Chapter 14
Collaborative Learning as Learning Based on Cooperation with the Use of New Technologies

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14.1 Introduction

The *collaborative learning* model refers to the concept of Lev Vygotsky, according to which tasks performed by learners are divided into those that can be performed and those that cannot be performed. Between the two areas, there is a so-called zone of proximal development, which includes tasks that the learner cannot do on his own the first time but is able to do it with the support of the council (Chaiklin 2003). The area of the nearest development allows to formulate conclusions on the development of the learner's skills. In his definition, L. Vygotsky stressed the importance of learning through communication and interaction with other people, and not only through independent work ("Lev Vygotsky" 2018).

The term *collaborative learning* means:

- An e-learning method in which one or more students, teachers, and/or people learn together, conduct research, and participate in educational courses. Collaborative learning strengthens the typical educational approach, enabling remotely connected peers and individuals to collaborate in real time through technological aids and resources ("Collaborative Learning," In *Technopedia* 2018a).
- The teaching techniques for student groups that have a positive effect on joint learning can be used for two students or a larger group. These techniques include one-on-one (when students help each other), peer learning (time when one student works with another student), and small group (simple and short activities, such as playing in games, charting, or project-based learning that requires

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teamwork of students lasting several weeks or longer) ("What Is Collaborative Learning" 2018).

- A situation in which two or more people learn or try to learn something together. In contrast to individual learning, those involved in collaborative learning can use each other's resources and skills (e.g., by asking each other, assessing each other's ideas, monitoring each other's work, etc.) ("Collaborative Learning," In *Wikipedia* 2018b).

In Polish, other terms are also used, such as cooperative teaching, learning in cooperation, and group form of students' work. In English, the term *collaborative learning* is combined with the expression *cooperative learning*; in the first case we are talking about a joint effort of learners and in the second about the systematic division of work in the learning process (Dillenbourg 1999).

The ultimate goal in collaborative learning is building common knowledge among group members. It is achieved in a cooperation system that provides real-time communication and collaboration between users. Each student or teacher can interact with others in real time via instant messengers, voice calls, video, or a combination of these communication solutions. Students can share, collaborate, and act on various tasks and assignments through the online portal ("Collaborative Learning," In *Technopedia* 2018a).

In the wider context, *collaborative learning* is based on the model that knowledge can be created within a population whose members actively interact by exchanging experiences and undertaking different (asymmetric) roles. Moreover, *collaborative learning* involves such issues as cooperative teaching methods (e.g., method of structured collaborative learning, informal learning methods based on cooperation) and its effectiveness (Bobula et al. 2018), teacher's role in cooperative learning (e.g., teacher–planner, teacher–moderator/facilitator, teacher–arbitrator, teacher–evaluator) (Kisner 2018), and the impact of cooperative learning on the motivation of students (Panitz 1999).

14.2 Theoretical Assumptions and Findings/Results

Based on the analysis of the literature, the following assumptions and conclusions were formulated:

– Promoting group awareness is a key challenge for online collaboration. In the research conducted, three categories of group consciousness are distinguished: behavioral, knowledge, and social awareness. Most research concerns awareness of knowledge that can be expressed through technology. Its users can consciously express their current knowledge and feelings or evaluate themselves and others and provide the necessary information. These data can be visualized. *Collaborative learning* environments are supported by the *group awareness tool* (GAT). The subject of the research is the relationship between the use of GAT

and cognitive functions in the group, the quality of interaction, learning achievements, and changes of these data over time (Ghadirian et al. 2016).

- *Computer-supported collaborative learning* (CSCL) is widely used to facilitate learning in classes. The study involved students who used CSCL in single-user mode and in multiuser mode. Research results indicate that students prefer to use the multiuser mode and, moreover, show that the social impact plays an important role in decision-making, (2) training and help in solving problems facilitate the work of students, and (3) strategies for students engaging in mode for many users require further research (each student has the right to edit the shared file, which makes it difficult to reach a consensus) (Wang and Huang 2016).
- Cognitive styles affect student learning preferences, both during individual learning and collaborative learning. It seems necessary to examine how cognitive styles influence the way students relate to these two methods of learning. Special attention was paid to the serialist approach and holistic approach. The research results indicated that heterogeneous groups of students (applying both approaches) obtained the best results in learning using collaborative learning (Chen and Chang 2016).
- *Collaborative project-based learning* (CPBL) has been used in an interdisciplinary research project in which the elements of CPBL influence the way of learning. The study was conducted at the university located in the urban city of Los Angeles. As an institution serving minorities, the university's student body consists of approximately 53% Hispanic, 22% Asian–American, 15.6% White, 9% African–American, and 0.4% American Indian. The research results indicated that significant learning outcomes and higher efficiency in engineering design were directly related to the project experience. In addition, Hispanic students showed the largest growth of self-efficacy through CPBL. In the longer term, it is planned to conduct research on three areas: (1) course related knowledge and skills outcomes, (2) engineering efficacy in relation to the presence of learning, and (3) student engagement (deep vs. surface learning) and team dynamics (Chen et al. 2015).
- Research on interdisciplinary joint learning and its impact on assessment was carried out in the artistic/humanistic school environment. The research concerned the effectiveness of interdisciplinary collaborative student symposium as an assessment task and a practical model for facilitating interdisciplinary collaborative learning. The test results showed that collaborative teaching and learning, coupled with social software tools and associated modes of communication, foster innovative, high-quality interdisciplinary work and offer an adaptable assessment framework for broader application in higher education settings (Miles and Rainbird 2015).
- Research on *social anxiety* (SA) and *foreign language anxiety* (FLA) during online *collaborative learning* sessions showed that among participants who had experience with the Wiki during international cooperation, a level of anxiety (SA and FLA) was reduced. The study involved 49 high school students, aged between 15 and 18, from a private school in Taipei, Taiwan (Ku and Chen, 2015).

- Research on *collaborative learning* and the theory of cultural reproduction in cyberspace takes up the topic of criticism as an integral part of all teaching methods that seek to change society or transform the status quo. The subject of the research is *authoring functions* embedded in some communication technologies. Criticism can serve as an information function in pedagogical practice aimed at social change, instead of cultural reproduction (Payne 2000).
- *Collaborative learning* also requires a "physical" place, which can be a library. In planning and arranging contemporary library spaces, the needs of learners are increasingly taken into account, emphasizing the need for a space of social learning and cooperation as well as traditional places for quiet learning and reflection. Academic library is perceived as a permanent "physical" place, providing a hybrid environment of traditional and electronic services crucial for the future of universities and their communities (Mcdonald 2006).
- The development of new technologies requires changes in the field of teaching styles. The research results suggest that the so-called gray literature and content found in repositories, databases, and training platforms will be more and more common. Diverse teaching methods should take greater account of the environment in which teaching and learning take place in small groups (Gelfand 2006).
- Research shows that various tools and technologies were developed and used to support e-learning communities. Three components and systems have been identified: (1) the document-focused Web-based training tools, (2) tool focused on meetings (such as video conferencing tools, Centra symposium, etc.), and (3) the three-dimensional (3D)-centered multiuser tools which are based on multiuser *virtual reality* (VR) technology. The first system focuses on document management and individual learning. The second system – tools focused on the meeting – uses the approach of virtual representation of the concept of frontal learning. The general problem of these tools is the limited social integration of participants. Therefore, in such e-learning sessions, participants experience a sense of alienation. The third system, VR tools, focuses on the participants to have a sense of interaction and the existence of other participants. Participants of a virtual 3D session are represented by avatars that can move in a 3D environment. They are also able to see the actions of all other chips. In addition, virtual reality technology tools for many users, used in communication media, offer benefits related to the creation of a social presence and thus strengthen communication and interaction among participants. That's why many VR technology users are used to support collaboration (Badawy 2012).

14.3 Application of Modern Technologies

The tools used in collaborative learning include:

- *Internet forums*. In the research, the authors try to indicate what factors determine the use of students from online forums and provide empirical evidence on their

impact on learning performance. The results indicate that not the ease of use, but the perceived usability, determines the positive attitude to the forum. The new education system should be seen as a gradual process in which students develop their positive attitude toward the system. Particular attention should be paid not only to the layout of the website supporting the forum but also to its usefulness and ability to stimulate current discussions among students (Camarero et al. 2012).

Interesting results were obtained during the study of the online course discussion forum, which were used to assess students' critical thinking. We measure critical thinking with the help of an appropriate model developed by D. R. Newman, Brian Webb, and Clive Cochrane, who distinguish 40 critical thinking indicators grouped into 10 categories. Calculated critical indicators of thinking for the analyzed two threads of discussion in the forum indicate a strong use of outside knowledge and intensive justification as well as critical assessment of posts by the student. But at the same time, weak points are also repeated. Based on these results, changes were made to the next course cycle to improve students' critical thinking (Beckmann and Weber 2016).

– *Tools shared by Google*. For example, Google apps for education (GAFE), as a Google service, provides independently configurable versions of several Google products, using the domain name provided by the customer. It contains several Web applications with functionality similar to traditional office suites, such as Docs, Drive, Gmail, Google Calendar, Groups, Hangouts, News, Play, Sheets, Sites, Slides, and Vault (Boudreau 2016).

  The results suggest that Google Docs is a useful tool for collaborative writing and influenced student learning. The research was about (1) assessing the effectiveness of using Google Docs in an out-of-class collaborative writing activity through measuring the assignment's influence on students' learning experiences, (2) teaching students to work collaboratively, and (3) teaching students to successfully communicate their understanding and application of concepts through writing. Most students were unfamiliar with Google Docs prior to the study. During the study, the results of students working in two teams were compared, one with Google Docs and one without. The following detailed results were obtained: (1) Google Docs changed the means of communication used in collaborative writing, (2) 93% of students considered Google Docs a useful tool for group work, and (3) using Google Docs had no effect on students' paper grades. Half of the students participating in the study reported that they would like to use Google Docs in the future (Zhou et al. 2012).

  Another study used a Web-based tool, Google Docs, to determine the effects of Web-based collaboration on vocabulary improvements among learners of English as a foreign language (EFL). The study was attended by 210 students who undertook the designed tasks such as vocabulary pre-/posttests and a self-report questionnaire survey of self-regulated vocabulary strategy use and perceptions of Web-based collaboration (SRvsWBC). The findings of the study suggest that collaboration using a Web-based tool affects knowledge development and strengthens the process of L2/FL learning (Liu et al. 2014).

– *Open access to tutorials*. For example, access to tutorials on information literacy in the InfoSkills database at the University of Technology Sydney (UTS) in Australia. The State Library of New South Wales provided access to an open repository of information literacy materials to enable the reuse of accumulated resources and collaborative learning. This is possible thanks to a combination of metadata and the work of search engines. In its InfoSkills database, the library also has implemented Web 2.0 functions (England 2010).
  Another example is the Configurable Argumentation Support Engine (CASE). The platform was designed in order to reduce the developmental effort and development costs. CASE detects pedagogically relevant patterns in argument diagrams and provides feedback and hints in response. A wide range of patterns are supported, including the ones sensitive to students' understanding of the domain, problem-solving processes, and collaboration processes. Teachers and researchers can configure the behavior of tutorial agents on three levels: patterns, tutorial exercises, and tutorial strategies (Scheuer and McLaren 2013).
  Hidden Markov models (HMMs) can be used to explore the relationship between dialogue structure and learning effectiveness. A model was developed to identify effective tutorial strategies using a machine-learning approach that (1) learns tutorial modes from a corpus of human tutoring and (2) identifies the statistical relationships between student outcomes and the learned modes. Research results suggest that HMMs can learn the structure of hidden tutorial dialogues. More specifically, the results point to specific mechanisms within a task-oriented tutorial that improves student learning (Boyer 2011).
– *Semantic Web*. In practice, there are Semantic Web services (SWS) perceived as a technology that has the chance to change the way of learning. For example, the Design Patterns Teaching Help System (DEPTHS) operating in the interactive personal learning environment was developed as a template for software design (Jeremic et al. 2009).
  The teacher can plan a collaborative learning (CL) scenario that increases the effectiveness of learning to help students properly acquire and develop their knowledge and skills. Such a scenario defines pedagogically structures that prevent non-task activities and involve students in more significant interactions. The main difficulty in designing effective CL scenarios is to change the teacher's intentions into elements constituting a learning scenario. To solve this problem, an intelligent document creation tool called CHOCOLATO was developed, using Semantic Web technologies (e.g., ontologies) to represent knowledge about the various methods and practices involved in collaboration. Through the use of this knowledge, CHOCOLATO can provide smart tips that help teachers create CL scenarios based on theory. The CHOCOLATO project has been verified in several experiments (Isotani et al. 2013). The latest research on collaborative learning uses the term pervasive knowledge. The broad spectrum of acquiring pervasive knowledge enriches the users' experience in learning. The use of online learning resources (OLR) from multichannels in learning activities such as compiling big data, cloud computing, and Semantic Web allows you to learn anywhere, anytime. Researchers propose pervasive knowledge that can meet the

need for integration of technologies such as cloud computing, big data, Web 2.0, and Semantic Web. Pervasive knowledge redefines value added, variety, volume, and velocity of OLR (Anshari et al. 2016).

Currently, the e-learning 2.0 model is proposed with social networking features, ubiquitous knowledge management, and the approach to cloud computing. We providing cloud services and we offer specialized service, dedicated personnel for specialized service, fees for use, richness of content and knowledge of Web 2.0 and Semantic Web. Web 2.0 enabled students to dynamically enrich personalized informations. Semantic Web will support the cloud service providers in providing e-learning services to users (Anshari et al. 2015).

– *Virtual technology platforms*. The platform that supports electronic business management section (eBMS) is an example of such a platform. *Collaborative learning* should use a mixed learning strategy in which the "personalization" principle plays a strategic role: A personalized learning model is applied to learning processes and services embedded in the technology platform that support an international community of scientists and learners (Assaf et al. 2009).

Experiences in cooperation in learning in an asynchronous environment through discussion forums on the WebCt platform of the virtual campus of the University of Huelva in Spain in 2007–2008 were subject to analysis. This interesting project describes processes of common knowledge building and meaning multi-to-many communication in solving collective cases in asynchronous writing contexts. Two analytical approaches were adopted: discourse analysis and social network analysis. In case group A, where the occurrence of speech was less widespread, social network analysis markers showed significant coherence and low level of network centrality. However, the occurrence of speech was higher in group B, and network centrality rates were higher, although the group was less coherent. These observations allow to formulate the conclusion that many-to-many communication is more important in collective knowledge generation processes than dyadic or triadic communication (Tirado et al. 2011).

Research in virtual worlds on collaborative learners are gradually gaining importance. Virtual learning environments are active for educational purposes and are often sponsored by academic institutions or nonprofit organizations. Virtual educational environments can use spaces where students can meet for lectures, class activities, group work, discussion, and projects or socialize with their peers. They are used as an addition to traditional classes or as a supplemental mode in distance education delivery programs. It is estimated that over 200 universities and other educational institutions run a virtual class in Second Life. These include the British Open University, MIT, Harvard, and Princeton (Hanewald 2013).

In addition, creating software for 3D simulation and virtual platforms for many users is the scope of activity of many companies that are prospering on the market. This is confirmed by experience in working with Linden Lab in the Second Life education department and neurological research. Its main goal is to learn together and to provide instructional design and cooperation with academic and business clients to create immersive learning environments (Beaubois 2013).

14.4 Original Projects

In practice, numerous activities are undertaken to help in the implementation of collaborative learning. Numerous projects are created, e.g., the international CoLab project "Promoting innovative collaborative teaching and learning," implemented by a consortium of seven European institutions, including the Educational Research Institute. The project concerns, among others, the support of professional development of teachers in the field of innovative methods and forms of teaching in lessons and, above all, the use of group work of students ("Instytut Badań Edukacyjnych" 2018). The home page of the project is available at http://colab.eun.org/home. An example of another project is "Mobile Intercultural Cooperative Learning (MICOOL)," conducted as part of Erasmus + by Dublin City University, in cooperation with the Faculty of Pedagogical Sciences of the Special Education Academy. Maria Grzegorzewska and partners: Agrupamento de Escolas de Figueiró dos Vinhos (Portugal), Pädagogische Hochschule FHNW (Switzerland), Staatliches Schulamt Lörrach (Germany), Osnovna Skola Marsal Tito (Montenegro), and Infocus Training Ltd. (Ireland). The project was being implemented in the period 01/09/2015–1/09/2017 ("Akademia Pedagogiki Specjalnej" 2018).

As part of another concept, a methodology for creating and disseminating audiovisual projects enabling online cooperation has been developed, using new technologies and video tools (*open source*) that can be used in any e-learning environment in higher education. The methodology was developed and applied at the Open University of Catalonia (Universitat Oberta de Catalunya, UOC). It combines three pedagogical strategies in an e-learning environment: project-based learning, computer-supported *collaborative learning*, and participatory culture as a new *literacy* form (Ornellas et al. 2014).

Interesting projects can also include a project implemented by the College of Architecture and Design and the Littman Architecture Library at the New Jersey Institute of Technology for cooperation of the academic community in the field of improving the quality of education (Cays and Gervits 2012) or the space design project of the Hong Kong University of Science and Technology Library (HKUST Library) understood as a platform for various educational activities (Chan and Spodick 2014).

14.5 Conclusion

Collaborative learning has advantages and disadvantages. It allows students to collaborate on the understanding, solution, or creation of an artifact in science. At the same time, it redefines the traditional student–teacher relations in the classroom, which causes controversy as to whether this paradigm is more favorable than harmful (Inaba et al. 2003), (Isotani and Mizoguchi 2006). Undoubtedly, joint educational activities may include joint writing and joint problem-solving as well as joint

debates, group projects, research teams, and other ventures. This approach is closely related to *cooperative learning* (Johnson et al. 2008), (Johnson et al. 2018).

Another important issue related to collaborative learning is the impact of new technologies. New media and technologies influence the learning process at every stage (Bowdur and Aptekorz 2014). In addition to traditional training methods and techniques, discussion groups are available on social networks, podcasts, webinars, WebQuests, etc. There are also new – for example, *blended collaborative learning*. All these technological facilities can increase the efficiency of training and education. However, remember that they do not override the most important principles and goals of learning and teaching.

The first step to implementing an effective virtual e-learning environment is to examine its main functions. These functional features should distinguish the e-learning environment from other designs and designed virtual environments commonly used. Research indicates that any virtual environment that integrates certain features can be characterized as *collaborative e-learning* (CEL). The following features of the CEL are listed in the literature on the subject:

- Users who have different roles and permissions can visit the environment.
- Educational interactions in the environment should change the simple virtual space to the communication space.
- Users should be provided with multiple communication channels that allow them to interact with each other in the virtual space.
- The environment should be represented by various representation forms, which can range from simple text to 3D worlds.
- Learners in the environment should not be passive but should be able to interact.
- The system supporting the e-learning environment should be able to integrate various technologies.
- The environment should support various e-learning scenarios.
- The environment should have common features with the physical space.

It seems that these features will have a decisive impact on the development of the CEL.

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