Journal of
Problem Based Learning
in Higher Education

VOL 13 • 1

Vol 13, No. 1, 2025 – Page 1-24
doi.org/10.54337/ojs.jpblhe.v13i1.11015

Creativity in Higher Education

Finding the Problem in Problem-Based Learning

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Abstract

This article explores *problem finding* as a lens to highlight creativity in problem-based learning (PBL) in higher education. By discussing two empirical examples from two social science and humanities educational programs at Aalborg University, Denmark, a Deweyan, experiential learning approach is put into play with socio-cultural and socio-material learning perspectives to explore how materials may support students' critical-creative problem inquiry.

The empirical analyses point to new insights for creativity in PBL as requiring students to build a certain basis of critical judgment to *find problems*, that is, competences to explore and question social and societal conventions, norms, and taken-for-granted worldviews, including those independent of the predefined objectives of their educational quests. The article points to the potentials of integrating materials and metaphors in PBL-project and group work to explore PBL and critical creativity as interconnected and, in some respects, mutual prerequisites for PBL in higher education.

Keywords: Problem-based learning; problem finding; creativity; critical thinking; imagination; materiality in education

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Received 4 November 2025 | Accepted 11 December 2025 | Published 16 December 2025

Introduction: from reproduction to production of knowledge

Since the 1960s, problem-based learning (PBL) has been widely acknowledged as a student-centered pedagogical approach in higher education that supports active learning, critical thinking, and the application of disciplinary knowledge in authentic contexts (Hmelo-Silver, 2004; Savery, 2006). PBL was a paradigmatic shift from teaching methods focused on the reproduction of existing knowledge through memorization and tests, toward forms of learning that emphasize active engagement, inquiry, and problem solving. In other words, the production of knowledge through learning (Savery, 2006). In its original form, PBL challenged the norm of students sitting in the classroom as passive recipients of disciplinary or theoretical content (Thomassen & Stentoft, 2020). Instead, students were encouraged to engage in authentic, open-ended exploration, simultaneously developing a personal and contextual relationship to knowledge. A task such as "How can we reduce plastic waste at our university?" situates disciplinary understanding within a well-known context for the students, while prompting them to explore theories and concepts through engagement with a real-world phenomenon.

This engagement is not solely disciplinary or conceptual, but also experiential. It requires students to explore and specify what constitutes *a problem* in the first place, and how disciplinary, theoretical perspectives shape what can be seen and acted upon. Engineering students, for example, may define plastic waste as a technical challenge focusing on materials and systems, while students from sociology, psychology, or philosophy may frame it as a question of cultural practice, organizational structure, or behavior change (Kolmos, 2017; Telléus, 2019). The PBL process thus becomes a question of both disciplinary and personal *judgment* for the students. Moreover, it is unpredictable, and it is creative, as we shall see in the following.

However, in the current educational culture of competition, performance, and time pressure, students are increasingly socialized into understanding learning as a competency to adapt to pre-formulated learning goals and curricular logics of fulfillment and mastery of canonic content (Jensen et al., 2022). The learning process is expected to be smooth, swift, and provide a clear basis for comparison with other students (Mackenzie & Olsson, 2023; Papageorgiou & Kokshagina, 2022). This educational culture places pressure on PBL to adapt to a goal oriented pedagogical approach that may obstruct some of its explorative foundations.

Problem finding: an overlooked and creative learning resource?

Creative production of new knowledge is emphasized as central value when working with PBL in a higher education context (e.g. Hansen & Bertel, 2024; Jensen, 2019). However, PBL is mainly framed as a means of fostering students' abilities to *solve* complex, real-world problems through collaborative project group work involving inquiry and (theoretical) reflection (Engen et el., 2018; Telléus, 2019). The extensive body of research documenting the pedagogical benefits of PBL tends to overlook, to some degree, the process of problem *finding* (exceptions are, e.g., Jensen & Lund, 2016; Thomassen & Stentoft, 2019; Wakefield, 2003). According to Jensen and Lund (2016), this may be a consequence of the adaptive educational thinking mentioned in the introduction, because problem finding concerns how students explore, conceptualize, frame, define, and redefine the problems that are the centerpiece of the whole collaborative problem-solving process. The ability to identify and construct meaningful problems and solve them is, however, not necessarily a smooth process, but rather one that forms the basis for learning that builds the judgment and competences necessary to think critically (Beghetto & Kaufmann, 2014; Jensen & Lund, 2016; Thorndahl & Stentoft, 2020). The capacity to identify and formulate problems also reflects students' level of disciplinary understanding and the transformative potential of working with disciplinary knowledge to process the problem identified (Scholkmann et al., 2023). If students' problem-finding process is cultivated, they are supported in producing new knowledge rather than reproducing already existing knowledge, in other words in *being creative* through PBL (Beghetto & Karwowski, 2019; Runco, 2019; Sternberg, 2018).

Research question

If it is in the problem-finding process that students engage in critical reflection within and between disciplines, it is a vital educational task to support creativity in PBL. This requires us to embrace the ambiguity and emergence that are some of the consequences of open, student-led inquiry processes. PBL's ambition of teaching students to apply disciplinary content and concepts to solve problems should therefore be accompanied by teaching them how to find, identify, and formulate disciplinary and societal problems worth both exploring, examining, and solving. Based on this, this article therefore addresses the following question:

> *How might creativity be a fruitful lens through which the processes of problem finding and problem solving may be framed in teaching in HE?*

To answer this question, I start with two empirical examples from my teaching practice at two different educational programs within the Faculty of Social Sciences and Humanities at Aalborg University. The examples are put into play with an experiential learning perspective as a foundational basis for my understanding of PBL involving creativity (e.g., Dewey, 1980, 1988), supplemented by theoretical concepts from socio-material pedagogy (e.g., Fawns, 2020) and socio-cultural learning theory (e.g., Bruner, 1996).

Theoretical framework: experiencing through problem finding and problem solving

Many of the approaches to PBL discussed above were developed within the field of psychology or sociology of learning rather than within pedagogy. They have provided valuable insights into how learning is linked to individual and social thinking processes and to teaching. In the following, however, I suggest a deeper exploration of pragmatistic takes on creativity. Although pragmatist thinkers, first and foremost John Dewey, have been the basis for much of the original development of PBL as a pedagogical approach, creativity as related to PBL has not gained as much attention as learning. As Petersen (2024) argues, "in contemporary discourse, PBL is predominantly tied to what Dewey argued against, namely extraneous aims" (p. 1). I am inspired by Petersen's critique of contemporary PBL research as taking Dewey's ideas into account for a rather instrumentalist, problem-solving take on PBL as my basis for taking up his ideas today. In this article, I concentrate on Dewey's ideas about finding problems through critical inquiry before solving them as a way to re-think the creative powers of PBL in contemporary higher education and work toward what Petersen attributes to Dewey as thinking education as a value in itself: "PBL as a form of education 'worthwhile in its own immediate having' (p. 109)" (Petersen, 2024, p. 1, citing Dewey's *Democracy and Education*).

Dewey and creativity

John Dewey was one of the first philosophers of learning to talk about creativity in the same breath as learning processes (Dewey, 1979, 1980, 1988). In his 1930 Milton Judson Davies Memorial Lecture, *Construction and Criticism*, at the Institute of Arts and Sciences, Columbia University, Dewey (1930/1988) presented creativity as being closely - in fact, inseparably, linked to learning and learning processes in education. He did not view creativity as the result of learning processes, but rather as an integral part of the experiential learning processes of both children and adults. He saw creativity in light of his fundamental idea that learning processes are closely connected to the

identification and solving of both practical and conceptual *problems* (Jensen, 2015, pp. 150–151).

According to Dewey, a problem arises when the student experiences a discrepancy between what she has previously understood, encountered, and been familiar with, and what she experiences in the current situation (Dewey, 1979). This situation poses a problem that encourages her to find out what this discrepancy is about – in other words, to understand the nature of the problem. This process relates to the student's efforts to explore and to discern components of the problem, and this exploration of the problem (problem finding) forms the basis for arriving at a meaningful problem formulation, which in turn is a prerequisite for ultimately changing and learning. In this explorative process, creativity plays a crucial role in how the student creates new understandings of something previously familiar or experiences something entirely new and forms a new insight, a "problem solution" (Dewey, 1979).

Creativity, problem finding, and PBL

What is particularly interesting in relating Dewey's concept of creativity to PBL in higher education is that he did not view problem exploration solely as a mental process, but as a concrete investigation of the surrounding world through the body, senses, and experimental actions in interaction with the physical, material, social, organizational, and educational environment (Dewey, 1988; Dewey & Bentley, 1991). Creativity thus serves as much more than a motor to thinking; it is a vital way to activate students' experiential processes, both by relating to previous experience and learning, and by being involved in finding the problem around which the PBL process evolves. This is in line with several educational researchers within the field of PBL, who focus on the explorative, creative, and critical aspects of PBL in higher education (Jensen & Lund, 2016; Thorndal & Stentoft, 2020). How creativity creates a bridge between theory and practice may also be one way to look at creativity in a problem-based approach to education. Creativity in Dewey's understanding entails a way of teaching and learning that involves *the practical* in the form of some kind of empirical material, along with *the conceptual* in the form of theory and/or philosophy (Scholkmann et al., 2023).

Dewey, criticism, and constructivism

One might, however, still ask whether the most fundamental parts of Dewey's understanding of creativity are encompassed by the concept of PBL in a modern Western university setting—namely, *critical inquiry* (Dewey, 1988). I raise this question because Dewey's normative and ultimate errand in emphasizing creativity in learning processes is the very reflexivity, independent judgment,

and discernment that students may develop in creative processes. As mentioned, when creativity becomes a vital component of student learning processes, their capacities for *critical exploration and thinking* are brought into play and nourished, in interaction with *constructive imagination*, where creativity plays a role in imagining a better way to act or understand the world. However, critical thinking and constructive imagination may be "dangerous" in an educational approach where students are expected to comply with more or less predefined competence goals and perform in accordance with absolutist grading systems. These dangers relate to the fact that creativity has two dimensions – the problem finding and the problem-solving processes. Both may challenge different states of status quo:

1. Problem finding and critical thinking. The development of students' independent judgment depends on whether the educational environment offers students opportunities to think critically. Critical thinking is not just about "wondering"—it is about acquiring competences to question what is culturally given and taken for granted, such as power structures, conventions, and norms, both in society and in university disciplines (Dewey, 1979, 1988). These critical aspects are deeply involved in the explorative process that leads to "finding" the problem to be solved in a PBL process.

2. Problem solving and constructive imagination. If critical thinking is made possible, students' independent judgment forms the basis for them to constructively imagine new actions and new ways of perceiving the world as solutions to the problem found in the first place. Constructive imagination is also in play when students solve problems by creating new possibilities for acting, negotiating, and thinking democratically in community with others and the environment (Dewey, 1988). Like problem finding, this process may be critical toward cultural conventions and norms, because a solution might pose a challenge to existing logics, both in society and in university disciplines.

Applying disciplinary content into critical inquiry to find the problem to solve may be the first role of creativity, and then applying disciplinary content to imagine new practices and worldviews to solve the problem found may be the second (cf. Tanggaard, 2019). In short, critical-creative exploration and constructive imagination are vital steps in this problem-finding/solving process in PBL in higher education. In Dewey's sense, putting this understanding of creativity in learning into play in the problem-finding/solving process makes the process inherently explorative (Dewey, 1979). In these explorative PBL processes, students' experience is brought into play in new ways and connected to the theories and disciplines they study (Jensen et al., 2022).

Context, method, and empirical background

To an increasing degree, I have integrated the considerations outlined above into my own teaching since my employment as a PhD student at Aalborg University in 2009. I teach in both the ordinary masters' programs and continuing education for professionals as well as at the PhD level. My specialized disciplinary content is also connected to creative approaches to learning, problem solving, leadership of innovative change processes, and competences to create transformation within organizations. This article's two empirical examples derive from my teaching in the continuing master's program *Innovation and Creative Learning Design* (60 ECTS) and the full master's program *Learning and Innovative Change* (120 ECTS).

Context: Aalborg University

It should be mentioned that PBL is the pedagogical model used at Aalborg University for all educational programs. At Aalborg University, this involves two distinct and fundamental pedagogical principles, namely that (a) students produce disciplinary and interdisciplinary problem-based projects as the core of a module (Engen et al., 2018; Telléus, 2019), and (b) the project work is predominantly carried out in collaborative groups of 2–6 students, often collaborating with local businesses, institutions, and organizations in the region of Northern Denmark (Zhou & Krogh, 2019). Within these two fundamental principles lies a pedagogical PBL approach in which students formulate a problem to explore within their disciplinary field, both through the empirical reality that constitutes the problem and their conceptual understanding of same. These fundamental principles are a prerequisite for understanding the two empirical examples below, where I focus on problem-based *project work* in the first example and *collaborative group processes* in the second. Before presenting the two examples, I briefly outline how I have generated empirical material from my own teaching practice and how I have composed the examples by combining empirical material and theory.

Methodology: my teaching portfolio

My teaching portfolio forms the raw material for researching my teaching practice. It consists of a professional learning diary that includes content such as descriptions, PowerPoint slides, student exercises and assignments, photos and videos from teaching situations, and a logbook with reflections. Methodologically, diary- and log-keeping is a widely acknowledged tool for professional development. Log-keeping both describes and documents activities carried out and methods developed, keeping track of my own professional development and learning (Dysthe & Engelsen, 2011; Youniss,

2011). The log itself, however, is not sufficient for theory development. Aiming to theorize my experience toward broader insights, I have developed a methodology of rigorous selection of empirical documentation and theoretical reflection on empirical practice. This method is inspired by Donald Schön's (1995) reflective practitioner and leans on his categories of knowing-in-action, reflection-in-action, and reflection on action (pp. 22–31). To emphasize the knowledge-generating aspect of using my own descriptions and reflections as empirical material, I draw on Edwards's (2017, p. 8) further development of the reflective practitioner-approach, the concept of *reflection-beyond-action*, which underscores the wider potential of reflection and reflexivity for knowledge production. The concept acknowledges the theorizing potential beyond the concrete, empirical situation by formulating condensed learning examples that can be recognized in other, similar contexts and future situations as conceptual development. and potential theory development.

Thereby, my logs function as any other qualitative empirical material such as interviews, field notes, or observations. To process the empirical material, I have developed a simple analysis tool or matrix that includes Schön's three levels of reflection (Columns 1 and 2) and Edwards's addition (Column 3) to process empirical material (Schön, 1995; also previously described in Jensen, 2016, 2019):

Knowing-in-action and reflection-in-action: Description	Reflection on action: retrospective reflection	Reflection beyond action: Practice development and theorizing

Figure 1. Analytical tool for research in own practice.
Source: Schön (1897), Edwards (2017), and Jensen (2016, 2019).

The column to the left contains "raw data" – that is, my own unedited classroom observations, descriptions, and photos, among others (knowledge-in-action), along with my immediate thoughts in the situation (reflection-in-action). The column in the middle is for (a) interpreting data, (b) condensing meaning, and/or (c) developing themes and categories (reflection on action). The column to the right relates to the two first columns by suggesting theoretical perspectives and concepts that would shed new light on the empirical material and the processing of it beyond the concrete context (reflection-beyond-action).

Empirical material

By means of this analytical tool, my situated observations, descriptions, and photos (among other data) are brought into play with a broader theoretical framework, in this case, a creative-pragmatic learning perspective, as outlined above. In this interplay between raw empirical material and theoretical concepts, my own material on teaching activities, my impression of the students' responses to the activities, and the material and conceptual outcomes of the teaching activities lead to the development of the narrative case examples presented below. The practical and theoretical insights created thereby can contribute to developing knowledge in a broader pedagogical sense, corresponding with Schön's (1995) and Edwards's (2017) understanding of the development of knowledge from practice.

To a wide extent, the use of my own pedagogical considerations, actions, and descriptions as empirical material aligns with an autoethnographic approach (Adams et al., 2015; Rowe, 2017). By emphasizing the context, atmospheres, and actions, the descriptions aim to communicate beyond the concrete context (cf. Edwards, 2017) and create imaginative resonance for other educators working with PBL (Adams et al., 2015). Because students are directly and indirectly described, and their creative learning products are depicted in the article, ethical considerations have been crucial. The descriptions are therefore not only anonymized according to the ethical principles and code of conduct within research developed by the British Educational Research Association (BERA, 2024), but also written with the deepest respect possible toward the students' agency, creativity, and trust in the process (cf. post-qualitative research, e.g. Ahmed, 2006). I have obtained their consent to communicate my observations from the classrooms, and I present my photos of the students' productions resulting from the creative problem-finding and problem-solving processes with their permission.

In the following, I present two examples of how I have used materiality to provoke critical thinking and creative imagination in students. The first example describes how a problem-finding process in relation to project work is initiated with the creation of a project avatar, and the second describes how problem finding may be dealt with in group processes in project work through collaborative reflection with LEGO bricks.

Project work with avatars: problem finding in project work

Below, I describe how I work with a material and metaphorical approach to initiating project work (with reference to my teaching portfolio).

Figure 2. Project avatars made from recycled material and trash.
(April 18, 2024, author's photo, with permission)

The photo (Figure 2) derives from a teaching session (April 2024) in the continuing master's program Innovation and Creative Learning Design; this session occurs at the very beginning of the students' work on their final master's thesis. Their theses are reports on a problem-based project completed in collaboration with a real-world organization. In the last 2 years, I have introduced the *project avatar*, a metaphor aimed at engaging the students creatively in exploring their initial problem formulations. According to the Merriam-Webster dictionary, the word *avatar* has a fourfold meaning: First, in *Sanskrit*, an avatar denotes a divine being or force that descends to earth and takes on a bodily form through which the divine power may be executed to accomplish a mission – in other words, the earthly body in flesh and bone is bestowed with divine powers. Second, in a virtual reality context, an avatar refers to a *virtual* body and the powers that this virtual body possesses, for instance, when a human player takes on the body of a superhero in a computer game, which is almost the reverse function as its original, Sanskrit meaning. Third, an avatar can also be an idea, a concept, or ideology that is embodied in human form, and finally, fourth, it can refer to a variant phase or version of a continuing basic entity (e.g. "the late avatar of educational policy"; Merriam-Webster, 2025). What unites these metaphorical, associative meanings, however, is the avatar as possessing transformative (super)powers.

The avatar metaphor with its association with both *flesh and blood* and *superpowers* inspired me to invite the students to reflect critically on how they used disciplinary knowledge from the field of learning as a superpower to

inquire, find, and formulate a problem for their project in the earthly sphere (empirical field) as well as their assumptions about the problem and its solution (theoretical field). I told them that the avatar should embody all their ambitions for the project: the positive change their project should generate in the organizations they worked with, the superpowers (in the form of creative learning design theories) the avatar would use, and what super-tools creativity would provide for the avatar to imagine new solutions, among other aspects. Finally, the avatar should be a physical "being."

The students started out by exploring two tables with "trash" materials such as used textiles and shoes, empty packaging material, plastic lids, old CDs, shells, and other materials from nature. I asked the students to choose materials that appealed to them and would help them to embody their initial project idea in the shape of an avatar, and that would "bestow" on the avatar all their conceptual and methodological ideas for their project (superpowers). I therefore asked them to have the problem they wanted to work with in mind so that the "superpowers" would be directed toward exploring, formulating, and clarifying the problem. Finally, their avatars should reflect what the students ultimately wished to accomplish in real life organizations with their superpowers.

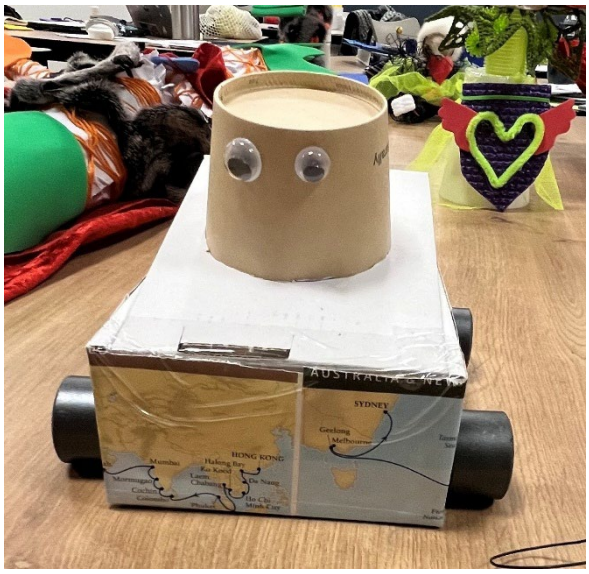

Figure 3. One student's avatar with conceptual superpowers.
(April 18, 2024, author's photo, with permission)

An example of an avatar and its superpowers is shown in Figure 3. This student worked as vocational education and training (VET) teacher. His project was about researching and developing a new way of teaching vulnerable students in his VET-school. The avatar's mission was to create an inclusive learning environment, and its superpowers were flexibility (the wheels), knowing the

landscape of the organizational context for teaching (the map), the VET students' learning processes and trajectories of learning (the map), awareness of the dynamics in the classroom (the eyes), and having an overview of how to act in situations while teaching (the elevated position of the eyes). The student thus reflected on the complexity of inclusive learning environments and how his learning theories might help him find and formulate the problem that would be used to guide his project work.

Metaphors and materials

In the reflective evaluation in plenum after the session, the students emphasized their experience of immersing themselves in a process of creativity-based inquiry. The metaphorical and material creative process of devising "beings" with transformative superpowers "forced" the students to ask basic questions of their preliminary problem formulations and their projects' ambitions, but also to ask if their avatars' conceptual superpowers were in fact directed toward the most relevant problem within the context of their projects. They acknowledged that they were "disturbed" in terms of their expectations of a "normal" thesis introduction (Jensen et al., 2022). The avatar metaphor not only pushed them toward reflecting on the problem within their project, but the superpower metaphor also led them to reflect on how much knowledge about learning and change processes that they had built up throughout their education. By being further disturbed with materials, they started to think about their disciplinary concepts as embodied superpowers that they would be able to use in empirical problem-finding situations, so they would be more equipped to look beyond conventions and taken-for-granted worldviews in practice (Dewey, 1988). Thus, they were given an opportunity to use their creative imagination to determine how they could apply conceptual superpowers when exploring their field of inquiry (finding the problem) – in this case, learning in an organization. Summing up, the material process created two spaces for learning for the students: (a) they had the opportunity to think in greater depth about how their understanding of learning (disciplinary content) was connected to the problem they planned investigating in their projects, and (b) how knowledge of learning could help them investigate, formulate, and solve the problem and create value in the organizations they worked with in their projects.

The students also expressed that the materials initiated new thoughts about their projects' problem fields, as well as the ideas and practices that were taken for granted in the empirical context. For instance, the student creating the avatar with the superpower of "wheels" said that the sensory feeling of the round metal studs in his hands made him realize that his problem field of *inclusive learning environments* was complex, because his student group acted in

unpredictable ways. The "wheels" made him acknowledge that it would be important for him to frame the *processual* aspects of organizational change in his problem formulation, not only the end goal of an implementation process (Runco, 2019; Tanggaard, 2019). Generally, the students said that the very encounter with the materials and the task of using them to express the avatar's superpowers made them imagine how their acquired conceptual knowledge ("superpowers") would function as tools for inquiry in their projects. As mentioned, this example with avatars addressed the problem-finding process related to the PBL project work at Aalborg University. The following example centers on the characteristic pedagogical approach of group work in the Aalborg University PBL model, in which students work together in collaborative projects.

Group work and problem finding

When students collaborate in groups as they carry out problem-based project work, a rather common challenge is establishing a collective understanding of the problem that guides the study that forms the core of the project in PBL at Aalborg University (Thomassen & Stentoft, 2020). The challenge often occurs when students have different interpretations of the theories or concepts in their field of study, as well as how to understand them in relation to a real-world problem. Challenges also arise when the students are unaware of the time it takes to explore these differences to ensure that the problem formulation is well researched (Jensen & Lund, 2016). The example below shows how creativity may be integrated into the problem-finding process, again by means of a material "disturbance"—here in the form of LEGO bricks.

The example originates from a teaching session that I facilitated within the master's program Learning and Innovative Change (September 10, 2019). The session was inspired by LEGO Serious Play (see Hansen et al., 2009), described in detail below. Using LEGO bricks is my way to direct students' attention to the collaborative aspects of problem finding in the problem-based project work. The LEGO materiality relates the students' content understanding to problem inquiry, because the LEGO bricks function as tactile tools for thinking and support the student in articulating and reflecting on the words, phrases, and actions that they associate with the concepts of the discipline, going into deeper layers of their present conceptual assumptions. This conceptual clarification process is especially important to allow PBL to play out in project group work, because it is precisely the lack of a common understanding of the concepts used in the project's problem-finding phase and formulation of the problem that can be an obstacle for the collaborative dynamics that ideally drive the process (Alt & Raichel, 2022). To clarify how the materiality of the LEGO bricks may enable

this deeper, collective understanding, I briefly describe the steps as they played out in a concrete process with seven project groups, with three to five members in each (I asked the students to move the tables from rows to group tables, onto which I put boxes with the LEGO bricks).

Individual problem finding

Figure 4. An individual student's understanding of the concept of "Learning".
(September 10, 2019, author's photo, with permission)

The process started with each student building an individual LEGO figure intended to express their present understanding of the concept of learning (which was the disciplinary content of the lesson). In 1-minute turns (which I carefully monitored), they presented their figures to the group with an explanation of the meaning of its different characteristics. These presentation rounds were made in the groups. The photo (Figure 4) is an example of one student's individual interpretation of the concept of learning, as reflected and visualized through the elements of the figure (e.g., key, helmet, the abyss, watering pot). The student's narrative explaining the figure contained metaphorical words and expressions like "key to understanding," "throwing yourself into the abyss," and "watering and nourishing a plant," which showed the student's individual and immediate understanding of the concept of "learning" from reading the course literature. The figure was also a starting point for a small narrative from the student's own previous experience of learning, where she had experienced that learning is both a painful (helmet) and rewarding (watering pot) process. I had asked the other group members to remain silent while each student presented their figure to the group, not commenting or asking questions, which allowed the presenting student to use

the full extension of time to present their thoughts. After each presentation, the other students in the group had the opportunity to ask questions or comment in a 2-minute round.

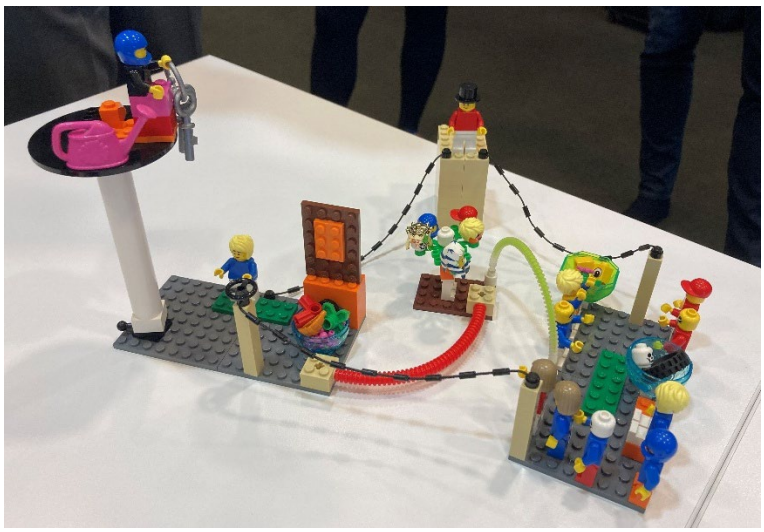

Figure 5, The individual figures built together.
(September 10, 2019, author's photo, with permission)

Collective problem finding

In the next task, the students had to combine their individual figures into a collective figure that could show how the students' perceptions and interpretations of "learning" overlapped and coincided and how they differed (Figure 5). Because the groups had already started to work on their PBL projects, this exercise gave the students an overview of the complexity of their collective project and the eventual collaborative challenges that derived from their different – and, to some extent, unacknowledged – taken-for-granted understandings of the concept of "learning" and the implications of these understandings for understanding, exploring, finding, and formulating the shared problem guiding their projects (cf. Alt & Raichel, 2022; Jensen & Lund, 2016).

In the students' reflective evaluation of the LEGO process (as covered in my teaching portfolio), their reactions to the first part of the process (where they had to listen for one minute to a co-student's presentation of their figure) was that it was difficult to stay silent and just listen to each other's narratives. They further reflected on the fact that they would normally strive to get to a quick consensus on how to understand concepts, how to establish the problem in which they would inquire, and how to formulate the problem that would lead them to proceed in the group work. However now, in being prevented from this "result-oriented" approach, they were able to see each other's figures and

hear each other's narratives with more patience. They experienced this as being rewarding in the sense that they widened both their understanding of the concept of learning and their understanding of their co-students' thoughts and ideas concerning how the concept of learning would guide their problem inquiry and the problem-finding process (see also Clapp & Hanchett-Hansen, 2019). By seeing each other's figures and listening to each other's narratives – and afterwards building the individual figures together – they understood how their collective assumptions of the problem and the concept of learning would enable them as a group to pose more critical questions to the problem field. This understanding made them more inclined to acknowledge the differences and respect each other's taken-for-granted perceptions and conceptualizations of learning.

Discussion: metaphors and materials in creative problem-finding processes

If I put the above processes with materials and metaphors in play with Dewey's (1980, 1988) thoughts on critical inquiry and problem finding as well as creative imagination, we see that both the production of avatars and the building of LEGO figures function as an articulation of the students' own experiences with learning combined with disciplinary knowledge that has been introduced in the educational activities as well as in the curricular literature. With Dewey (1979), I also regard the avatar and LEGO production tasks as examples of how knowledge creation and learning are intertwined with processes of creative inquiry. This means that students are supported in asking – and, indeed, allowed to ask – critical questions about conventions and taken-for-granted worldviews, including within the very disciplines that they study, in this case, learning. The examples illustrate how critical inquiry and problem finding are both a precondition for learning to occur and something that is created within the process of learning itself as *emerging knowledge*. Both are expressions of how students build judgment and develop critical creativity (Dewey, 1980, 1988).

In the next section, I widen the Deweyan understanding of experience by focusing specifically on the metaphorical-material perspectives that the empirical examples call for. These perspectives are both a socio-cultural and socio-material understanding of problem finding.

Socio-cultural problem finding and creativity

Socio-cultural learning theory is relevant when understanding the empirical examples as showing *cultural production* activities (Bruner, 1996). Both processes took a creative symbolic form when students created avatars and LEGO figures.

According to Bruner, working with materials occasions the students to *externalize* experience, knowledge, and understanding. Externalization refers to the process in which students make "inner" thoughts, world understandings, and ideas tangible in material form by "creating works" (like artwork). Bruner uses the term "oeuvre" with reference to Ignaze Meyerson (the French cultural psychologist) to emphasize that it is not enough to create a product; the oeuvre is an object to which the students have attributed meaning, almost as if it is "bestowed with a life of its own" (Bruner, 1996, p. 76). The concepts of the oeuvre and externalization thereby cast light on the processes of building mutual understanding in the student group in the *externalizing* LEGO process and of bestowing the avatars with the individual student's externalized understanding of their project, its problem formulation, and its conceptual superpowers. If understood as oeuvres, the avatars and LEGO figures facilitated a creative process through which the students could externalize, explore, and "own" their own and each other's perceptions of the same disciplinary words, phrases, concepts, and problem understandings. This supported the students in negotiating collective meaning by means of the avatar and LEGO oeuvres (Hansen et al., 2009) and, very importantly, the *narrative*, *symbolic*, and *metaphorical* language that creates, in socio-cultural understanding, *intersubjectivity* (Bruner, 1996).

These theoretical considerations emphasize how a Deweyan understanding of creativity may relate to a socio-cultural perspective (cf. Bruner, 1996), but also how critical inquiry and problem finding may be understood as a performative and emergent phenomenon, arising within a network of relations that are entangled across processes, relational movements, materials, and spaces. This calls for a socio-material perspective on the kind of problem finding and problem solving embedded in the empirical examples.

Socio-material problem finding and creativity

A socio-material perspective on the examples allows me to analyze the interrelations between human and social processes within a situated context in which materials and metaphors play a role for how the processes of critical inquiry emerge (Smith, 2016). In the examples above, the trash materials and LEGO bricks enable certain formations of experience. These experiences through materials become linked to participation, the creation of social communities, the development of conceptual insight, and the performance of experimental, investigative, critical inquiry into the students' problem fields. In a socio-material perspective, this is connected to the concept of entanglement.
Holmes (2024) describes *entanglement* as a tangle of connections between technology/materiality, methods, contexts, values, and purposes, and, in higher education, I would add disciplinary content as a relational node in the processes

of critical inquiry and problem finding. Applying the new materialist perspective on the examples above captures the interplay between the value-based dimensions of problem finding and problem solving and the learning processes through which insights, creativity, and new practices emerge. The socio-material perspective on creative PBL practices in the classroom allows me to illuminate and bridge the *affective* and *material* dimensions of knowledge creation and learning, while also incorporating *body*, *relationships*, and *materiality* as meaningful components of the collective and shared learning process (Fawns, 2022; Holmes, 2024).

From a socio-material point of view, learning as such is seen as shared knowledge production, generated through students' embodied practices and material engagements in, for example, aesthetic representations and visualizations, in this case, avatars and LEGO figures. The socio-material perspective points to the fact that the materials in the two examples are open to interpretation and therefore invite negotiation of meaning among the students. The materialities thus enable the students' explorations, processing, and application of content knowledge in critical inquiry and problem finding (Fawns, 2022). The students' critical inquiry and problem finding is thus *inscribed* in materialities such as avatars and LEGO figures. Through materiality, the acquired understanding of the problem can also be stabilized and used again in future critical inquiry – in other words, it can be *reified* (Jørgensen et al., 2023; Chemi & Jensen, 2026). This reified understanding of the problem may be awakened in new ways in changing socio-material contexts and occasion new learning processes, such as when students present their avatars and LEGO figures to other students (Sørensen, 2009). In a material, problem-based process of critical inquiry, the different forms of reified understanding are ultimately reified anew when students write their project report. Here, their problem-based inquiry is converted into the form of a problem formulation, an empirical study, or a report (among other forms), thus reflecting the creative process with its material, embodied, and affective aspects.

Creativity and critical socio-cultural and socio-material inquiry in PBL

We can sum up by looking at the two empirical examples within both the socio-cultural and socio-material perspectives, and in doing so, we can see that the students' existing ideas, their critical inquiries, and experiences with the discipline content of learning are all socially re-created in a new material context and new metaphorical narratives, mediated by the avatar creation and LEGO building processes (Fawns, 2022). The inquiry-oriented aspects of PBL are thus rethought and emphasized in novel ways that visualize the students' reflections, problem finding, and imaginative knowledge-creation processes

(Dewey, 1988). In doing so, problem finding and imaginative knowledge creation may thus become socially relatable as well as critical and creative.
In other words, the students' oeuvres may materialize a PBL process, which can be reactivated in new ways across changing socio-material contexts, for example, in the interplay between the classroom (together with peers and educators) on the one hand and their project organizations on the other (Fawns, 2022; Jørgensen et al., 2023). The conceptual understanding of the empirical examples points to the fact that the explorative and creative process of problem finding includes aspects that are more easily nuanced and expressed in multifaceted ways in material-metaphorical form, rather than through words or unambiguous language.

Concluding remarks and implications for practice

Looking at creativity in experiential, socio-cultural, and socio-material perspectives might be a fruitful lens through which the equally vital processes of problem finding and problem solving may be framed in teaching in higher education to pave the way for students' experience of being able to imagine and create change in their future lives. A focus on creativity makes it possible to bring forward potentials of critical inquiry and constructive imagination. A focus on creativity may enable pedagogical reflections on several of PBL's characteristic traits: problem formulation, problem processing, project work, and collaboration in group work, all of which are needed to build judgment and create change. The inclusion of creative activities as an opportunity for collective, inquiry-based reflection on discipline-related problem finding (critical inquiry) and problem solving (imagining new ways to apply disciplinary knowledge and concepts) might therefore benefit PBL project work in groups. As we saw in the examples, creativity in the form of metaphorical and material processes invites students to engage in these collective explorations that challenge conventions and habits (critique), play with reality by means of theory and concepts, and stimulate imagination as a creative effort to develop meaningful new understandings of disciplinary content, as well as new understandings of the world. However, this article also points to the need for educators in higher education to consider how to create opportunities for students to engage in material and metaphorical activities as an opportunity to ask critical questions about what we take for granted in the contexts we inhabit.

Future ambitions for PBL

Based on the above discussions of my empirical examples, I feel impelled to discuss PBL in a slightly wider perspective. As mentioned along the analytical parts and the discussion, the idea of drawing in materials and products in teaching PBL has the aim of paving the way for creativity in relation to problem finding and solving. However, as I understand it, creativity is not a way to merely fulfill the goals of the study program; to me, creativity has a much deeper, radical educational purpose, as touched upon in the introduction. In a world characterized by comprehensive and deep crises, creativity in PBL is more important than ever as an approach in higher education where students are subject to educational policies that encourage them to reproduce knowledge and adapt their thinking to absolutistic educational goals. These goals risk carrying with them a taken-for-granted white, Western, and paternalistic approach to the world that has proven harmful to our earth and its living creatures. I see a different path, where creativity – with its explorative, critical, and constructive ways of asking questions for these taken-for-granted beliefs and systems – could guide our educational ideas. This path potentially leads toward a creative educational environment that could be curious, critical, imaginative, and empowering for the students, while also encouraging them to be part of the changes needed in the future in our societies. To achieve this end, we should build educational policies, systems, and environments that encourage students to develop critical-creative judgment and enable them to create change in society. Based on my own research and experience in classrooms in higher education, this environment is developed by offering students a wide variety of possibilities to engage with disciplinary content. My research suggests that materiality and products in PBL processes support and embrace critical questions and playful processes involving metaphors, poetics, and above all, building students' judgment and experiences of critical-constructive application of knowledge for future change.

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