A Literature Study on Experiential Collaborative e-Learning Based on ECEL Articles

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Abstract: Educational institutions around the world continue to develop teaching practices in which the importance of digital solutions is expanding. The increasing digitization of education and learning has made it even more important to explore and test how experiential collaborative teaching methods can be digitized and designed to facilitate collaboration, active participation, and exploration, elements that are all crucial to support development of complex skills and competencies. Previous research reveals that many solutions for e-learning do not sufficiently support more complex forms of learning. The authors argue that many technologies developed for the field of education fall short of their purposes and neglect or ignore intended underpinning pedagogy and didactics. As new technologies are being developed, promising great improvements in supporting student' learning processes, the problem is exasperated by a technological euphoria, supported by EdTech companies, which effectively undermines appropriate cautions and reservations. The article applies the overarching conceptualization **Experiential and Collaborative learning (ECL)** in an attempt of include an array of established and complex educational methods or pedagogical models, such as Problem-Based Learning (PBL), Reflective Practice-based Learning (RPL) and Inquiry- of ECL have been derived. Based on those keywords, a systematic literature study within the database of ECEL article from 2012-2021 has been conducted to investigate and summarize the potential gap often seen between pedagogical and technological development in Edtech. The research question is twofold: "How is ECL addressed in ECELs papers" and "What is the potential gap transforming ECL to digital solutions"? The findings reveal that ECL is present in many articles to some extent. However, after sorting the articles using PRISMA, only a few articles are included capturing the complexity of ECLs. Based on the selected articles, gaps and potentials are identified, indicating a need for further research.

Keywords: experiential collaborative learning, ECL, technology, PRISMA

1. Introduction

Globally, educational institutions continue to develop teaching practices where digital solutions play an increasingly larger role (Albæk, 2018). While many educational institutions have been working for a long time in various ways to integrate open, experiential and collaborative learning designs into their practice, lockdowns, in particular as a result of the Covid-19 pandemic, and the resulting rapid transition to digital emergency education (Georgsen, 2021) have revealed, that many of the existing digital learning platforms do not adequately support the experiential, collaborative forms of learning. The increasing digitisation of education and learning has created a need to explore how experiential and collaborative teaching methods are being digitised so that collaboration, active participation, and exploration still support the learner in developing complex skills and competencies. According to Selwyn (2016), a technological euphoria created by EdTech companies contributes to undermining relevant caution. In addition, new technologies are constantly being developed, promising great potential in supporting and strengthening students' learning processes but educational institutions need to recognise and consider the consequences of the influence that developers/designers have on the learning experience (Gyldendahl Jensen et al., 2022; Selwyn, 2016). The OECD emphasises that increasing speed of change necessitates a shift from traditional teacher-led teaching methods' focusing on 'knowledge transfer to student-centred forms of education such as inquiry-based learning, problem-based learning, reflective practice-based learning, challenge-based learning, e.g. focusing on the development of needed competences (OECD, 2019).

Therefore, the article conceptualises **Experiential and Collaborative learning (ECL)** as an overarching approach to capturing an array of established and complex educational methods or pedagogical models. Through systematic desk research, several pervasive key concepts on the nature of ECL have been derived. Based on those keywords, a systematic literature study within the database of ECEL articles from 2012 to 2021 is conducted to investigate and articulate the potential gap often seen between pedagogical and technological development. Therefore, the research question is twofold: ***"How is ECL addressed in ECELs papers" and "What is the potential gap*** **transforming ECL to digital solutions"?**

The article will initially explain the terminology of ECL to derive ontologically key concepts and positions to answer the research question, which will be followed by a systematic literature review. *Based on the included articles, capturing the complexity of ECLs, potentials and gaps are identified and* presented, and finally, the article concludes on the findings and calls for further research.

2. The ontology of Experiential Collaborative learning (ECL)

Experiential and Collaborative learning (ECL) is in this article used as an overarching concept to capture an array of established educational approaches or pedagogical models, such as Problem-Based Learning (PBL), Inquiry-Based Learning (IBL), Challenge Based Learning (CBC), Reflective Practice-Based Learning (RPL), Discovery-based learning e.g.

One of the key principles behind these established educational approaches or pedagogical models that constitute ECL is the notion of learning through experiencing and experimenting. The positions use different terminologies to describe the learning processes, such as exploration, inquiry, investigation, or discovery, but generally come from the same ontological understanding of learning. All these theoretical positions that together can be characterised as ECL have in common that they draw on epistemological perspectives related to, e.g. constructivism, social constructivism, and socio-cultural theory, where learning is seen as the link between theory and practice. Within this field, pragmatism in particular, and thus the theoretical legacy of e.g. Dewey's work, inspired several positions (Horn et al., 2021; Johnson et al., 2009; Spronken-Smith and Walker, 2010). Dewey writes about how students(re)construct meaning and actions through an experimental approach using tools and artefacts and the social context acts as stimuli that elicit particular reactions (Buch and Elkjær, 2015; Dewey, 1933; Elkjaer and Wiberg, 2013).

Regardless of linguistic definitions, there are similarities between the different theoretical positions or conceptual models. The interpretation of Dewey's ideas about experiential learning manifests itself differently, RPL for example, is based on a coupling of the concepts of experience, thinking and action through exploration (Horn et al., 2021; Jensen, 2020), while PBL is more concerned with an experiential approach through problem identification (Davidsen and Konnerup, 2016), IBL is explicitly based on inquiry processes (Aditomo et al., 2013; Dewey, 1933), and the question or the problem is replaced by challenges in CBL (Baloian et al., 2006; Gallagher and Savage, 2020).

The ontological grounding of ECL is thus founded as an authentic, collaborative process where people and their surroundings are interwoven entities. Thus, collaboration is a common feature within ECL, characterised by ideals of group work and student-led organisation (Davidsen and Konnerup, 2016). Hence, ECL is part of a human and social science tradition that understands learning as something more than just the acquisition of knowledge, and where action and thinking are interdependent and closely linked to and situated in transactions between individuals and their environment through experimenting with authentic real-world problems in a student-centred learning environment.

2.1 Learning through experiencing and inquiry

ECL has its theoretical point of departure in Dewey's work on experiential-based learning, where the concrete and the abstract exist in a relationship of tensions created by challenges, obstacles, and disturbances that arise over time (Dewey, 1933; Dreier, 2016; Horn et al., 2021). Dewey, for example, describes learning as an emotional encounter with an embedded conflict. Often, there is a feeling that something is difficult at the beginning of a learning process; an uncertain situation where concepts such as exploration, investigation, and experimenting are the method of resolving this conflict and making sense (Dewey, 1933; Elkjaer and Wiberg, 2013). The student must diagnose a situation that may be unclear or puzzling to identify practical issues. It requires the ability to see both practice-related problems and their derivative consequences to consider alternatives and make visible the underlying assumptions (Hüttel and Gnaur, 2017). Understanding a situation is thus very much about manoeuvring in complex interpersonal situations, which requires an exploratory and reflective response to and transformation of the acquired knowledge (Schatzki, 2017).

Processes that are experimental, exploratory, or investigative support the student in recreating meaning in learning situations, where the dynamics and constant movements of reality affect what is being explored and thereby create a lot of disturbances and breakdowns (Dreier, 2016; Horn et al., 2021). Thus, ECL sets specific requirements for the applied pedagogical designs and the surrounding learning environment where practice plays an important role.

Through a systematic exploration of practice, the student is challenged to work analytically and critically to make existing and often implicit and taken for granted premises explicit. Here, in particular, the continuous disturbances will create a need for the students to practice reflective behaviour in order to be able to recognise new knowledge (Jensen, 2020; Siti et al., 2013). Therefore, several established educational approaches or pedagogical models that characterise ECL have the concept of inquiry embedded in the learning process to address complexity (Balım, 2009; Horton et al., 2018; Pedaste et al., 2015).

One way to kickstart the inquiry process is through systematic and planned disruptions or situations that arise spontaneously in the learning process where the student fails. Inquiry-based learning and RPL talk about appropriate disruptions as part of the pedagogical planning (Horn et al., 2021), while challenge-based learning works with the concept of fun-failure where the goal is to create a culture where failing is a way to learn and thus a favourable circumstance (Castronova, 2002). PBL does not speak directly about disturbances but instead how the student needs to practice the capability to respond to changing contexts (Stentoft, 2017).

2.2 Formulating problems as a driver for learning

A very central focus in ECL is the formulation of problems that both acts as natural disturbances in the learning process and at the same time set the direction for the students' work through an inductive approach (Guerra et al., 2017; Holgaard et al., 2014). According to Hüttel and Gnaur (2017), the problem is the central driver for learning and the critical factor for challenging conventional thinking. In Inquiry-based learning, the problem is tightly linked to generating hypotheses (Aditomo et al., 2013; Pedaste et al., 2015), and in challenge-based learning, the learning process actively engages students in relevant real-world problems that exist in their environments and that require a solution (Portuguez Castro and Gómez Zermeño, 2020).

The array of established educational approaches or pedagogical models that characterise Experiential and Collaborative learning (ECL) is an overarching concept to capture an array of established educational approaches or pedagogical models that differ according to the necessity of finding a solution to the problem (Kolmos, 1996). Challenge-based learning, in particular, focuses on working with real-world issues that students then must translate into solutions of local applicability (Johnson et al., 2009), but also inquiry-based learning talks about a complex real-world problem to solve through a specific scientific and experimental methodology (Aditomo et al., 2013). While 4 of the presented pedagogical models focus on formulating problems as a driver, reflective practice-based learning (RPL) focuses more heavily on how professional judgment entails different dilemmas. RPL stresses that normative beliefs, aesthetic judgments, emotions, and the intersection between theory and practice creates different challenges (Horn et al., 2021). Regardless of the differences in emphases of problems in the learning process, there seems to be agreement on how real-life matters and empirical exploration causes a need for reflection, critical thinking and problem identification (Friesen and Scott, 2013; Hüttel and Gnaur, 2017; Portuguez Castro and Gómez Zermeño, 2020).

Based on the above theoretical description of ECL covering Problem-Based Learning (PBL), Reflective Practice-based Learning (RPL), Inquiry-based learning (IBL), Challenge-based learning (CBL) and Discovery learning (DL), a systematic literature review is elaborated in the next section to investigate and summarize the potential gap often seen between pedagogical and technological development.

3. Research method

A systematic literature review following the PRISMA 2020 guidelines (Page et al., 2021) was conducted centred around ECEL publications. The ECEL conference proceedings are listed or indexed in several different scientific databases, among others Web of Science, SCOPUS, and ProQuest. In these databases, the identified ECL positions and key-concept and their abbreviations were queried individually along with the conference proceedings' ISSN number. In order to ensure recency, the search was scoped to articles published between 2012-2021. The keywords generating results were accumulated in a final search string for each of the selected databases. ProQuest generated the largest quantity of results which were thus retrieved for the selection process. The final search string performed in ProQuest can be seen in figure 1.

issn(2048-8637) AND noft(ECL OR "problem based learning" OR PBL OR "inquiry based learning" OR IBL OR "challenge based learning" OR CBL OR "Reflective Practice Based Learning" OR RPL OR "Discovery based learning" OR "Discovery learning")

☑ Additional limits - Date: From 2012 to 2021

Figure 1: Final search string

Querying the selected database resulted in 32 articles, which were subjected to two iterations of abstract and full text assessment performed by four reviewers. In each assessment round, the inclusion of articles was based on the following criteria: 1) the article must focus on higher education, 2) there should be a pivotal focus upon digital technologies, and 3) there should be a pivotal focus upon technology *usage* in a learning context rather than implementation from an organizational and management perspective. The selection process resulted in an exclusion of 5 articles based on the assessment of abstracts and 4 articles from the full text assessment (figure 2).

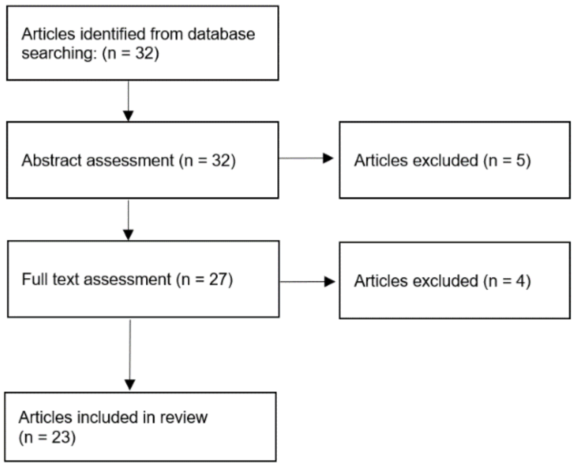

Figure 2: Flow diagram of the identification and selection process

The final pool of articles included in the review were subjected to a mapping process based on categories related to general characteristics (e.g., publication year and country), technologies of investigation, as well as the overall pedagogical model and some of the identified key concepts related to ECL (e.g., social context, interdisciplinarity, and problem orientation). The analysis was carried out on the basis of prevalent themes that emerged from the mapping process.

4. Results and discussion

Table 1 displays key information extracted from the 23 articles included in the review. The articles were mapped in accordance with the underpinning pedagogical model as well as the geographical setting of the research, which showed a predominance of publications centered around PBL (n = 16), while the remaining 4 identified pedagogical models were present in 1-2 articles each (figure 4). The geographical distribution has shown a predominance of Danish publications (n = 10) out of which the majority attributes a PBL model and more specifically the Aalborg University (AAU) PBL model (n = 9), while the remaining 10 countries are represented in 1-2 articles.

Table 1: Included articles

Authors	Year	Country	Research design	Pedagogical model
Andersen, Hüttel & Gnaur	2021	Denmark	Survey	Problem-based learning
Ørngreen, Henningsen & Hautopp	2021	Denmark	Explorative case study	Problem-based learning
Andersen & Dau	2020	Denmark	Mixed methods	Reflective practice-based learning
Recke & Perna	2020	Italy	Presentation of a narrative experience design and adaptation in remote learning scenarios	Challenge-based learning
Gnaur, Hindhede & Andersen	2020	Denmark	Survey	Problem-based learning
Jonasen & Gram-Hansen	2019	Denmark	Semi-structured pilot study	Problem-based learning
Hautopp & Ejsing-Duun	2019	Denmark	Explorative case study	Problem-based learning
Barber, van Oostveen & Childs	2019	Canada	Theoretical	Problem-based learning
Ørngreen, Knudsen, Kolbæk & Jensen	2019	Denmark	Mixed-methods, design-based	Problem-based learning
Lambie & Law	2018	UK	Focus group	Problem-based learning
Gnaur & Hüttel	2018	Denmark	Design-based	Problem-based learning
Kotsifakos, Vichou & Douligeris	2018	Greece	Design-based	Problem-based learning
Elgeddawy	2018	Saudi Arabia	Survey	Inquiry-based learning
Alafouzou, Lamprinou & Paraskeva	2018	Greece	Design-based	Problem-based learning
Juskeviciene & Kurilovas	2017	Lithuania	Expert evaluation method	Problem-based learning
Dau & Rask	2017	Denmark	Design-based	Reflective practice-based learning
Shnai	2017	Finland	Literature review	Problem-based learning
Barber	2016	Canada	Qualitative narrative examination	Problem-based learning
Sadik	2015	Oman	Longitudinal research design	Active and collaborative learning
O'Sullivan & Krewer	2015	Ireland, Germany, Portugal	Design-based	Problem-based learning
Naidoo & Naidoo	2015	South Africa	Experimental research design	Discovery learning
Loughlin, Warburton, Crane & Sammels	2015	UK	Comparative study	Active and collaborative learning
Ørngreen & Mouritzen	2013	Denmark	Action research study	Problem-based learning

The prevalent themes emerged from the mapping process includes real life problems, collaboration, technologies, and design processes, which will be elaborated upon in the following sections.

4.1 Real life problems

A fundamental focal point across the different pedagogical models is real-life matters and empirical exploration as the driver for the learning process. This is highlighted to varying degrees across the different articles, some of which emphasize the process of solving empirical and complex real-life problems in a PBL context (Gnaur et al., 2020; Jonasen and Gram-Hansen, 2019; Ørngreen et al., 2019), pre-defined problems presented by the instructors (O'Sullivan and Krewer, 2015) or external companies (Dau and Rask, 2017). Other articles describe rather specific pre-defined problems as the initiator of the process of inquiry in CBL (Recke and Perna, 2020) or solving mathematical equations through discovery learning (Naidoo and Naidoo, 2015). In other cases, focus was redirected from problems to *"(…) open-ended, ill-structured and student-centred tasks and activities"* (Barber, 2016), knowledge sharing among peers (Ørngreen and Mouritzen, 2013), reflection in relation to action (Andersen and Dau, 2020), or the development of desirable skills and attributes such as knowledge acquisition (Juskeviciene and Kurilovas, 2017).

4.2 Collaboration

An essential element in ECL is the collaborative aspect, where learning is socially constituted. Here, several studies indicate that E-learning contributes to the formation of social communities both in the classroom and across organizational boundaries (Gnaur and Hüttel, 2018; Kotsifakos et al., 2018; Ørngreen and Mouritzen, 2013; Recke and Perna, 2020). Recke, Perna (2020) writes, for example: *"experiential e-learning principles in the context of Challenges Based Learning can result in increased engagement, motivation and sense of community in learners."* (Naidoo and Naidoo, 2015; Recke and Perna, 2020; Sadik, 2015). However, in the light of Covid19, several studies highlight that transitioning from physical to online learning challenges the social aspects. Andersen, Hüttel, and Gnaur (2021) writes that *"… the social aspects of learning suffered for most, posing challenges for both teaching and group work during the transition to online learning during Covid19"*. Again, the same general trend is seen where the theoretical understanding of learning as something taking place in a social context created by human relations is not unfolded. The question of collaboration, for example, is predominantly discussed based on the technologies used. In other words, how does technology contribute, for example, to the students being able to collaborate in groups on a digital platform, or what competencies are necessary to use a particular technology that demands contextual understanding and practical experience (Hautopp and Ejsing-Duun, 2019).

4.3 Technologies

Several articles are based upon applications of flipped learning approaches (Barber, 2016; Elgeddawy, 2018; Lambie and Law, 2018; Loughlin et al., 2015; Sadik, 2015; Shnai, 2017), involving video lectures, related materials, online quizzes (Sadik, 2015), video podcasts (Barber, 2016), and open online video lectures (Elgeddawy, 2018) as preparation prior to the teaching delivery consisting of e.g. online synchronous tutorials (Lambie and Law, 2018) or synchronous video conferences (Barber, 2016). Video production is also addressed as a teaching format for the purpose of establishing a joint online design inquiry by both students and teachers (Hautopp and Ejsing-Duun, 2019) and supporting students to be reflective in different PBL-based settings (Ørngreen et al., 2019). Similarly, Andersen & Dau (2020) investigate how the use of podcasts can increase students' reflection skills and understanding of a topic before attending class. Another frequently mentioned technology is LMS (Alafouzou et al., 2018; Kotsifakos et al., 2018; Naidoo and Naidoo, 2015; Ørngreen et al., 2019; O'Sullivan and Krewer, 2015), which is often addressed from a design-based approach, e.g. the design of an online course integrating gamified elements in the LMS (Alafouzou et al., 2018) or the design of a new PBL-LMS that facilitates instructors in structuring projects (O'Sullivan and Krewer, 2015). Other online platforms include video conference systems (Dau and Rask, 2017; Ørngreen and Mouritzen, 2013), web-based platform for supervisor competence development (Gnaur and Hüttel, 2018), and more generally digital learning environments (Andersen et al., 2021; Barber et al., 2019).

A large proportion of the articles conclude that the inclusion of technologies that support different forms of E-learning has a positive impact in terms of achieving a higher level of learning expressed through the keywords that also characterize ECL. The studies indicate that the students became better at identifying a real-world problem, problem-solving, reflection, engagement, working collaborative, and valuing intuition and creativity. (Andersen and Dau, 2020; Barber, 2016; Jonasen and Gram-Hansen, 2019; Juskeviciene and Kurilovas, 2017; Kotsifakos et al., 2018; Ørngreen et al., 2021; O'Sullivan and Krewer, 2015). However, when reading the selected articles, it is striking that the majority does not mention the relationship or the link between technology and learning theory on a theoretical level. The studies state that an ECL-based teaching approach is used, for example PBL, but the origin of the learning theory is not specified or elaborated in detail. A single study by Ørngreen, Knudsen, Kolbæk and Jensen (2019) even points out this problem: *"This finding is intriguing, as PBL comprise the pedagogical foundation of AAU, but use of Moodle does not reflect this. The investigation found several reasons for the lack of PBL in Moodle".* Learning is thus discussed primarily based on organizational forms and didactic tools, while the inclusion of theoretical arguments and basic principles is completely absent. Many of the article's state that the learning objectives, for example, is PBL without this being discussed or clarified in detail.

4.4 Design processes

A pervasive aspect across the systematically selected articles is the matter of design. There seems to be a broad consensus that a prerequisite for creating digital learning environments or platforms that can embrace the theoretical dimensions of learning that characterize ECL is a design-based approach. Gnaur, Hindhede, Andersen (2020) conclude, for example *"Hybrid learning environments must be designed in the context of each programme and the specific study elements, and with respect to differences among students regarding their learning needs and preconditions for learning"*. Ørngreen, Henningsen, & Hautopp (2021) and Barber (2016) explicitly talk about an approach where a form of co-designing the learning tasks between educators and students creates better conditions for working with digital form of ECL based teaching. Shnai (2017) also points out that the challenges and barriers encountered by the students primarily concern the design aspects of e-learning.

However, none of the studies found addresses the concept of design in detail, and learning designs are used extensively without an explanation of how these designs are created or which design theory are used in the process. Being a E-learning designer requires, according to Ørngreen, Henningsen, & Hautopp (2021), a "creative production pedagogy" where the students can influence their learning process, including the possibility of selecting and working with methods and tools that are most appropriate and rewarding in a given situation. This perspective challenges the tension between the technologies' facilitation possibilities while preserving the learner's autonomy. Ørngreen, Henningsen, & Hautopp (2021) talk about how an ECL based teaching strategy requires the courage to embrace uncertainty. It means that students must be able to *"navigate through the digital landscape, emerging unscathed with a few inevitable bumps and bruises".* This statement specifically addresses ECL, where disruption is seen as a prerequisite for learning (Barber, 2016; Ørngreen et al., 2021).

5. Conclusion

This article has applied ECL as an overarching term for complex models of learning through experiencing and experimenting centered around authentic and collaborative processes. Based on initial desk research, several ECL positions and key concepts have been identified, which formed the basis of a systematic literature review centered around ECEL publications. The findings shed light on a gap between intended pedagogical underpinnings and technological development, as the theoretical link between them is generally absent or not substantially addressed, although several articles conclude that the technologies of investigation did have a positive impact on learning in general. Furthermore, a large portion of the selected articles claim to adopt a design-based approach to the development of digital learning environments or learning designs but fall short in accounting for the design process on a methodological and theoretical level. Further research is thus needed to address the theoretical link between technological development and the complex ECL models as well as the process of transforming this insight into digital solutions through design.

References

Aditomo, A., Goodyear, P., Bliuc, A.-M., Ellis, R.A., 2013. Inquiry-based learning in higher education: principal forms, educational objectives, and disciplinary variations. Stud. High. Educ. 38, 1239–1258. https://doi.org/10.1080/03075079.2011.616584

Alafouzou, A., Lamprinou, D., Paraskeva, F., 2018. Gamified Project Based Learning Environment for Motivation Improvement. Eur. Conf. E-Learn. 10-17,XII.

Albæk, K., 2018. Den teknologiske udvikling og kompetencer pá fremtidens arbejdsmarked. En litteraturoversigt. Vive.dk.

Andersen, E., Hüttel, H., Gnaur, D., 2021. Going Online: Student Perspectives in a Problem-Based Learning Environment During the Pandemic. Eur. Conf. E-Learn. 42-49,XIII,XVI. https://doi.org/10.34190/EEL.21.031

Andersen, R.H., Dau, S., 2020. The Potential of Podcasts as a Learning Medium in Higher Education. Eur. Conf. E-Learn. 16-22,XII,XIV. https://doi.org/10.34190/EEL.20.137

Balım, A.G., 2009. The Effects of Discovery Learning on Students' Success and Inquiry Learning Skills. Eurasian J. Educ. ….

Baloian, N., Hoeksema, K., Hoppe, U., Milrad, M., 2006. Technologies and Educational Activities for Supporting and Implementing Challenge-Based Learning, in: Kumar, D., Turner, J. (Eds.), Education for the 21st Century — Impact of ICT and Digital Resources, IFIP International Federation for Information Processing. Springer US, Boston, MA, pp. 7–16. https://doi.org/10.1007/978-0-387-34731-8_2

Barber, W., 2016. Critical Reflective Practice in Digital Pedagogy: Embracing Creativity in Problem-Based Learning Environments. Eur. Conf. E-Learn. 65–70.

Barber, W., van Oostveen, R., Childs, E., 2019. Situating Resilience, Grit and Growth Mindset as Constructs of Social Presence in the Fully Online Learning Community Model (FOLC). Eur. Conf. E-Learn. 65-69,XI. https://doi.org/10.34190/EEL.19.012

Buch, A., Elkjær, B., 2015. Pragmatism and practice theory.

Castronova, J.A., 2002. Discovery Learning for the 21 st Century : What is it and how does it compare to traditional learning in effectiveness in the 21 st Century ? [WWW Document]. URL https://www.semanticscholar.org/paper/Discovery-Learning-for-the-21-st-Century-%3A-What-is-Castronova/2171dc0a8c7e510c6f95b714f06b8bdebb0a0d74 (accessed 6.9.22).

Dau, S., Rask, A.B., 2017. Connecting eye to eye: The Challenge of Computer Supported Contact. Eur. Conf. E-Learn. 124–131.

Davidsen, J., Konnerup, U., 2016. Revitalisering af PBL i videregående uddannelser gennem Learning Design. Tidsskr. Læring Og Medier LOM 9. https://doi.org/10.7146/lom.v9i15.23126

Dewey, J., 1933. How we think: a restatement of the relation of reflective thinking to the educative process. D.C. Heath and company, Boston, New York [etc.].

Dreier, O., 2016. Conduct of everyday life: Implications for critical psychology, in: Psychology and the Conduct of Everyday Life. Routledge/Taylor & Francis Group, New York, NY, US, pp. 15–33.

Elgeddawy, M., 2018. Impact of Analyzing Open Online Educational Video on University Students' Academic Performance. Eur. Conf. E-Learn. 726–730.

Elkjaer, B., Wiberg, M., 2013. Læringsteori og didaktik. Hans Reitzel, Kbh.

Friesen, S., Scott, D.S., 2013. Inquiry-Based Learning: A Review of the Research Literature. undefined.

Gallagher, S.E., Savage, T., 2020. Challenge-based learning in higher education: an exploratory literature review. Teach. High. Educ. 0, 1–23. https://doi.org/10.1080/13562517.2020.1863354

Georgsen, M., 2021. Experiences of Online Teaching at 9 Institutions of Higher Education in Spring 2020. Summary.

Gnaur, D., Hindhede, A.L., Andersen, V.H., 2020. Towards Hybrid Learning in Higher Education in the Wake of the COVID-19 Crisis. Eur. Conf. E-Learn. 205-211,XV. https://doi.org/10.34190/EEL.20.093

Gnaur, D., Hüttel, H., 2018. Building a new Community Around a Platform for Developing PBL Competences. Eur. Conf. E-Learn. 161-168,XIV-XV.

Guerra, A., Rodriguez, F.J., Kolmos, A., Reyes, I.P. (Eds.), 2017. PBL, Social Progress and Sustainability, International Research Symposium on PBL. Aalborg Universitetsforlag, Aalborg.

Gyldendahl Jensen, C., Clausen, N.R., Ryberg, T., Dau, S., Bertel, L.B., 2022. Envisioning scenarios in designs for Networked Learning: Unfolding value tensions between technology and social learning. Networked Learn. 2022.

Hautopp, H., Ejsing-Duun, S., 2019. The use of Visualisations and Video Productions in Online Game- Based Learning. Eur. Conf. E-Learn. 192-199,XIII. https://doi.org/10.34190/EEL.19.094

Holgaard, J.E., Ryberg, T., Stegeager, N., Stentoft, D., Thomassen, A.O., 2014. PBL: Problembaseret læring og projektarbejde ved de videregående uddannelser. Samfundslitteratur, Frederiksberg C.

Horn, L.H., Pedersen, P.M., Georgsen, M., 2021. Teori og praksis i professionsdidaktik: En bog om refleksiv praksislæring. Aalborg Universitetsforlag.

Horton, P.A., Jordan, S.S., Weiner, S., Lande, M., 2018. Project-Based Learning Among Engineering Students During Short-Form Hackathon Events. Presented at the 2018 ASEE Annual Conference & Exposition.

Hüttel, H., Gnaur, D., 2017. If PBL is the answer, then what is the problem? J. Probl. Based Learn. High. Educ. 5. https://doi.org/10.5278/ojs.jpblhe.v5i2.1491

Jensen, C.G., 2020. Playing with Sequential Learning and and Inquiry Processes by Bringing "World of Warcraft" to the Real World: Based on Reflective Practice-based Learning. Aalborg Universitetsforlag.

Johnson, L.F., Smith, R.S., Smythe, J.T., Varon, R.K., 2009. Challenge-Based Learning: An Approach for Our Time. New Media Consort.

Jonasen, T.S., Gram-Hansen, S.B., 2019. Problem Based Learning: A Facilitator of Computational Thinking. Eur. Conf. E-Learn. 260-267,XII. https://doi.org/10.34190/EEL.19.150

Juskeviciene, A., Kurilovas, E., 2017. On Linking Problem-Based Learning Activities and Students' Learning Styles in Personalised Learning. Eur. Conf. E-Learn. 238–246.

Kolmos, A., 1996. Reflections on Project Work and Problem-based Learning. Eur. J. Eng. Educ. 21, 141–148. https://doi.org/10.1080/03043799608923397

Kotsifakos, D., Vichou, M., Douligeris, C., 2018. Organization of a Teaching Network Routing Algorithms Scenario in a Learning Management System (LMS). Eur. Conf. E-Learn. 263-272,XV.

Lambie, I., Law, B., 2018. Tutor Perception of Delivery Mechanisms for Online Tutorials. Eur. Conf. E-Learn. 290-298,XVI.

Loughlin, C., Warburton, S., Crane, S., Sammels, W., 2015. Towards Active Learning Spaces and the Flipped Classroom Model. Eur. Conf. E-Learn. 322–XV.

Naidoo, K., Naidoo, R., 2015. Exploring a Blended Learning Model to Teach First Year Mathematics Education Students Trigonometry at a UoT. Eur. Conf. E-Learn. 719–XVI.

OECD, 2019. Trends Shaping Education 2019. OECD Publishing, Paris.

Ørngreen, R., Henningsen, B., Hautopp, H., 2021. Creative Audio-Visual Approaches Applied in Online and Hybrid Educational Designs. Eur. Conf. E-Learn. 329-338,XV,XVIII. https://doi.org/10.34190/EEL.21.096

Ørngreen, R., Knudsen, S.P., Kolbæk, D., Jensen, R.H.S., 2019. Investigating the use of Moodle at a PBL University: Design Factors and Experiences. Eur. Conf. E-Learn. 444-452,X. https://doi.org/10.34190/EEL.19.144

Ørngreen, R., Mouritzen, P., 2013. [Teaching Desktop] Video Conferencing in a Collaborative and Problem Based Setting. Eur. Conf. E-Learn. 360–XV.

O'Sullivan, D., Krewer, F., 2015. Structured Approach to Project Based Learning using a new type of Learning Management System. Eur. Conf. E-Learn. 460–XVII.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P., Moher, D., 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 372, n71. https://doi.org/10.1136/bmj.n71

Pedaste, M., Mäeots, M., Siiman, L.A., de Jong, T., van Riesen, S.A.N., Kamp, E.T., Manoli, C.C., Zacharia, Z.C., Tsourlidaki, E., 2015. Phases of inquiry-based learning: Definitions and the inquiry cycle. Educ. Res. Rev. 14, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Portuguez Castro, M., Gómez Zermeño, M.G., 2020. Challenge Based Learning: Innovative Pedagogy for Sustainability through e-Learning in Higher Education. Sustainability 12, 4063. https://doi.org/10.3390/su12104063

Recke, M.P., Perna, S., 2020. Narratively Driven Educational Experiences in Remote Learning Scenarios. Eur. Conf. E-Learn. 438-444,XIX. https://doi.org/10.34190/EEL.20.062

Sadik, A., 2015. The Effectiveness of Flipped Lectures in Improving Student Engagement and Satisfaction. Eur. Conf. E-Learn. 507–XVII.

Schatzki, T., 2017. Practices and Learning. pp. 23–43. https://doi.org/10.1007/978-981-10-3130-4_2

Selwyn, N., 2016. Is Technology Good for Education? John Wiley & Sons.

Shnai, I., 2017. Systematic Review of Challenges and Gaps in Flipped Classroom Implementation: Toward Future Model Enhancement. Eur. Conf. E-Learn. 484–490.

Siti, M., Tajuddin, A., Jailani, A., 2013. Challenge Based Learning in Students for Vocational Skills. Int. J. Indep. Res. Stud. - IJIRS 2, 89–94.

Spronken-Smith, R., Walker, R., 2010. Can inquiry-based learning strengthen the links between teaching and disciplinary research? Stud. High. Educ. 35, 723–740. https://doi.org/10.1080/03075070903315502

Stentoft, D., 2017. From saying to doing interdisciplinary learning: Is problem-based learning the answer? Act. Learn. High. Educ. 18, 51–61. https://doi.org/10.1177/1469787417693510