PRESERVICE TEACHER TRAINING PROGRAM FOR WORKING WITH NETWORK MEGA-PROJECTS

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ABSTRACT

Network technologies bring together schools, universities and scientific and business organizations to effectively work on network projects on the Mega-Class educational platform. This study aims to develop a program for training preservice teachers to work with network mega-projects. It relies upon the projective-recursive network learning model and Intel’s Teach to the Future initiative. The program design has specific pedagogical and methodological conditions and sets out nine stages of implementing the preservice teacher training methodology. The program incorporates elearning tools and a scientific laboratory, which connects all network participants. The teacher training program is effective for working with network mega-projects in educational clusters.

Keywords: educational cluster, network technologies, network mega-project, mega-lesson, preservice teacher training, Mega-Class

INTRODUCTION

Worldwide threats and challenges, including pandemics, force educators to “identify the best teaching tactics” for an online class (Gewin, 2020, p. 295). A variety of elearning tools and web conferencing platforms for education contribute to the effective remote teaching of a great many students from different educational institutions. Globalization and the digitalization of education, which drive remote teaching, have brought to the surface the need for stringent requirements for teacher training. The ability to teach school students online should be a foundational skill that preservice teachers have to master.

Teacher training should be advanced, integrated with science and life, and continuous. It enables preservice teachers to use resources from several organizations to obtain an academic degree and provide quality education (Nozaleda & Agorilla, 2019). These requirements can be met using technologies that allow the organizing of interactions indirectly (or partially indirectly) via information and communications technologies (ICTs) (Garcia Aretio & Garcia Blanco, 2016; Nabatova, 2016).

This interaction characterizes distance learning, which involves using telecommunication technologies and network technologies as examples of ICTs. These allow people to communicate regardless of their geographical location and collectively carry out activities at different educational institutions. These technologies make it possible to overcome social and cultural barriers, so the educational infrastructure contributes to achieving students’ learning goals (Nozaleda & Agorilla, 2019). ICTs are integrated into higher education programs for full-time and part-time students, as well as secondary and further education students. ICTs are widely used in student independent work, where elearning tools give them
Network technologies are becoming popular in education, as they provide an opportunity for more productive business, practical, and research-oriented training (Baran & Mamaeva, 2016; Kandiawan et al., 2018). Incorporating network technologies into the curriculum (“network forms”) involves the remote interaction of organizations as equal participants via elearning tools. Distance learning also enables educational institutions from different countries to interact and cooperate, which facilitates using best practices to create a global educational space. Implementing network technologies helps organize interactions among schools, universities, and scientific and commercial organizations to achieve a cooperative outcome through networked projects. Therefore, there is a need to orient the education system towards the integration of schools, universities, scientific organizations, and businesses to work on topical network projects.

The organization of these network forms is primarily connected to the emergence of educational clusters where interconnected institutions of secondary and higher education have partnerships with industrial enterprises. The main role of the educational cluster is to integrate its members, which are organizations with contractual relations, including schools, universities, science organizations, and commercial organizations. The members’ shared goals allow for close cooperation, which helps improve the quality of education in schools and makes teacher training at universities more effective.

Such clusters are widespread in developed countries like the United States, Canada, Great Britain, France, the Netherlands, and Poland. In actively developing countries such as the United Arab Emirates, Singapore, China, and Jordan, educational clusters are also growing in popularity. The clusters in the state of New Jersey (USA), the province of Ontario (Canada), and the city of Dubai (UAE), which mainly integrate the interaction of universities, research centers, and commercial organizations in order to improve the quality of continuing education, are good examples (Aitbayeva et al., 2016).

Today, network forms permeate the educational processes of schools that are more readily applying network technologies. Bringing together different types of educational institutions has proven to be important. For example, Russian network projects united under the name School-Technopark integrate secondary and further education (Gaivoronskii et al., 2017). The student is the center of the educational process, and resources for further education allow them to develop, and laboratories provide the following resources: robotics, the internet of things, nanotechnologies and microelectronics, geoinformation networks and ecology, ICTs, bionics, and 3D modeling and prototyping. The Spanish network project The School to Work Transition Observatory, under the program The Sant Vicenc dels Horts network (Barcelona), is being built to integrate secondary and further education (Mayayo & Romani, 2016). The project aims to improve academic achievement in schools with a low sociocultural level.

The Romanian Educational Seismic Network (ROEDUSEIS) project is dedicated to protecting the public during an earthquake and operates in nine Romanian schools (Tataru et al., 2016). Research institutes, a university, and a commercial software development organization are involved in informing its participants about seismic risks. Also of interest is the experience implementing the Lunar Caves Analog Test Sites (LCATS) for Space-STEM Learning Performance, a three-year network project to study aerospace known (Ximenes et al., 2019). The project participants are representatives from the United States, South Korea, the Netherlands, and Mexico, and the project promotes STEM education, which means building student learning on a practice-oriented, interdisciplinary approach in science, technology, engineering, and mathematics.

Researchers from Finland and Denmark describe teacher training in a Nordic online course on gender equality promotion in education. The project involves not only school administrative and teaching staff but also university faculty and activists. Teacher training institutions benefit from preparing preservice teachers to be respectful of cultural diversity, gender differences, and identity (López et al., 2017). Notably, the relevant foreign studies do not effectively address the experiences of preparing preservice teachers for working with network projects.

An integrated environment must be created
to efficiently organize network forms that focus on interaction and cooperation among the state, education, science, and business. In educational clusters, this environment should be built on a technological educational platform that introduces a network learning model. Such platforms include PBL-Maestro, which prepares network projects in computer science (de Oliveira & dos Santos, 2018), and ALISON (Advanced Learning Interactive Systems Online), which is most commonly used for mass open online courses (Rehman et al., 2019). These platforms facilitate mutual interaction among cluster members and organize and allocate collaboration.

The most promising educational platform is Mega-Class, which allows new network learning models to be built in educational clusters. Russian researchers created it at the Department of Computer Science and Information Technology in Education at Krasnoyarsk State Pedagogical University named after V. P. Astafyev (Ivkina et al., 2016). It is a methodological system that promotes different schools’ cooperative efforts in the educational environment through cloud services. Distance learning technologies enable the integration of the scientific and educational processes of teacher training at universities, schools, and municipal education departments (Baran & Mamaeva, 2016). This platform is a free resource that facilitates students’ independent work and controls and assesses joint educational and scientific activities that are simultaneously provided to the students of several schools and university departments (Ivkina et al., 2016).

Mega-Class involves organizing simultaneous mega-lessons (named after the platform) that involve preservice teachers and school students in conjunction with university faculty and in-service teachers, as well as scientists and business representatives. Video conferencing using the network and cloud services facilitates online mega-lessons that are coordinated by a moderator (Baran & Mamaeva, 2016). Other participants include mega-teachers, mega-students, mega-tutors, and experts who work to create the mega-lesson’s content, which should be interactive, creative, and practice oriented (Bidaibekov et al., 2017). Both in-service and preservice teachers plan mega-lessons and incorporate them into their curriculum. These can be school lessons, methodological lessons for preservice teachers, consultations with scientists or business representatives, or practice-oriented teacher training courses.

Mega-Class has great didactic potential for creating network projects (“network mega-projects”) that involve participants of the educational cluster solving social issues together via cloud services both online and offline, which results in developing a relevant website. Examples include websites about participants of World War II, the Olympic Games, and Olympic champions. In the educational clusters, the participants create conditions for their personal growth and the development of their ICT competencies (Kozlov, 2016). This is possible due to cooperation among computer science teachers from other schools and curriculum developers, content specialists, and academic staff. In cluster interactions, an in-service teacher facilitates planning a lesson but has the opportunity to constantly share experiences with colleagues and learn about new teaching techniques and elearning tools.

Network mega-projects can be organized in schools so that school students are taught skills for open communication and teamwork so they can be flexible and creative in new situations and confidently take action in rapidly changing circumstances. The Mega-Class Achinsky Cluster project, which was implemented in schools in the city of Krasnoyarsk (Russia) (Baran & Mamaeva, 2016), the computer science mega-lessons in the Krasnoyarsk Territory educational cluster (Russia) (Ivkina & Pak, 2015), the mega-lessons in geometry involving participants from the city of Krasnoyarsk (Russia) and the city of Almaty (Kazakhstan) (Bidaibekov et al., 2017), have all demonstrated such results. Krasnoyarsk State Pedagogical University named after V. P. Astafiev (Russia) organized these network mega-projects.

There is some international experience in creating network projects in various academic subjects, but the existing network projects have some drawbacks. The loose culture of collaboration and the absence of a common legislative policy to support networking often make participants determine topics of interest by themselves (Azorín & Muijs, 2017). Other obstacles to implementing the networks are time constraints and budgeting (de Oliveira & dos Santos, 2018).

There is also insufficient development of
organizational, scientific, methodological, and technical support for cluster education associated with an unwillingness among in-service teachers and students to work together on joint network projects (Bidaibekov et al., 2017). This results from theory-oriented teacher training, which inhibits in-service teachers’ effectively working on network projects. Brazilian researchers share this opinion and assert that preservice teachers are not adequately trained to work in distance learning courses (Luz, 2018).

In-service teachers must be trained to work with network technologies in order to create and implement network projects, since the introduction of these technologies in schools is a recent trend. Teacher training for organizing network mega-projects can be carried out in three dimensions: (a) classes on teaching methodology for undergraduate students, (b) courses on network interaction in graduate programs, and (c) online courses on creating network mega-projects. Ivkina et al. (2016) are developing classes on teaching methodology for undergraduate students by encouraging preservice computer science teachers to work in an educational cluster. The learning outcomes then become their methodological portfolio, which includes complex tasks to perform.

Because it is difficult to use Mega-Class, not all areas for preparing preservice teachers to work with network mega-projects are being implemented. Additionally, in-service teachers’ low awareness of this platform and insufficient skills to use network technology complicate the process. Other barriers to the widespread use of network mega-projects in schools are associated with teaching staff’s unpreparedness to implement them. A program needs to be developed that ensures the effective development of the readiness of students in teacher training universities for using network technologies, which will help reduce the risks associated with implementing network projects in schools. To that end, the current study aims to develop a program for training preservice teachers to work with network mega-projects.

**MATERIALS AND METHODS**

The development of a program for training preservice teachers to work with network mega-projects is based on a projective-recursive learning strategy (Bazhenova, 2015) and the conceptual ideas of Intel’s Teach to the Future initiative (Intel, 2007). The basic principles of a projective-recursive network learning model are as follows:

- **Projectivity.** The main teaching technique in schools is the project method, specifically the projective strategy where the teacher and students jointly come up with a new network project, develop a training roadmap for implementing it, study, and master the appropriate ICTs and elearning tools.
- **Recursiveness.** With a view of implementing a network mega-project, the teacher and students are required to create learning tools and methods for learning the subject content.
- **Stage-by-stage approach.** Implementing a network mega-project has nine stages:
  - Stage 1. View examples of network mega-projects.
  - Stage 2. Create a sample plan of the content and stages of the network mega-project.
  - Stage 3. Propose the subject of the network mega-project.
  - Stage 4. Create a training roadmap individually or in a group for student independent work.
  - Stage 5. Organize student independent work.
  - Stage 6. Create the “business card” of the network mega-project.
  - Stage 7. Create a presentation and prepare students to defend the network mega-project.
  - Stage 8. Defend the network mega-project.
  - Stage 9. Explore elearning tools to implement the network mega-project.
- **Nonlinear approach.** The sequence of stages can be arbitrary.
- **Transformability.** The teaching methodology is able to transform the content of training any preservice teacher.
- **Econtent transparency and accessibility.** Learning and teaching support is open and accessible from any mobile device anytime and anywhere.
• Personification. Training roadmaps created by students themselves guide network mega-projects.

First proposed by American researchers, Intel's Teach to the Future initiative is the basis of the program because it aims to prepare teachers for using ICTs in schools effectively. Students are the center of this program, and the teacher's task is to improve the quality of the students’ education by using ICTs. “Each of the 11 modules of the program is designed as the result of students’ independent creative activity organized on the basis of using [ICTs], which has a socially significant and educational goal” (Intel, 2007, p. 4).

Class projects created by teachers can be used with students from their own schools and others and in the classroom or after school hours. Elearning tools are also applicable when students work with multimedia presentations, publications (newsletters, leaflets, announcements, calendars, business cards, and invitations), materials for student independent work created with spreadsheets and a text editor, and project websites. The following premises determine the readiness of a preservice teacher to use modern ICTs in schools:

• The teacher has the knowledge and skills to organize the educational process in the network learning model by means of ICTs on a global scale.
• The teacher is able to work virtually and cooperatively,
• The teacher utilizes the principles of the projective-recursive network learning model.
• The teacher is able to implement the ICTs and elearning tools required for working on network mega-projects with students.

The program tutor is in charge of implementing the program for training preservice teachers to work with network mega-projects.

The basic principles of the projective-recursive network learning model and the premises to determine a preservice teacher’s readiness to use modern ICTs in schools underlie the preservice teacher training program of working with network mega-projects. This current study reveals the conditions, stages, and elearning tools necessary for implementing the program. These elements are key to understanding how the program is to be performed in schools. In this regard, our theoretical foundations and expertise in implementing network mega-projects led us to choose the modeling method for our study (Baran & Mamaeva, 2016; Bidaibekov et al., 2017; Ivkina & Pak, 2015).

RESULTS

Some pedagogical and methodological conditions for implementing Mega-Class determine the preservice teacher training methodology. The pedagogical conditions include the following:

1. Teaching students a subject, training preservice teachers (with the university faculty involved), and advanced training of in-service teachers should represent a single process. Therefore, school students, preservice teachers, university faculty, and in-service teachers are the main subjects of the research.

2. Structuring the single process in four blocks:
   • a problem block that determines the content of theoretical foundations relevant to a school subject, an academic subject at a teacher training university, or a practice-oriented teacher training course;
   • a knowledge block that contributes to developing the competencies of the participants in the learning process, which help solve the problems of the previous block on the basis of practice-oriented tasks and learning games;
   • a project block that engages the competencies from the second block to implement network mega-projects (for example, developing useful websites for the sociocultural sphere, industries, business, and science; implementing specific activities for educational projects or grants); and
   • a control block that provides identical indicators of the success of performing educational and training activities for school students and in-service teachers, respectively (tests, assignments, projects), that also evaluates the effectiveness of advanced training for in-service teachers of particular subjects.
3. Rebuilding the curricula and instructional programs of schools and universities into a vertical educational format and providing a unified class schedule for pupils, students, academic staff of teacher training universities, and in-service teachers.

4. Providing the material, technological base, and telecommunications system (computer classes, resource centers, networks, and communications) necessary for conducting mega-lessons online simultaneously in schools and teacher training universities.

5. Providing learning and teaching support and elearning tools and monitoring the effectiveness of mega-lessons aimed at creating network mega-projects.

6. Designing new teaching techniques for conducting mega-lessons that ensure the orderly and effective organization of classes and providing comfortable working conditions for participants in the educational cluster.

The methodological conditions include the following:

1. The subject content is chronological, concentric in nature, and is consistent with all participants in the educational cluster.

2. The system of mega-lessons is organically integrated into the instructional program of the school subject.

3. Mega-lessons are focally embedded in the curriculum planning of a subject via prior coordination of requests from in-service teachers and teacher training university faculty.

4. Network cooperation between participants in the educational cluster is carried out continuously via regular webinars between all mega-lesson participants.

5. The programs of teaching methodology courses at teacher training universities are reconstructed and implemented for experimental groups of students in which mega-lesson scenarios are considered and the curriculum for students is consistent with the schedule of the mega-lessons.

6. Students are trained in course selection and independent work for participation in any mega-lesson and elearning tools and learning resources for mega-lessons are designed.

7. The model of teaching all community members using a mega-lesson should integrate into a single process student learning, preservice teacher training, and advanced in-service teacher training.

The teacher training methodology to implement network mega-projects can be described in several stages.

**Stage 1.** View examples of network mega-projects. At this stage, the program tutor and a group of preservice teachers review and discuss existing and previously completed network mega-projects hosted in cloud-based project databases on Mega-Class. They analyze mega-lessons scenarios in various academic subjects and exchange ideas for updating the content and how to organize mega-lessons in order to implement a network mega-project. It is important to discuss the elements necessary to implement it while taking into account the curriculum requirements and the students’ age group.

**Stage 2.** Create a sample plan for the content and the stages of a network mega-project. Preservice and in-service teachers are expected to familiarize themselves with examples of training roadmaps for planning and implementing a network mega-project. They compile their own roadmaps based on sample network mega-projects and the stages for implementing them.

**Stage 3.** When developing the subject of the network mega-project, the following must be considered:

- the students’ age
- formulating the overarching research question and considering the problematic issues of the course section or subject that the network mega-project is addressing
- setting the learning goals and teaching tasks of a network mega-project
- defining the name and topic of a student’s individual research as part of the network mega-project
- possible hypotheses for solving research problems
• inventing a creative name for a network mega-project
• creating groups to carry out a network mega-project and determining the format for presenting results
• identifying possible sources of information, elearning tools for, and regulatory issues of data protection

Stage 4. Create a training roadmap individually or in a group for student independent work. Video conferencing is used to discuss possible spreadsheets for planning students’ implementation of the network mega-project. Students should be taught to share the results of their work with other participants in the educational cluster.

Stage 5. Organize student independent work. When working on a network mega-project, it is important for students to achieve the following learning outcomes: self-development aimed at gaining new experience, the ability to work in a network cooperatively, the ability to find the relevant information and the ability to master and apply elearning tools. Particular attention should be paid to organizing student network interactions that meet the requirements for implementing network technologies.

Stage 6. The participants in the learning process should agree on a unified “business card” for the network mega-project. It can have the following structure:
• the name of the educational institution
• the subject of the network mega-project
• the scope of the network mega-project
• the learning goals of the network mega-project
• an overarching research question
• a summary of the network mega-project
• the software and hardware required to carry out the network mega-project
• keywords

Stage 7. Create a presentation and prepare students to defend the network mega-project. This stage involves developing software tools for creating presentations and exploring cloud services (for example, Web 2.0, Web 3.0). These services allow you to create online training materials independently, distribute these materials among the participants of the network mega-project, participate in new online activities, and simultaneously observe the activities organized by the network community. Workshops on presenting reports and defending the network mega-project are also held at this stage.

Stage 8. Defend the network mega-project. Technology for developing assessment criteria for student presentations should be considered, as well as developing practical guidelines for the network mega-project.

Stage 9. Master and study elearning tools to implement the network mega-project. The main objective of the program is for teachers to become proficient in distance learning, in particular ICTs (for example, studying the Microsoft Office suite), and in elearning tools. The following resources offer such tools during mega-lessons:
• The interactive whiteboard. Linoit.com (en.linoit.com) is a free electronic resource that can act as an online whiteboard. On this board, you can create canvases and attach sticky notes to them. For a mega-lesson, it is advisable to create several interschool groups of students with 1–2 participants from each school. The proposed interactive whiteboard allows these groups to communicate online with one another and with a mega-tutor by posting colorful stickers. Figure 1 provides an example of using an interactive whiteboard during a mega-lesson in computer science.

Figure 1. Example of Using an Interactive Whiteboard during a Computer Science Mega-Lesson
• Web 2.0 applications support the learning process using interactive modules. An example is LearningApps (learningapps.org), a resource for creating interactive learning materials. Using this resource, it is possible to diversify the subject matter of network mega-projects, work with maps, do crosswords, create mind maps, etc. Knowledge acquisition is easy to monitor using a test presented as a horse race. In the “Play with Friends” mode, each student is given the opportunity to move their horse forward by correctly solving a task (Figure 2).

• Google applications. These applications let you create files, store them on Google Drive, and collaborate online from anywhere in the world and from any computer. To organize mega-lessons, creating cloud drives for learning and teaching materials is recommended. In this regard, a mega-lesson can be organized as a web quest for students’ group work. It is advisable to prepare route sheets and assignments for students in the Google Docs application, and all participants can view the results for each lesson in the Google Sheets ranking table.

The scientific laboratory, designed to be a connecting link between all the participants in the educational cluster, holds a special place in the structure of Mega-Class. Krasnoyarsk State Pedagogical University named after V. P. Astafev (Krasnoyarsk, Russia) and Abai Kazakh National Pedagogical University (Almaty, Kazakhstan) jointly created one such laboratory. It is an international laboratory for addressing the issues of information systems development and employing educational technologies. The laboratory deals with issues pertaining to the methodology of network mega-projects and creating learning and teaching support for preparing in-service teachers to work with network mega-projects. The laboratory’s research activity is based on virtual collaborative research of all the participants involved (Figure 3).

DISCUSSION
This article presents specific pedagogical and methodological conditions for best implementing Mega-Class. The quality of preservice teacher training could be called into question if these conditions are not observed and complied with for all stages when work on network mega-projects.

A variety of network mega-projects require the use of a scientific laboratory and various e-learning tools, including an interactive whiteboard, Web 2.0 applications, and Google applications. These tools can be effectively employed if all the participants in an educational cluster have ICT competencies, and Russian researchers have confirmed the importance of using web 2.0 network services to create mega-projects (Charikova et al., 2018). Having a mastery of network technologies and e-learning tools is critical for being to use them. Therefore, when preservice teacher training program participants work with network mega-projects, this facilitates their mastery of network technologies so they can
use these technologies in real-life projects in the integrated environment on Mega-Class.

The success of preparing and conducting a mega-lesson depends on involving all the participants in the educational cluster with coordinating their work and having a personal interest in the project (Ivkina & Pak, 2015). In-service teachers who learn about these powerful resources for implementing their teaching goals and ideas, and who undertake continuous “real-world” training, are at a greater advantage than those who do not (Sozdanie klasternoj sistemy ..., 2013).

According to the projective-recursive learning strategy, network mega-projects, as a rule, produce specific products related to the topic or course section being studied and provide an opportunity to engage students in network interaction and the acquisition of knowledge and skills through cooperative activities in a network learning model. Work on network mega-projects is consistent with the conceptual ideas embodied in Intel’s Teach to the Future initiative, as participants use ICTs and elearning tools to create and present their work.

The preservice teacher training program for working with network technologies is implemented via the Mega-Class technological educational platform, which is effective for working in educational clusters. The proposed training program allows school students and preservice and in-service teachers to solve urgent, practice-oriented issues that are important for developing a modern approach to education, especially for remotely teaching many students from different educational institutions. This contributes to the preservice teachers acquiring the competencies necessary for working in educational clusters. A theoretical study of Ukrainian researchers attests to the effective work in educational clusters, which call for the integration of knowledge and skills through network technologies, access to distance learning, and advanced training of in-service teachers and university faculty (Gryshova et al., 2017).

Some schools in Asian countries work in educational clusters and are also involved in their network organization. For example, clusters in Cambodia were created to improve education and strengthen the interaction among schools while integrating different levels of education in primary and lower secondary schools. (Pellini & Bredenberg, 2015). Schools in Spain also use network technologies to organize network projects. One such project is the Asperones Avanza program designed to promote education opportunities for students living at risk of social exclusion (Ruiz-Román et al., 2018).

Examples of international network projects are found in the interactions among schools in Western Canada and East Africa, which focuses on solving existing social problems in these countries and enriching their connections with global and local communities. Establishing interactions among the project participants took time, as their sociocultural experience, views on schooling, and English proficiency levels differed (Kendrick et al., 2014). Chinese studies show that network technologies contribute to learning foreign languages (Shen, 2019; Wang, 2019). Researchers from Japan, Chile, the USA, Brazil, and Peru highlight their significant role in student engagement and synchronous learning in STEM education on a global scale (Isoda et al., 2017).

CONCLUSION

Incorporating network technologies into school curricula involves using resources from several institutions (teacher training universities and scientific and commercial organizations) as an educational cluster in order to facilitate learning. The interconnected relationships of such institutions improve the quality of education and self-development of all participants involved in the network interactions. Teachers need to be ready to work with the Mega-Class technological educational platform in order to successfully create and implement network mega-projects.

The program for training preservice teachers was developed on the basis of the projective-recursive learning strategy and some conceptual ideas from Intel’s Teach to the Future initiative and its aim is to prepare teachers to use effectively information and communication technologies in schools. The program describes pedagogical conditions that characterize teaching students a subject, preservice teacher training, and the advanced training of in-service teachers. The methodological conditions focus on the subject content, a system of mega-lessons, and the instructional program and curriculum, as well as preparing network participants for online collaboration. All the conditions contribute to
the nine main stages of work on network mega-projects and promote e-learning tools along with a scientific laboratory.

Mega-Class can be introduced to connect an educational cluster with a view of conducting school and university classes in any subject. The platform can be used to deliver educational experiences during extracurricular activities when school students and preservice and in-service teachers implement social network mega-projects. This program is recommended for use in teacher training since it breaks the barrier to teachers working with network mega-projects in a global, digital environment.

Future studies should focus on enhancing teacher training in three ways. First, design an undergraduate course aimed at organizing network mega-projects in various school subjects. Second, target graduate students who will benefit from an elective course on network interaction in various subject areas. Third, offer the massive open online course Projects on Mega-Class, which will teach even more students to create network mega-projects.

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HUMANIZING ONLINE LEARNING EXPERIENCES
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ABSTRACT

Background: It is common for postsecondary online students to experience feelings of isolation and disconnection that negatively influences their learning experience, academic success, and student retention rates. Best figure teaching practices regarding online andragogy (the method and practice of teaching adults) suggest that maximizing human interactions in online learning spaces creates feelings of closeness and connectedness. The positive outcome results in enhanced feelings of belonging and engagement motivation of students. A question to be answered is: What does it mean to humanize postsecondary online learning experiences and which strategies maintain this sense of human presence?

Purpose: This paper summarizes evidence from credible peer-reviewed literature related to the concept of humanizing online postsecondary education in order to enhance the online learning experience. Themes from the literature review are described.

Methods: We used a four-stage algorithm with 83 articles. Applying an exclusion and screening process yielded 15 articles for complete review. We conducted an interrater reliability check using two of the selected articles.

Conclusion: This paper provides practical guidance for online educators and course designers who aim to humanize postsecondary online educational experiences. To humanize technology is to dim the awareness and perception of the virtual aspect in digital milieus. In other words, in humanity-infused learning environments, participants view technology as an extension of themselves and as an asset that further strengthens the art and science of online pedagogy. Educators can deliberately use online pedagogical strategies to extend their humanity in online learning spaces. The outcome is postsecondary learning environments that students perceive as more caring and interactive and lead to enhanced engagement in learning, greater academic success (achievement of educational goals), and student retention.

Keywords: humanizing postsecondary online learning, digital pedagogy, online andragogy, caring online, digital milieus

One in five Canadian students are taking online courses with more than 1.3 million online course registrations (Canadian Digital Learning Research Association [CDLRA], 2019b). Online learning is vital as it promotes accessibility for a diverse set of students while providing a more affordable (CDLRA, 2019b) and flexible (Fox, 2017) educational platform. Online learning environments can feel isolating (Fox, 2017; Kebritchi et al., 2017; McKenna, 2018; Murray et al., 2015; Rush, 2015) and dehumanizing (Fox,