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Publication date
2022

Document Version
Final published version

Published in
Proceedings for the Thirteenth International Conference on Networked Learning 2022

How Networked learning can facilitate professional development?

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Abstract

In this review article, our main goal is understanding the Networked Learnings used for professional development. Networked learning can be defined as a form of learning where information and communication technology (ICT) can be used to promote connections between learners and their peers, learners and tutors and learners and learning resources. Such networks play an important role in professional development of employees in different sectors, from high tech industries to traditional businesses, and in both formal teaching and educational programs and informal learning activities. In this review, we explore how networked learning contexts, domains, and levels of scale are practiced and reported in the academic literature. And finally, we will investigate support technologies that have been used to facilitate networked learning for professional development.

Keywords

Networked learning, professional development, value creation, Technology Enhanced Learning

Introduction

We are living in an era of constant change and transitioning which for example is experienced at work, by global challenges, and through transforming technologies (Jakupec & Garrick, 2000). These changes and challenges bring us many opportunities for growth but also require us to tackle many work-related and professional issues. Issues that more often than not involve learning and development and require continued or lifelong professional learning to support capability development. The Building Energy Management System (BEMS) within the Heating, Ventilation, Air Conditioning (HVAC) sector is one of the professional sectors which has been significantly affected by transition at work. This sector is becoming increasingly complex, and it

is facing significant challenges related to the energy transition. For example, stricter energy performance regulations and higher comfort expectations make the buildings more heavily equipped with complex (smart and/or digital) systems which often generate larges volumes of data. Because of those developments in the sector, knowledge about HVAC systems alone is no longer enough. HVAC consultants, contractors, and maintenance companies are suddenly expected to have knowledge about data management and data analytics techniques (Ligtvoet et al., 2016, Radar 2020, 2014). Transition skills such as problem-solving, critical thinking, creativity, and the ability to collaborate (Topsectoren & PBT, 2017a; 2017c), and technical skills like data analytics and machine learning are becoming increasingly important. In the context of such changes in the sector, there is an urgent need to reflect on lifelong learning and practices in the sector.

Lifelong development can be considered as "all learning activities that are undertaken throughout life, with the aim of improving knowledge, skills, and competencies within a personal, civic, social and/or employment-related perspective" (Commission of the European Communities, 2001, p. 9). It concerns adult learning, whether in formal and informal learning pathways and whether concluded with a diploma or certificate (Gielen et al., 2017). To enhance lifelong development, people must have the opportunity to participate in learning and be willing to learn (Topsectoren & PBT, 2017b). The possibility to participate in learning is related to the ability to learn, the type of profession, work environment, financial resources, available time to learn, information provision, and the connection to the demands of both the employer and the employee. Because of more dynamic job profiles as also the distribution of jobs between humans and robots, there is a noticeable focus on learning and professional development in the workplace (Topsectoren & PBT, 2017b). The use of learning communities and learning networks can strengthen the capacity of individuals and organizations to learn (Topsectoren & PBT, 2017; 2019). As Lave and Wenger (1991) describe, learning communities have been used for a group of people who interact regularly, share the same concern or passion for something, and they aim to improve thier knowledge and practice. Networks of Practice (NoP) or learning networks (Seely Brown and Duguid, 2001), have been used to describe a more informal and developing social network that encourages and supports the sharing of knowledge and information between a group of people who gather around the same practice and profession. Seely Brown and Duguid (2001) and Wenger, Trayner and De Laat (2011) claimed that there are a few differences between learning in networks and learning in communities of practice. First, in Networks, the relationship between network's members is more informal and intimate in comparison with communities. Second, powerful interpersonal relationships and group unity are shaping the fundamentals of communities, while networks are more widespread, and the relationships can be weak or strong. And finally, relationships in networks can be temporary, but in communities, people tend to form a more permanent and lifelong connection. Also, as mentioned in "Networked Learning: Inviting Redefinition" (2021), "Networked Learning involves processes of collaborative, co-operative and collective inquiry, knowledge-creation and knowledgeable action, underpinned by trusting relationships, motivated by a sense of shared challenge and enabled by convivial technologies. Networked learning promotes connections: between people, between sites of learning and action, between ideas, resources, and solutions, across time, space and media" (p. 319).

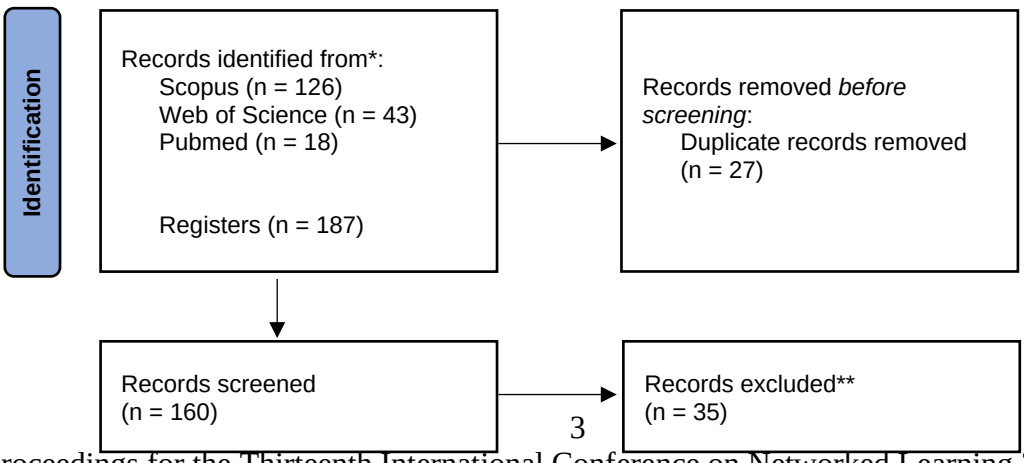
In this research, we combine theories and principles from the field of networked learning with challenges and transition in lifelong development. Within networked learning, forms of social learning related to informal learning can exist in various configurations, such as field labs (e.g., Stolwijk & Seiffert, 2016), living labs (e.g., Maas et al., 2017; Nyström et al., 2014), Collaborative Innovation Networks (e.g. Xie et al., 2016), and Centers for Innovatief vakmanschap (English translation: Innovative Craftsmanship) at vocational schools (e.g. SBB, 2020). Examples of learning communities related to formal learning are, employees who take a course together or with their peers to be informed about developments in their field. And in all these different learning processes, emerging technologies can help in both facilitating the access to educational resource and communication between learners. But in this research project, we mostly focused on the networked learning framework because the way HVAC is currently organised is more similar to network principles instead of community organisation.

Therefore, in this review article, we try to investigate current developments in the field of networked learning, and continued professional development to explore how this can support emerging needs for lifelong development and learning in the HVAC sector.

Methods

Search and Identification Process

In this research, PRISMA guidelines (Page et al., 2021) for conducting systematic reviews have been used to report the results of study in a systematic way. We used three different search engines Web of Science, Scopus, and Pubmed to find relevant articles. Our keywords include "Networked Learning" and "professional development", and all articles between 1998 till 2021 have been covered. We included the research that our mostly focused on professional development of employee, followed the experimental methods. And the articles which they focused only on primary education, and technical computer science methods (e.g., neural network analysis) were excluded. The results of the search findings are presented in figure 1.



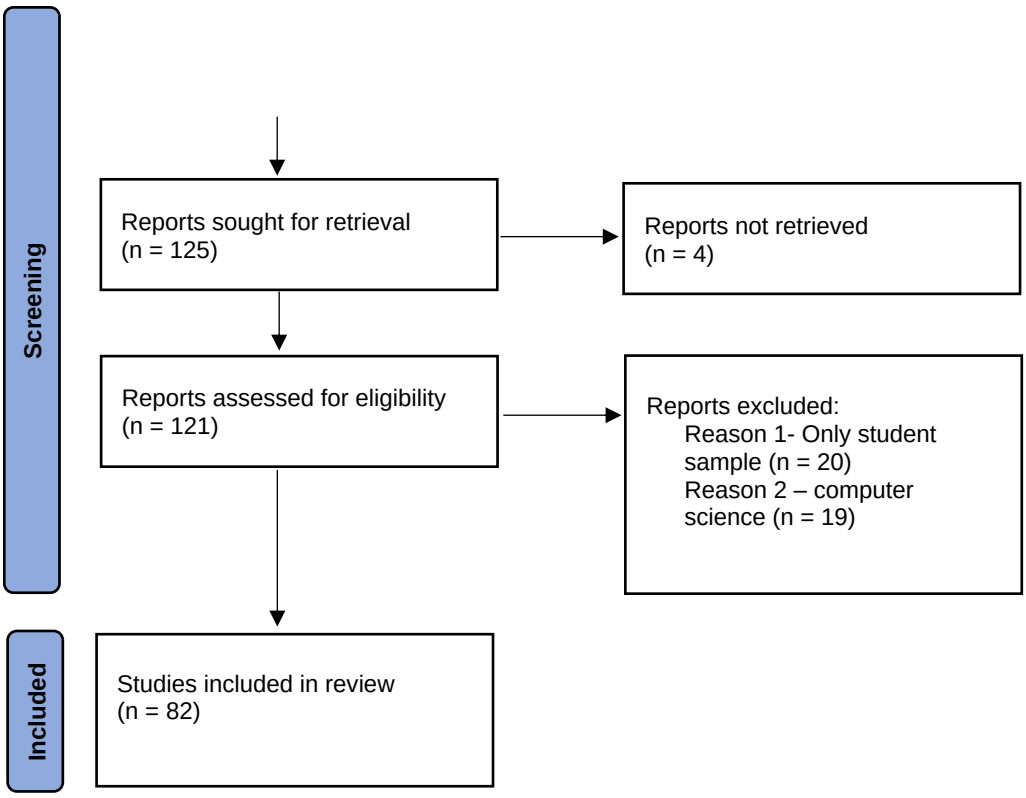


FIGURE 1. PRISMA table.

Apraisal: Screening and Selection Process

The titles, abstracts, and keywords of the search results provided by search engines were checked for selecting the relevant publications. Also, during the screening process, a few supplementary references were included based on a search of the reference list of papers. The results are presented in figure 1.

Results

To understand how the literature can support emerging needs for lifelong development and learning in the HVAC sector, we categorize our findings as follows. First we describe networked learning contexts, followed by social and individual attributes of networked learning, networked learning domain, and finally mechanisms and design features that support productive networked learning practices.

Networked Learning Context

The literature we reviewed shows that professional learning can take a place not only through formal setting, like organized workshops, conferences, and classrooms, but also it might be a part of everyday working of professionals (Eraut, 2004, 2007, 2011). Such informal learning can happen during the face-to-face communication of employee, observervation of more experienced colleagues or any other form of unintentional learning beside working (Felstead, Fuller, Jewson, & Unwin, 2009; Tynjälä, 2008). These informal learnings are mostly invisible to managers, organizations, and professionals as a form of professional development (Milligan,

Littlejohn, & Margaryan, 2014) and it considered as a "huge mass of iceberg" (Vaessen, 2014) because mostly such informal activities are invisible and spontaneous (De Caluwe and Vermaak, 2003; De Laat, 2012). Although it is mostly unknown for organizations, but often it is at least as influential as the other form of formal education (De Caluwe and Vermaak, 2003; De Laat, 2012).

In general, both formal and informal form of learning can be important for professional development. For example, Bautista et al. (2021) shown that for art specialists and music teachers both formal and informal education needs be seriously considered by policy makers. Vaessen et al. (2014), also explored the relationship between formal and informal professional learning of teachers. And finally, instead of conflicting formal with informal learning, we should highlight the need to develop a "hybrid form of learning". With this approach both formal and informal activities recognised, respected, and promoted (McGuire & Gubbins, 2010; Vaessen et al. 2014) and formally supported/implemented by organisations as forms of learning and professional development (De Laat, 2012).

Networked Learning Social and Individual attributes

According to Vaessen et al. (2014) Networked learning can promote different social and individual attributes. For example, by providing a networking and communication opportunities for people to connect and learn with other professionals, networked learning can provide more professional autonomy, freedom of choice, commitment, responsibility, accountability, power, control, trust, communicative openness, and interest to share and provide feedback. On the other hand, it can also provide collaborative atmosphere in the organization, and increase the chance of success of networked learning activities (Vaessen et al. 2014).

In addition, networks can also create an opportunity to link to other professionals outside of the direct working environment by creating the freedom of choice (cf. Büchel & Raub, 2002). This option which enables you to choose what you want to learn can improve a person's performance (Akkerman, Petter & De Laat, 2008), because it is believed that such freedom can brings a feeling of responsibility and increase personal motivation (Varga- Atkins et al., 2010). Oddone et al. (2019), explored the role of autonomy within the professional learning networks of teachers and claimed that teachers experience autonomy in learning networks as linking (choice and control), stretching (an expression of self as teacher and learner) and finally amplifying (an expression of self as individual).

Also investigating the networked learning in continuing medical education, show that educational networking and communication between professionals can encourage learner engagement and commitment to practise improvement (Margolis et al., 2015). Especially, "interactivity conducive to learning and behaviour change" in professional learning network can be facilitated with trusted relationships and freedom to express their concern or dissatisfaction with peers (Parboosingh et al., 2011).

Networked Learning domain

Networked Learning has been used in a wide range of domains like, higher education, management and organizational learning, workplace, and continuing professional development. But one of the main domains of

networked learning application is in professional development of teachers where they can expand their relationship in and outside of their school's network to learn, solve their everyday problems and innovate in their teaching (De Laat, 2012).

In the last few years, more digital technologies have been used for teachers professional learning that can cross the boundaries of school's limitations. ICT can enable the teachers to remain connected with their professional learning network regardless of their geographical limitation (McGregor et al. 2004, 2006). As an example, we can mention about the TeachConnect platform that provide community support for teachers (Kelly, 2018).

Mechanisms and design features that support productive networked learning practices

Different mechanism and design features can support network learning and its value creation. We can argue that the recent progress in networked learning field has been largely influenced by understanding and development of technologies to support networked learning and moving from traditional way of learning to a more innovative, technology-based learning. Lee et al., (2020), reviewing empirical research revealed a few important factors that can influence member's engagement in knowledge creation in online learning communities and networks. Structured approach (for example, Bedford, 2019): argue that incorporate structure and having a timeframe for online professional learning network can be beneficial. Organizational support: we already observed the importance of organizational support in our interview with different companies involved in TransAct project. Our interview revealed that imagining success for online learning networks in organizations without managers or leaders support, is out of reach. Conducive environment: as we also discussed earlier in social and individual attribute section, psychological characteristics of professional network members can highly influence the success of learning networks (Owston et al. 2008). Culture of sharing: this feature of online learning networks that professionals are actively engage with sharing and it is also appreciated by the organization can promote network learning between professionals. Shared ownership: It can have a significant effect and explore whether there is a sense of a personal value in the online learning networks and co-ownership of common goals such that members find may value and perseverance in engaging in online knowledge construction.

Beside that there are a wide range of web technologies that have been used for facilitating the networked professional learning; from a local website that professionals can communicate with each other using email messaging, chat, or discussion forum to a more national or international platforms that they provide video cases, lesson plans, and many different teaching and learning activities (Lock, 2006; Powell & Bodur, 2019).

Discussion

Professional networked learning is situated within a broad economical, societal, and educational context. Answering this question that whether and how networked learning can be considered and being developed in the professional working environment of expert in the high-tech industries like energy management sector can be

challenging. By critical reviewing the literatures and exploring what have been so far achieved in the field of networked learning, we are able to take the next steps, fill in the gaps in research and implement new ideas.

Now, the energy transition is on its fast speed. Distribution of technical knowledge and experience is needed and continuous professional development of the current workforce, and educating the new employees is crucial. That is the main reason which we have conducted this research to be able to develop a conceptual model of networked learning which can help tackling these educational challenges. These days, many educational and research institutes in the Netherlands have tried to develop a formal form of learning communities and networks to help the energy transitions (Topsectoren & PBT, 2017c). We discussed the importance of both formal and informal networked learning activities (Brown, Collins & Duguid, 1989). Organizations that only focus on formal education and ignoring informal learning may miss a big and important aspect of professional development. On the other hand, considering only informal learning for professional development can be misleading. Therefore, as it is also suggested by McGuire & Gubbins, 2010, we recommend a hybrid form of learning where both formal and informal is recognized and respected. High tech industries like HVAC, cannot unlock their potential by focusing on one form of networked learning and ignoring the others.

In both formal and informal learning networks, different social and individual attribute can be important and affect the productivity of such networks. Different aspects like level of control on the learning process and autonomy, self-directedness and independent decision-making can change the direction of networks (Vaessen, 2014). We see that freedom for professionals to choose the areas to explore can improve their performance (Akkerman, Petter & de Laat, 2008). Also, research in professional development of teacher shows that how important is the role of organization culture in providing the opportunity to develop (de Laat, 2012). Organizations with hierarchy and more centralized culture can negatively affect the possibility to learn from more senior experts (Pahor et al, 2008). Hence, policy makers and strategist in the energy management field needs to consider these important social and individual attributes in their future decision and consideration for designing a professional learning network.

We strongly believe that professional learning networks in HVAC sector can be inspired and learn from other domains. Professional learning networks have been used in the field of professional development of teachers (e.g., Pettersson and Olofsson, 2019; Spante et al., 2019; Oddone et al, 2019; Bautista et al., 2021) ZooCamp educators, (Khalil et al, 2017) and continuing medical education (Margolis et al., 2015). Each of these networks has it own specific features, but the fundamental idea behind all of our same and is generalizable to the other networks. Therefore, by reviewing these different professional learning networks in different domain we can explore the current initiatives, barriers, and opportunities of network learning designs and implement them in HVAC sector.

Finally, this literature review is not only providing a comprehensive overview of current statue of networked learning research, but also it can help us to develop a conceptual model that can help the energy management

system experts in the HVAC sector. Our practical model focus on hybrid form of network learning where the freedom of choice and trust between the participants of the network is respected, and organizational culture facilitate this type of learning.

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Acknowledgements

I would like to express my sincere gratitude to my colleagues in TransAct project, Dr. Ellen Sjoer, Maaike Konings, Dr. Paula van den Brom, Prof. Wim Zeiler, and Samir Ahmed, for their extensive support and feedbacks during preparation of this research.
I also want to thank my colleagues at Center of Education and Learning for their feedback on our manuscript.
And finally, to my caring, loving, and supportive wife, Fatemeh Kazempourmofrad, my deepest gratitude.