together with others, despite mental chaos, ethic gaps, and excess opportunities. The present research on problem-based learning reveals complexity and contextuality of the PBL phenomenon arising not only from a philosophical paradigm, conceptual PBL attitudes, but also from its application context, such as study field, interdisciplinarity, and other.

Postmodern thought has highlighted the expression of exclusive dichotomy in education: individualization and socialization, reality and simulation, teaching and learning. [1] PLB has been grounded in the following incongruities: student’s self-directed learning is being integrated into group learning which is a part of social interaction; students work together, analyzing and solving genuine contextual or simulated situations under the supervision of a tutor who, subduing his/her epistemological authority, observes the learning process, its development, and stasis. Dolmans argues that "modern insights on learning emphasise that learning should be a constructive, self-directed, collaborative, and contextual process". [2]

Initially, PBL was not a learning method; it was introduced as a philosophical perspective which would re-structure student-centred curriculum in higher education, interdisciplinary learning, and lifelong learning. [3] PLB helps students create both their learner identity and the meaning of learning; it allows experienced situations, which are likely to be encountered in working environments. [4] In general, a PLB is understood as a set of integral principles, presupposing a certain educational approach which interpenetrates the whole curriculum. [5] In addition, a PLB is closely related to the Learner Centred Ideology which views learning as a construction of authentic meanings and implications. It takes place during the interaction of an individual and his/her physical, intellectual, and social environments. Therefore, the creation of learning contexts, environments, and groups lies at the heart of such learning. [6]
In the present research, PBL is defined as tutor-empowered student learning, related to both individual work and collaboratively in small groups, where learners apply analytical methods for solving contextual real life issues of different types, complexity, or structure. In this way, they create interdisciplinary problem solving scenarios. Savin-Baden argues that the PBL model, enabling interdisciplinary knowing, empowers students to overcome gaps among “know-how”, “know-what” and the knowledge on different subjects. [7]

Interdisciplinary teaching and learning have not been related to any set of unique educational methods. [8] This type of learning integrates knowledge from varied sources and experiences. It applies different theories to the analysis of practices and it relates problems to multi-layered confused contexts. The current research deals with the concept of interdisciplinary environment, where a learner finds himself/herself in touch with problems from different fields and is affected by learners’ prior knowing, experiences, and values. This environment enables interdisciplinary knowing construction of an individual and a group.

The interdisciplinary approach to learning focuses on the methodologies, interpretive tools, and language of several disciplines on a central problem, issue, or theme. [9] The Structure of the Observed Learning Outcome by Biggs and Collis [10, 11], or SOLO taxonomy, can be meaningfully related to interdisciplinary [9] and PBL, when we aim at the gradual advancement in metacognitive skills, critical thinking, and personal epistemology. Interdisciplinary PBL "contributes to a personalized integration and assimilation of knowledge, transferable to other contexts, issues, or problems." [9]

Boix Mansilla states that cognitive processes involved in interdisciplinary integration have proven difficult, as "interdisciplinary synthesis can only be observed through manifest communicative efforts" [12] (a reflection on learning). Integration is embedded in complex, often-circuitous investigative processes [13], when describing a problem to be understood, formulating questions, creating theoretical frameworks, combining methods, deploying analytical categories or when gauging the contribution of an interdisciplinary approach. [12, 14] Obviously, "interdisciplinary synthesis embodies a vast array of purposes and disciplinary combinations." [12]

The aim of this research is to reveal the essential PBL experience of students in constructing an interdisciplinary knowing. The investigation has been conceptually grounded in constructivism and social constructionism. Constructivist epistemological considerations appeal to the idea that individuals, due to their unique experiences, create meanings – concepts or mental representations. [15, 16, 17] Then, social constructionism regards knowing to be interactively constructed in social practices, with some practices given the advantage, and others – disadvantage [18, 19]. Taking this perspective, a researcher seeks to identify a distinct notion of the investigated phenomenon, together with varied experiences of reality. [20]

## 2 METHODOLOGY

The present research seeks to reveal learning situations, events, and experiences, crucial for constructing an interdisciplinary knowing, using problem-based learning. The investigation aims at finding out what experiences of PBL are essential in constructing an interdisciplinary knowing. Qualitative data has been collected from anonymous written reflections, produced by the surveyed students who depicted their everyday PBL experience, the construction of new knowledge, and its shift along different learning stages.

**Case study.** The investigation relies on the case study theory by Stake and Merriam. [21, 22] The target respondent pool (n = 16) has been comprised of university students in Social Sciences who had taken an experimental course, using the method of the PBL. Qualitative data have been provided by their written reflections (learning diaries); the data have been analysed and interpreted by applying the qualitative content analysis method. [23, 24, 25]

The case study by Stake has been adopted in this work to assure homogeneity of a philosophical stance in the research. From a Stakian viewpoint, constructivism and existentialism (non-determinism) should be the epistemologies which orient and inform qualitative case study research, since “most contemporary qualitative researchers hold that knowledge is constructed rather than discovered.” [21] Qualitative case study researchers are interpreters and gatherers of interpretations who construct and render new meanings. A researcher interprets the reality, revealing diverse attitudes towards the object researched, placed in certain contexts. Stake claims that qualitative research focuses on a thorough understanding of complex interrelationships among the elements in the phenomenon’s
internal structure, or between the phenomenon researched and its context(s); it does not aim, however, at determining causal relationships. [21]

Stake advocates an interpretive case study of flexible design which allows the researcher change selected methodological decisions in the course of research, at the same time, keeping the research problem and research questions. Cronbach considers a case study to be interpreted in context. [26] Stake asserts that research problem is the conceptual structure which makes the researcher focus on the complexity and contextuality of the investigated phenomenon. [21] Observable facts or events relate to numerous random actions, the understanding of which directs the researcher to different contexts – those of time, space, personal, social, cultural, and the likes. [21] A case study pursues unique complexities and commonality of the case. [21]

Merriam argues that the epistemology, which should orient qualitative case study, is constructivism; she maintains that the key philosophical assumption upon which all types of qualitative research are based is the view that reality is constructed by individuals who interact with their social worlds. [22] The reality under investigation is not fixed or objectively situated; there are numerous interpretations of reality. [22] This philosophical stance implies that the researcher is primarily concerned with knowledge and meanings, individually constructed by people. [27]

Stake does not specify when data collection and analysis should start and end in qualitative content analysis. [21] The researcher can concentrate on one case per day, or one per year, since the length of research is determined by the phenomenon itself, by problem questions, or participants, to mention just a few. The present investigation took place in September 2016 through January 2017. The research aims at, firstly, revealing the process of constructing an interdisciplinary knowing in the practice of PBL, secondly, at disclosing different individual and group learning situations, scenes ranging from "active" to "stagnant", to "non-operating", and, thirdly, at showing diverse events and experiences. This interdisciplinary study module lasted for four months and embraced an integrated PBL model - lectures and seminars combined with problem-based learning. With the application of PBL in this case, the main learning task had to be completed in four weeks. The students had to transform a static learning environment, housing an exposition about the circus, into an interactive learning environment for a selected target audience. They also had to consider the contexts of this particular museum and the Old Town, where the museum was located. Then, students participated and interacted in a theoretical lecture on PBL; after that, they had a practical seminar for applying the method to solve the given interdisciplinary problem. The learners had to reach mutual agreement about the time and place for their study, they had to choose a group discussion moderator. The tutor consulted students both directly and virtually. Students could address the tutor individually or as a group. Learning results were assessed individually and in groups. To reach the aim of the research, written reflections (learning diaries) were introduced, where students could freely express their views without researcher’s participation.

Research participants. The concept of qualitative case study defines neither strategies, nor procedures, nor sources of social information for collecting the qualitative data. [21] Upon the initiation of the case study, the researcher is usually unaware of the number of research participants in the case; scholars point out that a specific number is not even important, as research representativeness is not a goal.

In the opinion of Merriam, the researcher should begin with purposeful sampling, selecting a target respondent group, and later he/she can apply theoretical sampling. [22] Purposeful sampling provides the researcher with more comprehensive data about the investigated phenomenon. The present research targeted a respondent pool (n = 16) of Social Sciences Master’s 1st year students at one Lithuanian university. It applied the written reflection method. The students were taking an innovative course which used the interdisciplinary PBL method (Table 1).

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Gender</th>
<th>Age</th>
<th>Bachelor’s study program Majors</th>
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<tbody>
<tr>
<td>University students of Social Sciences (1st year Master’s studies), taking an experimental course and studying according to the PBL method (n = 16)</td>
<td>Female (n = 16)</td>
<td>22 – 25 yrs. (n = 13); 35 - 41 yrs. (n = 3)</td>
<td>English philology, Lithuanian philology, History, Geography, Preschool and primary school education, Management, Social work, Social pedagogy</td>
</tr>
</tbody>
</table>
Consequently, research data has been collected from students who regarded this course as an innovation. Most likely, these students are a reliable source of getting information on interdisciplinary knowledge formation with the help of a new learning method.

**Research methods.** Case study does not require any specific methods of data collection or analysis. [22] In this research, the data was collected from student reflections on PBL [28] and analysed applying qualitative content analysis. [23, 24, 25]

Stake does not indicate any particular moment when data collection should begin and how the analysis should be implemented. Before entering the research field, the researcher of the present paper had not prepared any structured research plan, as would be required in the view of Yin [29]. Scientific investigations support the idea that the researcher, driven by an initial informal impulse, decides upon the necessary sampling size “in an impressionistic way”. [21] Therefore, Stake’s understanding of “legitimate” data is much broader than Yin’s [29]; he refers to researchers “sensitivity and scepticism” which help collect the right amount of data. [21] Whereas Merriam claims that researchers need certain techniques and procedures for data collection to ground qualitative research legitimacy. [22]

**Data collection.** To collect qualitative data, this case study research relies on semi-structured written reflection, [28, 20] anonymously produced by research participants who described personal daily experiences in PBL as well as the emerging new knowing and its alternations during different learning stages. Research participants were issued recommendations on diary writing, specifying writing intensity and suggesting three groups of questions to stimulate reflection. Reflective students’ diaries covered one cycle of PBL, devoted to the completion of a definite task. In the course of writing diaries, students were not consulted additionally.

<table>
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<tr>
<th>Basic rule</th>
<th>Questions to stimulate reflection</th>
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<tr>
<td>A diary entry is to be produced after each group meeting (date to be marked) and is to accompany every instance of individual learning (date to be marked).</td>
<td>What are the difficulties and discoveries I daily experience (related to the task, to group work, to PBL, to knowing/not knowing, to procedures of what/how is to be done, etc.)?</td>
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<tr>
<td></td>
<td>What were the changes in my personal and group understanding of the task and its separate elements, contexts, individual and group learning, etc.? What knowledge – the possessed and/or newly established – determined this change?</td>
</tr>
<tr>
<td></td>
<td>During which learning stage a new multidisciplinary and/or interdisciplinary attitude to the problem, its contexts, and implementation scenarios started developing? What was most embarrassing and/or was helpful in knitting together minds and knowledge?</td>
</tr>
</tbody>
</table>

16 written learning reflections were submitted by 16 research participant to the researcher in this project.

**Data analysis.** Research strategy and techniques of data analysis, chosen by the researcher, are usually determined by the specific research aims. For the analysis of qualitative data, this particular research has chosen the inductive qualitative content analysis [23, 24, 25] which helps reveal students’ essential experiences in interdisciplinary PBL.

The primary purpose of the inductive approach “is to allow research findings emerge from frequent, dominant, or significant themes, inherent in raw data, without the restraints imposed by structured methodologies.” [24] The application of inductive qualitative content analysis, particularly emphasizes analyzing, first, language characteristics which serve as a way of communication and, second, contents, themes, and contextual meanings. [30] Qualitative content analysis allows the classification of large texts into categories, representing similar meanings. [31] Meanings of the text can be either directly articulated or decoded during text analysis, in total or in part. [30] Qualitative content analysis also enables the assay of interrelations among the identified major categories, noticed and recognized by the researcher, with the benefit of revealing research object’s immanent features.

In analyzing qualitative data, the first impression and researcher’s intuition are important. Stake capitalizes on researchers’ impressions as the main source of data and making sense of them as the analysis. [21] Besides, inductive qualitative content analysis requires making certain sense out of data.
which involves consolidating, reducing, and interpreting research data, making meaning, to produce a significant description of the researched phenomenon. Such a view is relevant to the constructivist epistemology. A case study enables the analysis of all qualitative research data as a single entity.

Research ethics. Ethical aspects of this case study are related to the principles of respect towards individual’s privacy, confidentiality, and anonymity as well as voluntary participation in the present research. In the beginning, all the participants were introduced to research aims and data protection issues. Specifically, the researcher was pointed out to be the only person to access the data, used for scientific purposes only. Research participants were given time to make a decision to participate; they were also informed about the possibility of withdrawing at any time. Each participation agreement was signed in written. During the research, open environment was created not only for facilitating free expression of ideas, emotions, and feelings, but also for not revealing them. Every respondent’s authentic experience was to be respected.

Anonymity was safeguarded, and participants were provided with pseudonyms. Describing the research data, no mention of the university, or the study program, or teacher names were granted.

Trustworthiness of the research. Lincoln and Guba note that the trustworthiness of the qualitative research is secured by following the criteria of credibility, dependability, confirmability, and transferability. According to Merriam, credibility deals with the question: “How congruent are the findings with reality?” Research credibility has been supported by the procedures of qualitative inductive content analysis by the congruence between research participant selection and research questions. In particular, research credibility is made certain by the fact that the researcher did not directly participate.

What concerns the criteria of research dependability, the investigation has aimed at describing in detail the contexts of constructing interdisciplinary knowing/knowledge as well as depicting unique learning situations. Besides, the procedures of data collection and analysis were revealed. Research confirmability in the present case means supporting research results by quoting authentic reflections of the participants. The transferability of research results and conclusions has been complicated due to the contextuality of the data and research outcomes. A detailed context description implies the possibility of research result application in similar contexts. As Merriam notes, qualitative investigation focuses on holistic, versatile and changing reality, and not on separate stable and objective phenomena which waits to be discovered, inspected, and measured. Therefore, the qualitative analysis of research data is to be detailed and persuasive. The present paper, actually, aims at such a description.

3 RESULTS

In qualitative research, different research phases (data collection, data analysis and the presentation of findings) are often not distinct, but merge with each other. One of the strategies for describing and illustrating research findings in qualitative style is using text matrices. Students’ ‘voices’ are central to the understanding of essential PBL experience in constructing interdisciplinary knowledge.

3.1 The essential PBL experience of students in constructing an interdisciplinary knowing

In the analysis of written reflections, two main categories emerge. They characterize essential PBL experiences within the investigated group during the process of interdisciplinary knowing construction. Those are the diversity of learner identity and the flexibility of managing complexity.

3.1.1 Diversity of learner identity

In the PBL process, students experience diversity of learner identity. The core of this category includes the following sub-categories: self-awareness, prior experience, voice(lessness), self-advocacy, and a person-centred challenge (Table 3).
Table 3. The essential PBL experience in constructing an interdisciplinary knowing: diversity of learner identity.

<table>
<thead>
<tr>
<th>Diversity of learner identity</th>
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<tbody>
<tr>
<td><strong>Self-awareness</strong></td>
<td><strong>Prior experience</strong></td>
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<tr>
<td>&quot;I am an individualist, a lone wolf, but I managed to click with the group. Group work was not too difficult, since all group members have been ready to search for scenarios to solve problems; of course, that depends on everyone’s learning style.”</td>
<td>&quot;When studying in a group, our different experiences and the ability to create a personal learning environment have had huge importance.&quot;</td>
</tr>
<tr>
<td>&quot;During the meeting with group members I realized that each group member’s work style is completely different; therefore, it’s difficult sometimes to blend or defend ideas.”</td>
<td>&quot;I have realized that it’s not possible to avoid the pressure among group members. Sometimes there is too much speaking, and sometimes – too much emotion. Some effort had to be put in an attempt to understand other person’s position, in trying to see the problem assignment through the eyes of another person. Also, every member’s unequal share in our common work hard to be accepted. Everyone’s experiences, brought into a common space, had to be acknowledged. Problems, which people are sometimes unable to overcome and load on their fellows, had to be admitted.”</td>
</tr>
<tr>
<td>&quot;I have always preferred working individually, but I realize that group work is a valuable experience which helps me develop such qualities as the ability to discuss, hear other people’s opinion, or seek a compromise.”</td>
<td>&quot;My participation in group discussion was not of quality. I haven’t been feeling ready for it, since I had not seen the museum environment and it was difficult to discuss features of the learning environment that was being created. While my colleagues were sharing their observations, I had to take down concepts and definitions for further investigation.”</td>
</tr>
<tr>
<td>&quot;I don’t like when my ideas are rejected.”</td>
<td>&quot;The investigation of circus applying the approach of semiotics appeared to be interesting, even though I did not voice this during the discussion. The major reason was that I had not studied the book thoroughly. The overview of a few chapters was not enough for me, and I failed to reveal this information to my group.”</td>
</tr>
<tr>
<td>&quot;Intuitive contemplation is my feature which allows me to feel the knowing, arising from the depth inside; later, however, I still have to cover a quite complicated path to find and substantiate such knowing of mine.”</td>
<td>&quot;There were certain clashes of ideas we flounced about; some of us kept silent, not even trying to look for the light in the tunnel. Person X wanted to persuade everyone without any perception filter or assimilation of other ideas.”</td>
</tr>
<tr>
<td>&quot;It’s somehow funny to look at my own learning and ask myself, how I really learn.”</td>
<td>&quot;I was constantly trying not to depart from a detailed plan I had prepared. I also took care of time management and I observed other colleagues speaking, controlling their talks not on the topic. I was trying to do this in a polite way and not to offend anyone. In my opinion, this instance of PBL was intense, useful, planned, and well directed.”</td>
</tr>
<tr>
<td><strong>Voice(lessness)</strong></td>
<td><strong>Self-advocacy</strong></td>
</tr>
<tr>
<td>&quot;When studying in a group, our different experiences and the ability to create a personal learning environment have had huge importance.&quot;</td>
<td>&quot;The first impression was that PBL was some kind of “space”, a black hole, about which I have never known anything.”</td>
</tr>
<tr>
<td>&quot;I have realized that it’s not possible to avoid the pressure among group members. Sometimes there is too much speaking, and sometimes – too much emotion. Some effort had to be put in an attempt to understand other person’s position, in trying to see the problem assignment through the eyes of another person. Also, every member’s unequal share in our common work hard to be accepted. Everyone’s experiences, brought into a common space, had to be acknowledged. Problems, which people are sometimes unable to overcome and load on their fellows, had to be admitted.”</td>
<td>&quot;I didn’t like the task itself, as I don’t like the circus; I have never seen any sense in getting interested, therefore, I had to force myself and bite on the bullet.”</td>
</tr>
<tr>
<td>&quot;The investigation of circus applying the approach of semiotics appeared to be interesting, even though I did not voice this during the discussion. The major reason was that I had not studied the book thoroughly. The overview of a few chapters was not enough for me, and I failed to reveal this information to my group.”</td>
<td>&quot;There were issues on the very first day, therefore, I was not sure what to begin with. There was much information in the task introduced, and it was easy to get confused. Therefore, I decided to read the slides carefully and complete everything point-by-point’.”</td>
</tr>
<tr>
<td>&quot;There were certain clashes of ideas we flounced about; some of us kept silent, not even trying to look for the light in the tunnel. Person X wanted to persuade everyone without any perception filter or assimilation of other ideas.”</td>
<td>&quot;Learning at home caused much problem, since it took a lot of time to understand and go into the tasks. Some places were inextricable in phrasing which prevented me from understanding and seeing into the tasks. I had difficulty in finding valuable scientific literature sources.”</td>
</tr>
<tr>
<td>&quot;I was constantly trying not to depart from a detailed plan I had prepared. I also took care of time management and I observed other colleagues speaking, controlling their talks not on the topic. I was trying to do this in a polite way and not to offend anyone. In my opinion, this instance of PBL was intense, useful, planned, and well directed.”</td>
<td>&quot;Unfortunately, the group could not be over persuaded.”</td>
</tr>
<tr>
<td>&quot;The first impression was that PBL was some kind of “space”, a black hole, about which I have never known anything.”</td>
<td>&quot;The whole task has been a single torture; this chaos does not elicit any positive emotion; I am completely dissatisfied with myself. When we get together, we just look at each other expecting someone tell what to do.”</td>
</tr>
</tbody>
</table>

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Qualitative research data reveal the diversity of students’ “critical reflexivity”, i.e., the capacity to recognize their own PBL experiences and contexts which are usually fluid and changing. [36] When interpreting the category of *diversity of learner identity*, it is obvious that interdisciplinary PBL induces cognitive conflict within students, leading to conceptual change, and helps ‘make sense’ for themselves. [4]

### 3.1.2 Flexibility of managing complexity

The *flexibility of managing complexity*, experienced by the students in the PBL process, is summarized in four underlying sub-categories: learning a new language, sharing discourse, synthesizing knowledge, and ‘taming’ complexity (Table 4).

**Table 4.** The essential PBL experience in constructing an interdisciplinary knowing: flexibility of managing complexity

<table>
<thead>
<tr>
<th><strong>Flexibility of managing complexity</strong></th>
<th><strong>Learning a new language</strong></th>
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<tbody>
<tr>
<td><em>“Each group meeting is like a snapshot of a moment in time. Each time you learn anew; you learn new words or concepts which you never knew before. For instance, a learning environment, a museum, a circus, the Old Town. You learn to read other people’s faces and to find out how they accept your ideas. You learn to tell what’s on your mind, making sure the listeners accept these ideas as their own ones. Otherwise, we wouldn’t be able to understand each other.”</em></td>
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<tr>
<td><em>“Each group member had different visions of work and diverse problem solutions, emphasizing a different angle. I was more interested in a legal approach to the problem, another member – in a historical, still another – in social. Such a variety gave us a possibility – to each of us individually and to the group – to consider a few main spheres, related to a possible solution; it showed the issues we still had to investigate in order to create a relatively sound scenario and reach the goal.”</em></td>
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<tr>
<td><em>“It is difficult to grasp and collect who said what during the discussion – this makes me mad; we are not used to such a format, but group sharing allows us to notice things we wouldn’t think of ourselves (e.g., the contexts of the problem). Varied (though not necessarily correct) opinions of other members helped us formulate a general idea.”</em></td>
<td></td>
</tr>
<tr>
<td><em>“I realized, this was a useful method, because every member has had some ideas to suggest which later appear to be interesting and unique.”</em></td>
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<tr>
<td><em>“I have changed my attitudes towards the circus. I started viewing the exposition with a negative attitude, as circus has not been my favorite things; to say more, I hate clowns. However, an interesting narrative of the tour-guide, the exhibits observed, circus properties, photos, books, video materials made me change my attitude towards the circus. Circus appeared to be a multipartite object, bearing the meaning of entertainment, art, sports, and celebration.”</em></td>
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<tr>
<th><strong>Sharing discourse</strong></th>
<th><strong>Learning a new language</strong></th>
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<tbody>
<tr>
<td><em>“When creating a learning environment, we investigated the history of circus, sociology of the company (life and travel in circus trucks), application of the laws of physics in performing tricks, the techniques, animal wellbeing (care and training), needs of museum visitors, marketing ‘operation’ of the Old Town. It was difficult to put separate pieces together - to knit all into a coherent and meaningful whole. It seems that you can’t just take it and stitch together as if it were a piece of cloth, but when you try and do something, what you get is something new, resembling a patchwork – made of different shapes and pieces, tacked together and multilayered.”</em></td>
<td></td>
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<tr>
<td><em>“I have realized that the available common context, combining all fields of the problem, helps approach effective solutions to the problem. It is important to link all the information and to know the combination system. This helps sort out the criteria, problematic issues, and the places to correct.”</em></td>
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PBL is a method of direction and structure, similar to road signs, to make you stay on your main road, not to go too far afield."

"My basic discovery was noticing the development of concepts, stemming from one branch, the major concept; but it took time to interpret and conceive some of them. The concepts looked very similar, but they were composed of different elements. I realized that in order to solve the problem, it is necessary to single-out specific concepts and know a few definitions to each; this would allow forming a general picture and, alter, creating a meaningful text. It was easier to realize the direction of a deeper problem analysis and to see the emerging contexts. I tried to consider the explanation of concepts as a supplementary element of the work."

"I realized that PBL was complex, and the deeper one investigates it, the more intricate and confusing it gets. Therefore, it is important to clearly and critically evaluate some of the suggestions. It is important to comprehend what really deepens the solution, and what just wastes time. It is important to reject even your own ideas (which is sometimes difficult, as they seem to be relevant in the beginning of the process)."

"We attempted to eliminate negative stereotypes, therefore, we tried hard to find a scientific approach towards the circus and the museum, and to discover a method to connect separate ideas into an entirety."

"During the last stage of PBL, a much deeper approach towards the problem, its contexts, and solutions was set. Maybe, by that time, we had overcome the resistance and had tamed PBL as if it were a weird animal?"

Interdisciplinary PBL is built on the integration of learning into the contexts of complex problem solving. These contexts provide students with the possibilities of developing flexible and reflexive thinking and the understanding of how various facts, concepts, processes, relate to specific problems, how problems are submerged into multilayered contexts. Students have to construe the PBL process flexibly and creatively; they have to regard it as individuals and collectively exchangeable, serving as an emancipating tool for thought, and not stagnant in legitimized forms. Different borderline PBL experiences highlight the multidirectional search for the relations among different ideas, concepts, theories, and methods.

3.1.3 The key challenge of interdisciplinary PBL

As PBL is multiplex and constantly changeable, any piece of qualitative research can only present a snapshot of a moment in time. The results of the present research are contextual, therefore, they can only be interpreted within the frame of a university student group which considers PBL an innovation. Besides, this piece is a part of wider research on interdisciplinary PBL, which embraces other qualitative research methods, such as interview, observation, and others.

The question arises – what is the relationship between the two essential categories, denoting students’ PBL experiences in the process of an interdisciplinary knowing construction, identified in the present research, namely, between the diversity of learner identity and flexibility of managing complexity. Students encounter the essential challenge of interdisciplinary PBL: (i) should they bracket or open their own dissimilarity, so that the group could manage its natural complexity? At the same time, (ii) how to keep the value, generated by authentic learner divergence, which enables synthesizing group thoughts or constructing a meaningful problem-based scenario, based on interdisciplinary knowing. The experiences of interdisciplinary PBL intervene between two antinomies – contradictions of the diversity of learner identity vs. a search for group unity, and the flexibility of managing complexity vs. cognitive dissonance, which arise due to diversity and complexity. Some authors view PBL as a tool helping students “learn with complexity, see that there are no straightforward answers to problem scenarios, but that learning and life takes place in contexts, contexts which affect the kinds of solutions that are available and possible”, and also help manage the personnel as well as learning challenges. [4] However, the issue remains multifaceted.

4 CONCLUSIONS

Students’ voices are central to the understanding of essential PBL experience in constructing interdisciplinary knowledge. The data from qualitative research reveal the diversity of students’ capacity to recognize their own PBL experiences and contexts which are usually fluid and changing. Students experience a fundamental challenge which lies along the interdisciplinary PBL. Students either need to bracket and/or disclose the authentic difference of each learner so that the group is able
to manage the inevitable complexity, but doesn’t lose the value, provided by this distinction, when building interdisciplinary knowing. The experiences of interdisciplinary PBL step in between the contradictions: the diversity of learner identity vs. a search for group harmony, and the flexibility of managing complexity vs. cognitive dissonance, upsurging because of the existing diversity and complexity. Different borderline PBL experiences highlight a multidirectional students’ search for the relations between different ideas, concepts, theories, and methods so that they could avoid cognitive dissonance and would tame the complexity.

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