



Systematic literature review as a digital collaborative research-like learning activity: a case study

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Abstract

Within the higher education sector, the principle of student-active and research-based education are established in strategy documents and action plans, but at the same time there is an ongoing debate about what is meant by research-based learning and how it can be applied in practical teaching contexts. The aim of this empirical study is to explore inclusion of research elements in higher education. The study introduces the concept of using systematic literature review (SLR) and digital collaboration as a learning method, and addresses how to succeed with digital collaborative systematic literature review as a research-like learning activity in higher education. An exploratory multiple case design is used, with participatory observation technique and thematic analysis. A practical contribution of this study is an example of how SLR is well-suited to do collective research-like learning activities. The main contribution is that the higher education teacher needs integrated knowledge, including research competence in addition to the traditional link between professional, didactic and technological competence. A model for research-like learning is proposed, which illustrates the need for research knowledge in relation to the technological pedagogical content knowledge.

Keywords Collaboration technology · Research-like learning · Student-active learning · Systematic literature review

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1 Introduction

In recent years, student-active learning activities with the teacher as facilitator has become important (Damşa & de Lange, 2019). Robertson (2017) points out the need to rethink the roles of students and teachers in student-active learning. The interaction between students, and between students and teachers, no longer solely takes place analogously in a physical learning environment. Buzzard et al. (2011) claim that digitalization in society provides a framework for understanding whether, how, and why digital tools are used in a learning process. Student-active learning in digital environments can be challenging and change an already established work culture related to the practice of teaching, perspective on student and teacher roles, introduction and updating of new digital systems, and requirements for one's own research (Lillejord et al., 2018; Bovill, 2019). Nerland and Proitz (2018, p. 205) call for more research on collaboration and communication in higher education.

Since the 1990s, discussion of the role of research in teaching has been increasing, and the goal of reconnecting the core activities of universities – research and teaching – in a way that consolidates and validates the values of academic life, has led to a view of ‘student as producers’, rather than ‘student as consumers’ (Neary & Winn, 2009; Valter & Akerlind, 2010; Hynes, 2018). A Norwegian teacher survey concludes that higher education teachers use knowledge from recent research in teaching, and that the curriculum is updated and adapted to developments in society and working life. Students are less exposed to research-like work and participate even less in research and development work (Lid et al., 2018). In this study, the concept “research-like learning activity” is used and defined as exploratory learning activities that activate parts of a research process within any university course, e.g., formulating researchable questions, collecting data, analysing data or performing a literature review.

The aim of this empirical study is to explore inclusion of research elements in digital collaborative student-active learning activities in higher education. Generally, any research project is based on a knowledge base within a research field. This means that one must prepare an overview of the knowledge, e.g. in the form of a systematic literature review (SLR). Students need to learn how to conduct SLRs, and this can be a learning objective in a research method course, but it is also possible to learn this through a “learning by doing” approach, as a student-active learning activity in any course. The research question of the study is: How to succeed with digital collaborative systematic literature review as a research-like learning activity in higher education?

According to Khan et al. (2003), a literature review is systematic if it is based on clearly formulated questions, identifies relevant studies, assesses the quality of the studies, and summarizes evidence using explicit methodology. The use of SLR as a learning activity is explored through three different cases at two Norwegian higher education institutions, with students from different subject areas and grade levels of higher education. The idea is to activate the students, let students collaborate and make them responsible in the learning process, and therefore the study is rooted in a social constructivist pedagogical perspective. Findings are discussed in a theoretical

framework related to research-based learning, student-active learning, and collaboration technology within the scope of the teacher's role in the process.

2 Research-based and student-active teaching in a digital learning design

The study is based on a social constructivist view of learning that differs from a behavioural pedagogical approach where the student is often more dependent on the teacher and instructions given (Adams, 2006). Based on the thinking of Vygotsky (1896–1934) and a broad literature study, Adams (2006, p. 247) summarizes the following key characteristics of a social constructivist approach to student-active learning activities: Emphasis on learning not performance; A perspective on learners as co-constructors of meaning and knowledge; Establish a teacher-student relationship based on the idea of guidance, not instruction; Seek to engage learners in tasks seen as ends in themselves and consequently as having implicit worth; and Promote assessment as an active process of uncovering and acknowledging shared understanding. In connection with an SLR as a learning activity, the teacher will introduce a framework so that the students understand the task, but even more, will engage the students to take an active part in a process where one is collaborating to create the content.

2.1 Research-based learning and teaching

Increased emphasis on research-based learning in higher education institutions is emphasized in the Norwegian Report to the Storting (White Paper) no. 16, which emphasizes that “active participation in research among students has a clear connection with students’ ability for critical thinking, investigation and lifelong learning” (Ministry of Education & Research, 2017, p. 54). Within the higher education sector, this principle is established in strategy documents and action plans, but at the same time there is uncertainty and an ongoing debate about what is meant by research-based learning and how it can be applied in practical teaching contexts. Norwegian teaching practice, as briefly described in the [introduction](#) section, corresponds to model one of the four that Griffiths (2004, p. 722) has defined in the link between research and teaching: (1) Research-led teaching, with curriculum based on research and focus on understanding research findings, not the research process itself. (2) Research-oriented teaching, where the goal is to understand the research process behind the findings. (3) Research-based teaching with exploratory learning activities. (4) Research-informed teaching where systematic exploration of teaching and learning are emphasized. The use of SLR as a research-like learning activity in this study corresponds with Griffiths’ third model. Complementary is the work of Pedaste et al. (2015) who refers to a pedagogical perspective where students are engaged in a framework of a scientific research process, where the complex scientific process is divided into research phases, and during the work the students are supervised, and important features of scientific thinking are emphasized. Willison and O’Regan (2007) proposed a framework for students’ research skill development, illustrating the process of students becoming researchers, emphasising that undergraduate stu-

dents must move from a low degree of autonomy to a high degree of autonomy. In this article, digital student collaboration related to SLR is based on Khan et al.'s (2003) 5 steps for systematic literature reviews; (1) Specification of issues. (2) Identification of relevant literature and selection criteria are specified based on the issue. (3) Assessment of the quality of the studies. (4) Summary of the findings. (5) Interpretation of the findings.

We did not find any studies combining SLR as a research-like and digital student-active learning activity. However, issues as how to engage undergraduate students in research-like learning activities as SLR have been addressed by Brereton (2010) who explored the effectiveness of second-year undergraduate computing students in carrying out an SLR, and identified the elements of the process that the students found most difficult. For example, the conduct phase was more problematic than the planning phase. It can be concluded that undergraduates can do SLRs, but the task is clearly quite challenging and time-consuming. SLRs are well suited to being undertaken by groups (Brereton, 2010).

2.2 Collaboration technology

In this study, we take as our starting point that research is a collective process, and we further explore how digital tools can be used to increase interaction among students in a research process. Aagaard et al. (2018) conclude that digitalisation promotes relevance as well as making education accessible, flexible and open to more student-active forms of learning. For technology to function as a collaboration tool, everyone involved should experience an immediate understanding of others' interaction in a shared work area (Gutwin & Greenberg, 2002). This is useful for coordination, initiation of collaboration and communication about the task at hand. Digital tools for collaborative learning are related to the research field CSCL, Computer-Supported Collaborative Learning (Stahl et al., 2006). Jeong and Hmelo-Silver (2016) present 7 opportunities within CSCL, which address specific needs and challenges that students experience through collaboration: opportunities to engage in a common task; communicate; share resources; participate in productive collaborative learning; co-create; monitor and regulate collaborative learning; and find and build groups and communities. Collaboration technology represents potential in the development of student-active forms of learning where students can also be a resource for each other. In this study we elaborate on both opportunities and challenges when such tools are to be used in connection with an SLR.

Koehler and Mishra (2009) illustrate the interrelated knowledge and skills that teachers need in order to use technology meaningfully into their teaching through their TPACK-model that highlights a need for technological pedagogical content knowledge. Teaching and learning with technology exist in a dynamic transactional relationship between the three components technology, pedagogic and content, and a change in any one of the factors has to be "compensated" by changes in the other two (Mishra & Koehler, 2006).

3 Method

This study was conducted as an exploratory multiple case study inspired by Stake (1995), and based on an understanding that knowledge is constructed socially. In order to achieve enough in-depth information about what characterizes a research-like learning activity using collaboration technology, a qualitative approach was used. Data was collected using participatory observation, and the empirical data is thematically analysed and interpreted in a hermeneutic interpretive tradition.

3.1 Selection of cases and data collection

To obtain characteristics of the learning activity that did not depend only on a specific level of education or academic affiliation, we selected three cases based on the criteria of a variation of subject areas and study level. The study programs involved were Games and Entertainment Technology with the bachelor courses “Game Lab 2” and “Game Design 2” (anonymous University), Geography with the master course “Experience-based value creation, the environment and passion” (anonymous University), and Teacher Education with the master course “MASIKT-TEK02 Technological profile subject 2” (anonymous University of Applied Sciences). The two bachelor courses involved the same student group. The researchers were also teachers, who planned and facilitated the use of SLR as a learning activity, and adapted SLR and digital tools to their subject area and study level. Data was collected through participatory observation, where the teachers/researchers had the role of “participant as observer” (Cohen et al., 2018, p. 543). Predetermined topics including the use of collaboration technology, learning resources, student autonomy, student engagement, collaboration between students, and the role of the teacher were used to narrow the field of observation. These topics were based on the research teams’ preconceptions and constituted the structure of a digital observation form. The observation form also included an open-ended question for unexpected occurrences. After each learning session, the teacher/researcher made notes in the digital observation form. All the researchers reported their observations as textual data, and these notes were later assembled in one common document, available for the whole research team. The following section describes the three cases structured with the five steps for SLR from Khan et al. (2003).

3.1.1 Case 1: Games and Experience Technology

In the first week of the semester, 22 students participated in conducting an SLR within the theme “Educational games”. In step 1, the teacher formulated 3 research questions (RQ) with different perspectives; game developers’ (RQ1), educators’ (RQ2) and researchers’ (RQ3). Steps 2 and 3 were also completed by the teacher who selected 29 articles for RQ1, 24 articles for RQ2 and 8 articles for RQ3. With the 2nd year bachelor students, it was challenging to find relevant databases and articles. The teacher took articles from academic journals, but they were too specific in the topic for RQ1, so more popular science articles were chosen for the game developer perspective (RQ1). The articles were made available digitally, and according to

the “first-come-first-served” principle, the students chose 3 articles each, which they analysed (step 4). The articles for RQ1 and RQ2 were analysed individually, while the articles for RQ3 were analysed in groups. The students analysed the same points in all articles, based on an analysis table initially made by the teacher, and adjusted through a discussion in class. The analysis table was first available in a digital co-authoring document, but this worked poorly, and the teacher made a digital questionnaire where the students filled out one form per article. This did not work optimally either, as the students had to be added manually to access the answers from other students. Interpretation of findings (step 5) was first done in a plenary session in the classroom, and then each student group had to use relevant findings when presenting their game ideas.

3.1.2 Case 2: Geography

The students from the master’s program in social sciences with specialization in Geography took the course “Experience based value creation, the environment and passion” in their 2nd semester. The study is a hybrid study programme, predominantly online-based with occasional physical meetings. Eight students, divided into two groups, participated. The students were introduced to an SLR and were briefed on organization, progress, and group composition. The university’s collaboration tool OneDrive (with associated editing software) was chosen. The co-authoring document was a table with a framework for the literature review, based on a revised version of the five steps of Khan et al. (2003). The teacher formulated an overarching research question and the students had to search for scientific articles in Google Scholar to show the large number of hits they get with a wide research question and the need for their own refinement (step 1). In step 2, search engines, keywords, and the number of hits, as well as 3–4 relevant articles were noted. In step 3, the student selected an article, wrote a summary, and noted a reference. In step 4, the article was analysed with a focus on relevant arguments and a geographical perspective. Step 5 should have been a more critical interpretation in a real research situation but was modified to identify further research needs discussed in the article. In the end, everyone had a table with 8 relevant articles.

3.1.3 Case 3: MASIKT-TEK

In the master’s program ICT in learning, 23 students participated in three activities connected to systematic literature review. The learning activities were part of the assessment basis from a course in the second semester. The students had a first draft of the problem ready (step 1). This was further developed through a systematized literature search. The literature search was required to produce an overview of which databases, time, focus, type of activity, language, keywords, method, and result were included/excluded. The overview served as a scaffolding for step 2. In steps 3, 4 and 5, the students reflected by writing on previous research. The literature review was an individual piece of work, but before completion, the students presented their work in online meetings to the class for guidance and input. The students worked in groups, and despite the individual focus, the teacher held the group with common milestones

in the research process. In the second learning activity “Writing summaries”, all students had to read and write a summary of the same scientific article (selected by the teacher). The summaries were collected in a digital booklet, accessible to all, and were discussed in groups and a plenary session, with the aim of learning to extract the most important things in articles and formulate this in a summary. The learning activity provided an opportunity to learn from each other and increase the quality of the work through collaboration. In the final learning activity, the students worked in groups with an argumentation analysis of the same article, based on several points prepared by the teacher. The groups presented the analyses in a plenary session afterwards. In the last two learning activities, the focus was on step 3 (analysis) in an SLR, and the teacher focused the work by selecting the article text (steps 1 and 2).

3.2 Ethical reflections on the study

An exploratory study divided into three different cases regarding study level, learning outcomes, organization and scope can be challenging methodologically, however can also be a strength in that more researchers encourage characteristics enabling the relevance of the study to increase. The responsible teacher anonymised the students before the data was processed together after the learning activities. The study follows the national research ethics guidelines in Norway.

3.3 Thematic analysis

Data from the three cases were dealt with as a comprehensive text. We used thematic analysis to identify, analyse and report patterns (themes) in the data material, cf. Braun and Clarke, 2006. Based on the research question and elaboration of this, as well as the observation form, we initially defined codes such as student activity, and opportunities and challenges in the use of digital tools. Later in the thematic analysis, we identified patterns in the data such as functionality of collaboration technology, relevance, and usefulness of SLR, and adaption to educational level. Four main themes were defined: (1) Structure/coordination, (2) Professional focus, (3) Relevance and motivation, and (4) Challenges. These were systematized in a cross-linking table (Table 1) to further analyse the themes in relation to four key parts of an SLR learning design, related to SLR as a digital collaborative research activity: *Learning Activity*, *Collaboration Technology*, *Activating students* and *The Role of the Teacher*.

Overall, Table 1 constitutes a systematization of the main themes found in the thematic analysis of the use of SLR as a research-like learning activity. The analysis clarified the importance of the teacher role as a facilitator in a digital collaborative research-like learning activity, both related to the competence with regards to digital collaborative tools, and experience using SLR in a research context. Further, SLR with the use of collaboration technology provides scaffolding opportunities for exploratory learning and co-creation of knowledge, more specifically through coordination of communication and interaction among students. However, using SLR and digital collaboration tools may provide challenges for students to analyse from in-depth understanding to a larger whole. It is important that the teachers prepare the

Table 1 Analysis related to systematic literature review as a research-like learning activity

Systematic Literature Review (SLR)	<i>Structure / coordination</i>	<i>Professional focus</i>	<i>Relevance and motivation</i>	<i>Challenges</i>
Learning activity	Defined procedures / steps act as scaffolding for exploratory learning.	Unknown learning method, but not so complex that it takes focus from academic content.	The method is perceived as relevant and useful.	Several methodologies for SLR exist.
Collaboration Technology	Coordination tools for communication and interaction.	Co-creation in knowledge production.	Students learn tools that can be used in other learning and collaborative situations.	SLR requires large joint documents, and this presents challenges regarding tool selection.
Activating students	All students are engaged and accountable, avoiding “free rider” issues.	Co-creation of various perspectives in the same professional theme.	Sees the utility value related to bachelor and master’s thesis.	Connecting in-depth understanding of individual articles to a larger whole.
Role of the Teacher	Requires thorough preparation by the teacher and active facilitation throughout in the process.	Adaptation to educational level and varying degrees of involvement.	Available tools and technical user support.	Select and adapt methodology for SLR.

teaching sessions thoroughly and that the teacher functions as an active facilitator in the process. A main characteristic is that the role of the teacher, in addition to exercising a traditional link between content, pedagogical and technological competence, also include research competence.

4 Findings and discussion

Research-like learning activity such as SLR using collaboration technology requires that the teacher has a complex competence, which corresponds to and expand Koehler and Mishra’s (2009) TPACK model where they emphasise that the teacher must have technological knowledge, pedagogical knowledge, and content knowledge, and be able to connect these competencies. A main finding is that research competence, including knowledge about digital tools which can be used in a collaborative research process, knowledge about research designs relevant for the content area and knowledge about explorative learning activities, e.g., SLR is useful in research-like learning activities. Based on this main finding, we propose an expanded TPACK-model, called “TPACK and Research-like learning” (see Fig. 1), which illustrates the need for research knowledge in relation to the technological pedagogical content knowledge.

The model “TPACK and research-like learning” will in the following paragraphs be further elaborated and discussed based on SLR as a digital collaborative research-like learning activity. First, with an individual focus on Explorative learning activ-

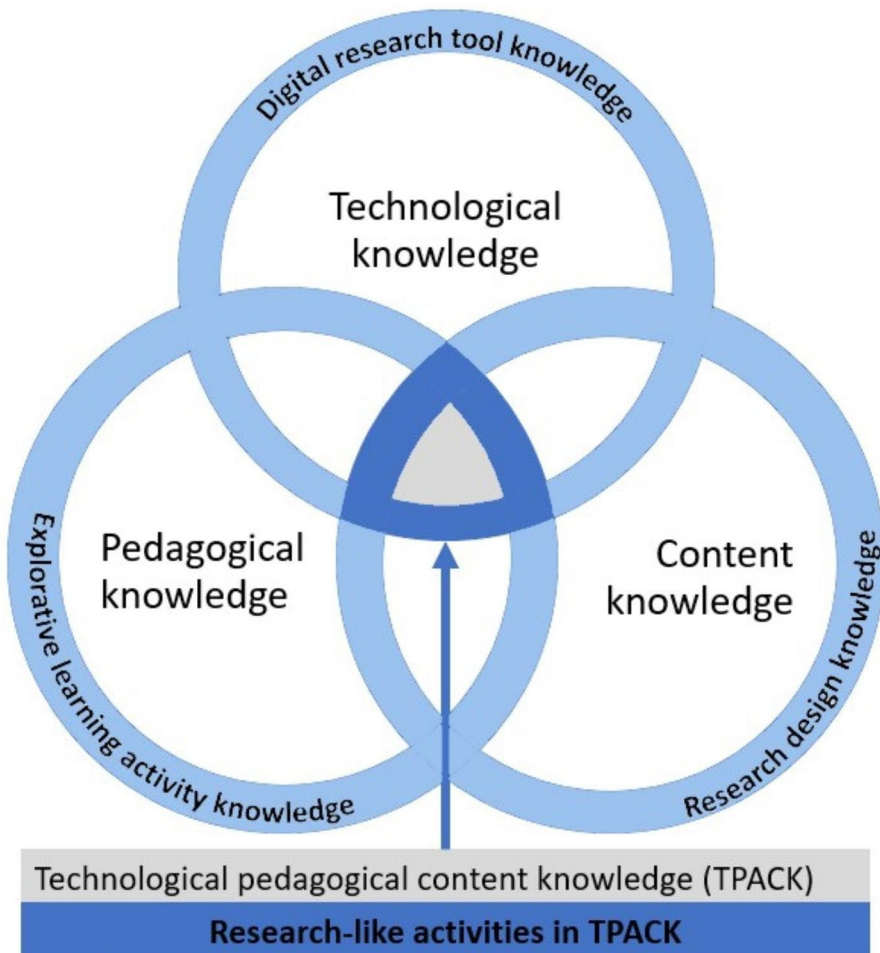


Fig. 1 TPACK and Research-like learning (an expanded TPACK model based on Koehler and Mishra, 2009)

ity knowledge, then focus on Research design knowledge and Digital research tool knowledge, and finally a focus on the integrated parts, also referring to the analysis (Table 1).

4.1 Explorative learning activity knowledge

Integration of research methods in learning activities is relevant in higher education for students to learn how research-based knowledge is produced, cf. Report to the Norwegian Storting, no. 16 (Ministry of Education & Research, 2017, p. 45): “... Higher education is in a unique situation when it comes to educating candidates who can read and use research, ask critical questions and use scientific methods to solve problems during their studies and in working life.” Implementation of SLR as a research-like learning activity in this study’s cases support that SLR is well-suited,

partly because the method has defined procedures, and in addition was perceived as useful because students could apply the methodology in their own bachelor or masters' theses, cf. Table 1. By using SLR as a learning method, the students in the three cases gained training in interaction with others and insight into research as a collective process.

In this study, the five steps of Khan et al. (2003) acted as scaffolding in students' explorative learning and contributed to the teacher's planning. There are several similar methodologies for SLR with clear steps and procedures that can work in a learning process (Badger et al., 2000; Tranfield et al., 2003), and an assessment and adaptation must be made for use in a learning process, requiring an explorative learning activity knowledge among teachers. Pedaste et al. (2015) also had the goal of structuring learning in a scientific research process divided into phases, and in addition highlighting and integrating scientific thinking. As previously mentioned, higher education in Norway has mainly used research-led teaching, just one of Griffiths' (2004) four models of research-based teaching. SLR using digital collaboration tools is an exploratory learning activity that exemplifies Griffiths' (2004) third model in the link between research and education. It is not a traditional learning method, but the experience from the cases shows that the method was not so complex as to decrease focus from the intended learning outcomes. Explorative learning activity knowledge means that teachers in higher education need pedagogical knowledge about how to use research methods, e.g., SLR, as frameworks for their teaching practices to succeed with research-like learning activities.

4.2 Research design knowledge

As mentioned earlier, the Norwegian Ministry of Education and Research (2017, p.54) emphasizes that "active participation in research among students has a clear connection with students' ability for critical thinking, investigation and lifelong learning". This corresponds with research in other contexts, e.g., Valter and Akerlind's (2010) study in Australia involving introducing students to ways of thinking and acting like researchers, with a focus on how discovery- and research-led education can be introduced into mainstream curriculum in an affordable way.

TPACKs "content knowledge" must in research-like learning be regarded as the teacher's knowledge of relevant and discipline-specific research topics and methods. Even though there are several, but quite similar, methodologies for SLR (Badger et al., 2000; Khan et al., 2003; Tranfield et al., 2003), SLR is a general methodology useable in most study programs. This study underlines the notion that teachers must adapt the SLR-methodology to the course content. This relates to the students' motivation and engagement to participate in the learning activity. Further, the teacher must make adaptations of the learning content to fit the educational level. The teacher in the bachelor course prepared several of the Khan et al.'s (2003) five steps, while the teachers of the master courses would leave more of the work to the students. This corresponds to Willison and O'Regan's (2007) framework for students' research skill development, where they divided the skill development into five levels of student autonomy. The student collaboration at bachelor and master's level each had a somewhat different character and function, but a common feature was the usefulness

of each individual student having to contribute to the production of knowledge and assembling that knowledge into a system that gave a greater overview and learning outcomes.

4.3 Digital research tool knowledge

Digital research tools can include both specific research tools e.g. NVIVO for qualitative analysis, SPSS for quantitative analysis, and general tools, e.g. collaboration tools, text editors, spreadsheets, which also are useful tools in a research process. This study highlights research as a collective activity, which requires a focus on digital collaborative tools. Collaboration technology was used as a coordination tool where, for example, the division of labour in the student group was handled. In addition, the collaboration tools contributed to co-creation and the analysis process. An example is using the analysis table or the five steps in SLR as the structure of a shared document. This simplifies the compilation and synthesis of findings. Using *OneDrive* or *Google* enabled co-creation in shared documents (Jeong & Hmelo-Silver, 2016), both synchronously and asynchronously in the learning process. Getting an overview of the research field in the start-up of a research project can be overwhelming and challenging. By facilitating collaboration and co-creation of knowledge, the students may experience an added value, both in terms of academic and social benefits. The use of collaboration technology made digital tools visible as a means and added value for the learning process, including the interaction between students and between students and the teacher, cf. Blau and Shamir-Inbal, 2017, Bovill (2019) and Buzzard et al. (2011). In line with Jeong and Hmelo-Silver (2016), findings from the study showed that the students were engaged in solving the task together, and digital sharing of the documents made progress in the process visible and obliged everyone in the group to contribute. In this way, “free riders”, who can be a challenge in group work, were avoided.

In this study, various digital collaboration tools were used, such as co-writing in word processors and spreadsheets, as well as the use of digital questionnaires. The advantage of co-writing in a word processor is that all participants have access to a common document for reading and editing, and all analyses are collected in the same document. This gave the students a common understanding of the co-creation process, cf. Gutwin and Greenberg, 2002. Some of the cases experienced challenges in handling large joint documents, and therefore chose other tools along the way. Shared spreadsheets allow for co-creation by letting students fill in tables together. Each student filled in the findings in either “their” column or “their” row. This can be experienced systematically when registering but can also provide an overwhelming amount of data when comparing findings afterwards. With the questionnaire tool, each student can enter their analyses by answering specific questions. The advantages are that the students make a structured analysis, and that presentation of the results can be structured in a spreadsheet format and diagrams afterwards. The challenge is that access to each other’s analyses is limited during the process and thus not optimal in a co-creation process, cf. Gutwin and Greenberg, 2002, as the individual student contributed without seeing their fellow students’ contributions along the way. These experiences indicate that teachers need knowledge of both the usefulness of, and bar-

riers to using collaborative digital research tools, in order to succeed with research-like learning activities in higher education.

4.4 TPACK and research-like learning – integrated knowledge need

The analysis of the study indicates that all three cases cover four of five characteristics of the student-active approach to teaching highlighted by Adams (2006); exploratory learning activities, students as co-producers, the teacher as supervisor, and emphasis on work tasks where the process is the goal. Findings in the study underline that the teachers need to prepare thoroughly, facilitate the process, and provide good information about SLR as method and its relevance, and digital tools for collaboration. Digitalisation enhance the student-active forms of learning, cf. Aagaard et al., 2018, and also in research-like learning activities. Overall, it is essential to clarify information to the students about the purpose, implementation, and expectations of participation in a research-like learning activity. The purpose is for students to emphasize the academic learning process as an end in itself (Damşa & de Lange, 2019; Blikstad-Balas, 2019).

The core of Fig. 1 illustrates the teachers' holistic integrated knowledge need, connecting respectively explorative learning activity knowledge, research design knowledge and digital research tool knowledge. To succeed with research-like learning activities as SLR, the teacher must consider the disciplinary learning outcome when selecting collaborative digital research tools.

In all three cases, an SLR using digital collaboration technology was tested for the first time. The first implementation involved, among other things, revising the framework offered by Khan et al. (2003) for SLR with the 5 steps so that it was adapted to a relevant professional context, and in addition select relevant and available digital collaboration tools. In carrying out the cases, we were aware of if the tool itself was receiving too much focus at the expense of the academic content and learning. By starting with relatively simple and “familiar” tools, no issues in the use of these tools were discovered in this context. Bower (2017) emphasizes that it is the teacher with a pedagogical drive who ensures that technology-supported learning takes place, and that this is central to whether the learning experience is positive or not. To check the quality of the student groups' understanding of the task and to ensure progress in the learning process, the study showed the need for a thorough review of the five steps, differentiated for different levels. For example, greater demands were made on students at master's level concerning responsibility and independence in solving the tasks.

After the learning activity started, the teachers in the cases became active supervisors and facilitators in the process. Bower (2017, p. 417) emphasises that in such a perspective, the role of the teacher is not only to be part of the social learning environment, answer questions and provide intellectual guidance, but also structure activities so that students can learn from and with each other.

5 Conclusion

The exploratory multiple case study introduces the concept of using systematic literature review (SLR) and digital collaboration as learning method in higher education. Using participatory observation technique and thematic analysis, we identified characteristics on how to succeed with digital collaborative systematic literature review as a research-like learning activity in higher education.

The literature review refers to recent studies concluding that students seldom are exposed to research-like work. A practical contribution of this study is an example of how SLR is well-suited to do collective research-like learning activities. Findings underline that the teachers need to provide good information about SLR as method and its relevance in a research process. Selecting familiar digital tools for collaboration can ensure that the students are focusing on the co-creation of content, and hopefully avoid technological obstacles. Adapting the SLR-methodology to the course content is important for the engagement and motivation of the students.

The main contribution of the study is that the higher education teacher needs integrated knowledge, including research competence in addition to the traditional link between professional, didactic, and technological competence. The study adds to the existing body of knowledge a model for research-like learning, called “TPACK and Research-like learning – an expanded TPACK model”. Based on the existing TPACK model, our proposed model illustrates the need for research knowledge in relation to the technological pedagogical content knowledge. The expanded model is discussed focusing on the need for explorative learning activity knowledge, research design knowledge and digital research tool knowledge. Finally, an integrated view of these needs must be seen in relation to each other. The model illustrates one way of achieving both student-active learning, where students are encouraged to engage with course content, digital collaborative learning, and research-based education.

Our findings suggest that the hiring of new teachers in higher education should emphasize the applicants’ research background, in addition to teaching qualifications to strengthen student-active learning and research-based teaching with exploratory learning activities. In addition, newly hired teachers should be offered/required to take pedagogical courses for university levels, which increasingly should include learning goals on ways of teaching research-like learning activities and using digital tools to enhance student collaboration to reach the aim of research-based higher education. However, it must also be remembered, that research-like learning activities are only one of Griffiths’ (2004) four models of research-based teaching.

Looking ahead, there is a need for more research on how to perform summative assessment when using research-like learning method in higher education, to obtain a goal of constructive alignment, with a clear connection between learning objectives, learning activities and assessment. There is also need for more knowledge on SLR as a learning activity, from the students’ perspective.

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Data availability The datasets generated and/or analysed during the current study are not publicly available due to national regulation with regards to individual privacy.

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