Trello as a Tool for the Development of Lifelong Learning Skills of Senior Students

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Abstract: The article focuses on the problem of development of the lifelong learning skills of senior students in secondary school of general education. The model of interaction between the subjects of learning in the Trello project management system is developed. The foreign literature learning environment in the Trello system is developed. The experience of using the Trello project management system in the process of teaching foreign literature in 10th and 11th grades is described. It has been found that according to the lifelong learning approach a person has to possess skills: goal setting, self-regulation, motivation, time management, self-directed learning, collaboration skills, and self-development. It was pointed out that there are common approaches to project management and educational process management. The use of online systems for collaborative work in the educational process in the secondary school of general education is suggested. Online systems for teamwork that support Kanban methodologies for project management have been analyzed. To confirm the effectiveness of the implementation of the Trello project management system as a tool for the development of lifelong learning skills of senior students, an experiment was conducted: criteria, indicators, levels, and the state of formation of lifelong learning skills of senior students were determined; statistical analysis of the results of the experiment was carried out. The effectiveness of the implementation of the Trello project management system as a tool of the formation of the lifelong learning skills of senior students has been experimentally proven. The study can be applied in educational institutions interested in using agile methods in teaching.

Keywords: *lifelong learning skills; Trello; project management system; Kanban board; senior students.*

1. Introduction

The systemic transformation processes, which accompany the rapid development of the information society, form a qualitatively new image of a postmodern high school graduate. Today, a successful graduate is a highly educated, well-rounded individual who is capable of creative thinking, independent problem solving, figuring out non-standard tasks, and ready for team interaction and productive cooperation (Kramarenko et. al, 2020). A student's ability to adapt to changes in the world around him, to learn quickly and to master new skills makes him competitive in the labour market in the future (Kryvylova, 2018). This is what makes the idea of lifelong learning or the ability to learn one of the key competencies that a graduate must possess in order to find his or her way to self-expression and success in life.

The development of lifelong learning skills occurs with the support of motivation for continuous learning, access to learning for all generations, the use of different learning styles and innovations in the educational process, the use of person-centered learning tools (Shyian, 2014).

Recent learning technologies should include immersion in a future professional environment, in order to train the student to master the most popular and relevant tools used in real professional activities, as well as the soft-skills necessary for work and life. That is why, among the well-known teaching technologies, the most interesting for schools are those focused on group work of students, cooperative learning, active cognitive process, work with various sources of information. These technologies imply wide use of investigative and problematic methods and using the acquired knowledge in collaborative or individual activity, development of not only self-critical thinking, but also the culture of communication, the ability to perform different social roles in collaborative activities (Stupak, 2020).

The online virtual board system Trello is widely used by a variety of professionals for the purpose of managing teams and projects, from business to education. This study has taken an interdisciplinary approach and attempted to combine new technology and the humanities: an innovative project management system as a platform for teaching foreign literature. The use of Trello system in education can play an important role in addressing the issue of formation of lifelong learning skills of senior students.

2. Literature Review

There is a large volume of studies describing the role of lifelong learning skills in education and professional activity. In his study Kaplan (2016) showed that there is no consensus on the concept of lifelong learning. Thus, the definition of lifelong learning was first proposed by Basil Yeaxlee in 1929. The idea of lifelong learning was also accepted and discussed in 1960 at a conference conducted by UNESCO. At the same time, the concept of lifelong learning was the result of research on adult training carried out by Eduard Lindeman in the 1920s.

According to Kirby, Knapper, Lamon, and Egnatoff (2010), the term Lifelong Learning was used in Edgar Faure's publication «Learning to Be» (1972) for UNESCO. UNESCO has adopted Lifelong Learning as a guiding principle for education around the world. In 1980, Malcolm Knowles, one of the key theorists of andragogy, predicted that lifelong learning would become the organizing principle of all education (Laal & Laal, 2012).

A large and growing body of literature in the field of lifelong learning contains many definitions of the term. In his study, Longworth (2003) believes that it is providing students with tools through which they can participate in learning according to their learning style and needs. Longworth also offers the European Commission' definition of lifelong learning as "all learning activity undertaken throughout life, with the aim of improving knowledge skills and competencies within a personal, civic, social and/or employment related perspective" (Longworth, 2003, p. 83).

Shiyan (2014) emphasizes that lifelong learning is a modern principle of organizing education, recognized worldwide and relevant for modern education in Ukraine. School is the institution where the principle of lifelong learning in Ukraine is implemented most of all. Every school that cares about the development of a competitive student should build its activities on the principles of lifelong learning.

The European Commission reviewed the lifelong learning skills under eight sections: communication competency in the native language; communication competency in foreign languages; basic competencies in mathematics; science and technology competencies; digital competencies; learning to learn competencies; social and citizenship competencies; taking initiative and entrepreneurship competencies; and cultural awareness and expression competencies (European Union, 2019).

The Decree of the Cabinet of Ministers of Ukraine No. 898 of 30.09.2020 approved the State Standard of Basic Secondary Education, which lists lifelong learning as one of the key competencies, which requires the ability to identify and evaluate own needs and resources for competence

development, apply different methods of competence development, to find opportunities for learning and self-development; the ability to learn and work in a team and independently, to organize their learning, to evaluate it, to share its results with others, to seek support when it is needed (State standard, 2021).

According to Harbuza (2011), the information society requires a person who has the ability to independently acquire and use knowledge outside the box, to master the information technologies of their search, comprehension, deepening and application, which are becoming an organic need of every person.

Traditionally, the development and use of information technology tools in education, including distance learning, are associated with special software and web services. But at the same time, there is a part of the current literature that pays special attention to the actively developing direction of creating effective educational tools based on use of IT for other purposes, for example, business applications, services for collaborative visualization of team work processes, etc. The authors Horbatiuk et. al. (2019) have studied the problem of development of communicative competence in foreign languages using mobile applications and claim: "The combination of the use of traditional learning methods and mobile learning enables to intensify the students' independent activity, increase their cognitive activity, and facilitate the individualization of education" (Horbatiuk et. al., 2019).

Also among these educational tools stand out modern flexible learning approaches (agile methodologies), which have their origins in the project management of IT development.

In their systematic review López-Alcarria et.al. (2019) concluded that education is a major life-long project that needs an efficient management. The authors also cite Stewart et. al., who state that "the correspondence between elements seen in the agile software development environment and the academic environment is striking. At first glance, the similarities can be easily seen. Both teaching and software development require detailed planning and scheduling. Each requires management and constant assessment and feedback from all involved. Making sure a course is delivered correctly and on time presents similar difficulties to those encountered in software development projects" (Stewart et. al., 2009, p. B3.3).

The similarity between the project management environment and the educational environment is discovered and described in their works by López-Alcarria et.al. (2019), Shchetynina et.al. (2019). The authors

Shchetynina et. al. (2019) showed that the process of working on educational projects is inherent in the project style of activity, which allows using project-based approaches to the organization and management of educational work. The effectiveness of using project management systems to develop time management skills, namely to develop planning skills, self-motivation, coping skills, organization, filing and independence, has been proven.

There are a number of studies describing the adapting agile methods to the area of higher education (Fernanda et al., 2018; Pavlenko & Pavlenko, 2021; Lazorenko, & Krasnenko, 2020). As Lazorenko and Krasnenko note, "students become prepared for lifelong learning. The acquired skills enable them to learn on their own and self-develop" (Lazorenko, & Krasnenko, 2020, p. 242).

However, a relatively small body of literature that is concerned with using agile methods in secondary school education.

Among agile approaches, one of the most popular, along with Scrum, is the Kanban method. In software development, Kanban is considered much more than a planning system. It helps to visualize the workflow, control the progress of works at each stage of the flow according to the team's capabilities, measure the cycle time, identify the problems, and maintain a constant working process. Kanban also enables visualisation of the process, as it shows the work assigned to each developer and specify priorities and limitations (Machado, et. al., 2017; Kamal, 2020).

López-Alcarria et. al. (2019) noted that Kanban boards can be both physical (board with sticky notes) or virtual, when collaborating remotely. Trello is a popular tool for creating shared virtual Kanban boards (López-Alcarria et. al., 2019, p. 6). With the Kanban method, all project-related activities are displayed in a single field that is viewable to all project team members. With Trello, users can visually arrange projects into boards, divide projects into groups, and subdivide groups into tasks (Heather, 2017).

Recent research has suggested that the Trello platform can be successfully used for the educational purposes. Belando-Montoro and Carrasco Temiño (2017) chose Trello for the group work of Complutense University of Madrid students in the subject «Planning and Management of Socio-Educational Programs». The advantages found in the use of the web application for group work are related to motivation and greater student involvement, as well as a better assignment of tasks among the different members of the group and more effective monitoring of the work by the teacher.

The case study presented by Mansur et.al. (2019) describes the experience of implementing Trello as a Virtual Learning Environment for a Project-based Learning approach to teach students from a specialization course in the multidisciplinary subject of Management, Design & Marketing at the Brazilian public university. From its obtained findings it it can be concluded that Trello has been useful as a task management tool for PBL classes as VLE scaffolding students to plan, gather and organise their education.

Kalizhanova et.al. (2018) share their experience of using Trello in the educational ecosystem of the Bolashak Academy in Kazakhstan. The authors believe that the Trello board provides a wide range of tools to control students, maintain their motivation level, and develop their collaboration in different project works or academic writing tasks.

There is a relatively small number of the studies on introducing the Trello into the teaching process of secondary schools. According to recent reports of Rathakrishnan et.al. (2020), the critical thinking levels of students, who use Trello online discussion are slightly higher in essay writing, compared to non-using Trello students.

Zaitsev et.al. (2016) highlights the following opportunities for developing educational resources on the Trello platform: visualization of students' personal progress; organization of students' group workflow; creation of electronic teaching aids; development of a flexible educational space.

Lutsenko (2020) describes the experience of using Trello for collective projects of engineering students in the course «Project Work Technology». The author concludes that the use of the service contributes to the development of students' teamwork skills.

Previous studies of using Trello as an educational tool were only practical and have not dealt with describing and visualizing the interaction of the components of the learning process in Trello as a systemic approach.

Also, no studies were found that described the experience of using Trello's Kanban board in secondary school of general education for humanities subjects.

Nowadays, the segment of online project management systems and services for teamwork is represented very widely. Depending on the purpose of use, the complexity and scale of projects, the size of the team, the need to integrate with other services, etc., the choice is made in favour of one or another resource. The most popular systems are Jira, Asana, Wrike, Bitrix24, Trello, Hygger, MeisterTask, Favro, Kanbanchi, Kanban Tool, WorkSection,

Kanban Flow, Week. When choosing systems for analysis, we focused on their ability to use a Kanban methodology for project management.

Also, we could not overlook virtual collaboration boards, which are at the peak of popularity among teachers who teach school subjects remotely in modern conditions. These are such resources as Padlet, Miro, Twiddla, Mural, Scrumblr, Cacoo.

In order to determine the most appropriate system for the organization of the learning process with the development of Lifelong Learning Skills, we analyzed mentioned 19 systems according to the main parameters: free plan; availability of the board for collaborative work and the possibility of placing tasks; the feature of dividing tasks into subtasks (checklists); project visibility for participants; time management; adding files and integration with cloud storage; activity stream in real-time; simple interface and ease of use; mobile application.

The results of the analysis showed that most of the systems under consideration have visual collaboration boards on which users can put tasks, activity streams to track actions and have the property of project visibility for all participants. Also, almost all have a free plan, except for three systems. However, not all have the Checklist tool, which is important for learning from the side of the interaction model we developed, as well as the needed level of simplicity of the interface and ease of use, which is especially important when working with schoolchildren. Not all systems also have a mobile application that is relevant for distance learning «anywhere and anytime». Some of the mobile apps are incomplete or have not passed the beta-testing phase.

As a result, Trello, MeisterTask, Hygger, and Kanbanchi are among the systems that correspond to all of the above criteria. However, among them, only Trello has unlimited access of any number of users to any number of projects within the free plan. Other systems have limitations either in the number of projects, users and tasks (MeisterTask, Hygger), or do not have a free plan at all (Kanbanchi). Therefore, for further work on the development of a visual board for teamwork on the subject «Foreign Literature», the Trello system was chosen.

Taking into account the tendency to use multidisciplinary approaches in secondary schools, project-based and individualized learning, distance and mobile learning requirements, Trello can become an alternative platform for the setup of an educational environment that enables collaborative and interactive practice, facilitates the sharing of knowledge and experience.

3. Methodology

For the educational purposes (as a project management system), the Trello online service is considered suitable for the planning and demonstration of learning outcomes and the realization of a variety of educational projects. However, it can be used to create a wider range of tools in the education sector.

One of the most perspective ways of using Trello in education is the development of computer-supported educational tools: electronic teaching aids, learning and methodological packages, etc. An important advantage of this approach is the possibility of dividing the teaching material into structural elements (modules, topics, tasks, subtasks), as well as an almost unrestricted field for building a full-fledged multimedia database on a certain subject. To demonstrate the process of interaction between the subjects of the educational process in the Trello environment, we developed the model (Figure 1). The specificity of the Trello system that it is a tool based on the methodology of project management, which means that it is primarily based on the project, and team collaboration between the process' participants.
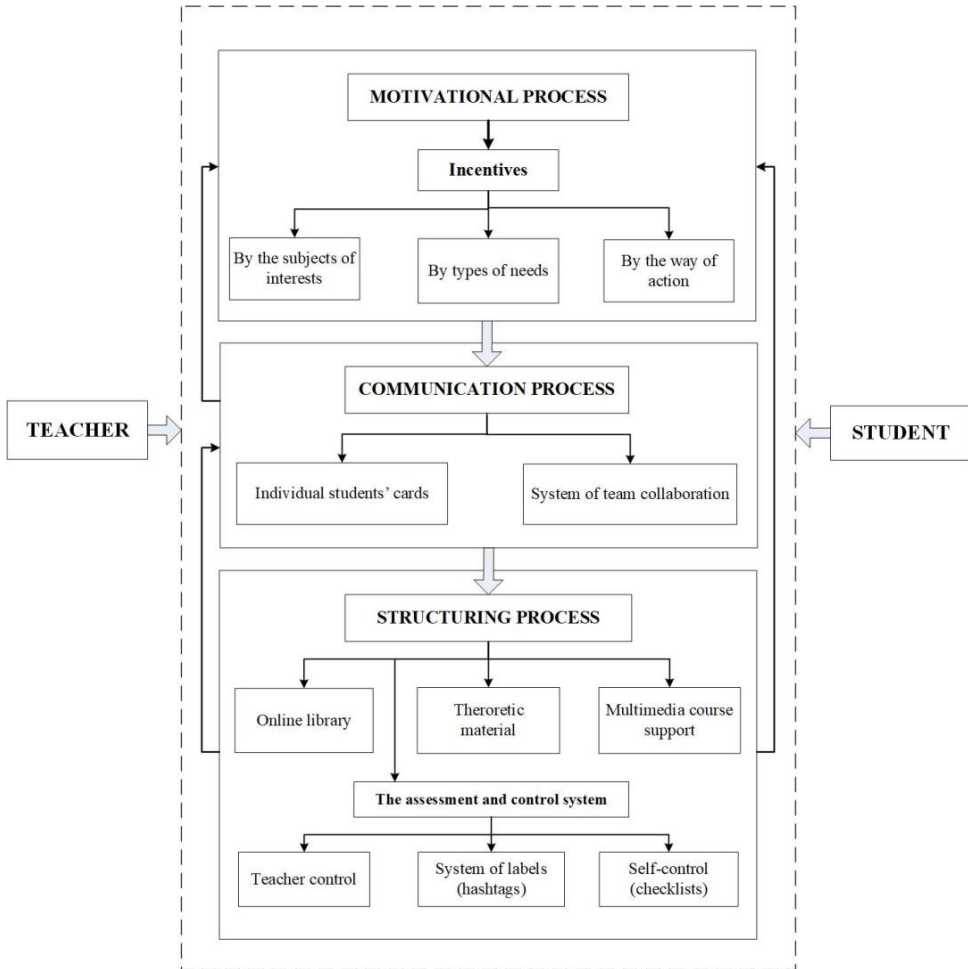
Figure 1. The model of interaction of the subjects of learning in the Trello environment

Modern education is difficult to imagine without project-based learning, where both the teacher and the student are full participants in the educational process, partners, and members of the same team. Interaction between participants in Trello is conducted in the interactive mode in a bilateral format of «teacher-students» and «students-students». On the one hand, the teacher as an analogue of the project leader sets goals, forms task lists, defines the terms of the tasks, and controls the process. On the other hand, students as the team members who work together on the project, but each has their own area of responsibility and individual interest in

completing the assigned tasks. Together they create a dynamic system in which all components develop, which leads not only to the successful completion of assigned tasks but also to the realization of the learning goal of the particular subject as a whole.

The system of interaction of the subjects in Trello consists of the motivational process, the communication process and the structuring process. The process of motivation will be described further in section 2.4.

The structuring process is represented by lists and cards – the main Trello tools for project decomposition. To form the structure of the virtual team board in a particular subject, in our case in foreign literature, it is reasonable to create the lists of topics for handling; an online library of works of fiction being studied; theoretical material, which includes presentations on academic topics, and multimedia materials that complement the online library with images, films, videos, audiobooks, links to sources on the Internet.

The assessment and control system may include a selection of multi-level test tasks, control questions, tasks for self-study, etc. Due to the possibility of adding links to any resources, tests or other forms of control can be conducted in parallel on other platforms and educational portals.

The Trello service allows to establish a clear allocation of responsibilities and visualize important aspects of interaction with students (planning and timing of work, exchange of ideas and useful links, control at each stage). And to make it even easier for users to organize and navigate, the program has special markers (cards, labels (hashtags), colours and stickers). All this together with the feature of exchanging comments enables to build a unique system of team interaction.

An important element of the system is the function of teacher control and self-control of students, which is implemented by the tool «Checklists». These are the lists of tasks that need to be fulfilled by the participant in working on educational topics.

A student independently marks the completed tasks on the checklist. Both the student and the teacher can track the progress, which is shown on the student's card. The teacher, having checked the completed assignments, confirms it by marking labels (hashtags). Also, for each task can be defined a deadline and if the student misses the deadline, he loses the opportunity to get a high score. This system helps to develop not only independence in learning, but also the highest form of discipline – self-discipline.

The study defines the components of lifelong learning competence to determine the tools of virtual boards as means of forming the lifelong learning competence of senior students. The classification method is used to

analyze online systems for collaborative work in order to apply them to form lifelong learning competence. Based on theoretical and empirical research, the model of interaction of subjects of learning in the Trello environment was developed.

To confirm the effectiveness of the implementation of the virtual board Trello as a tool for developing lifelong learning skills of senior students, the experiment was conducted:

1) criteria, indicators, levels and the state of development of lifelong learning skills of senior students were determined;

2) the model of interaction of subjects of learning in the Trello environment was applied to the teaching of foreign literature to 10th and 11th graders;

3) the effectiveness of the implementation of the virtual Trello board as a tool of forming lifelong learning skills of senior students was experimentally tested.

The research hypothesized that the use of the Trello platform in the process of teaching foreign literature will increase the level of lifelong learning skills of senior students.

According to Kaplan (2016), individuals have lifelong learning skills: planning their learning; evaluating their learning; being active; being open to learn in both formal and informal environments; integrating the knowledge to different subject fields in the appropriate situations; using different learning strategies for problems or different situations. Kirby, Knapper, Lamon and Egnatoff (2010) describe such abilities of effective lifelong learners: setting goals, applying appropriate knowledge and skills, engaging in self-direction and self-evaluation, being able to find relevant information, and adapt their learning strategies to different conditions.

When the previous studies were analysed, it was found that there is a consensus concerning the basic skills that the lifelong learning approach encompasses. According to it, an individual generally should have skills: Goal setting, Self-Regulation, Motivation, Time Management, Self-directed learning, Collaboration skills, Self-development.

To determine the level of indicators "Goal setting", "Self-Regulation", "Time Management" was selected the questionnaire "Ability to self-management" by Peysakhov & Shevtsov (1991). The level of "Motivation" indicator was determined based on the test "Motivation of educational activity" according to the methodology of Dombrovska. To determine the level of indicators "Self-directed learning" was chosen "Questionnaire of self-organization of activities", developed by Mandrikova. Methodology of Rozanova "Development of positive group motivation"

was used to determine the level of "Collaboration skills". The questionnaire "Assessment of the ability to self-development and self-education" was chosen according to the method of Tarasova to determine the level of the indicator "Self-development".

The website (https://lllforschool.wordpress.com) with implementation of the methods of Peysakhov, Dombrovska, Mandrykova, Rozanova, Tarasova was developed specifically for this research and used to survey the senior students.

The study was conducted during the academic year 2020/2021. The participants were 10th and 11th graders from Mariupol and Berdiansk, Ukraine. The number of participants in the control group was 25 and the experimental group – 29. A total of 54 senior students.

All senior students in the control and experimental groups were assessed for each indicator. The following Likert scale was used for these methods: high level, medium level, low level.

4. Research Results

Development of a literature learning environment in the Trello system.

Virtual boards in Trello can be public or private. The private board can only be accessed by invitation or link. Students in different classes or subgroups should be grouped into teams. The system of teaching foreign literature includes two teams with a total of 54 senior students. The teacher is a member of both teams and an administrator.

According to the model of Figure 1, the motivation block includes a set of incentives for learning in the Trello environment. Based on the classification given by Sladkevich (2001) we cross-referenced the incentives with the list of Trello functionalities and found that this software has a powerful system of motivation for learning. The matching of the tools and features of Trello with each type of incentive is shown in table 1.

Table 1. The matching of the tools of Trello with incentives

Trello functionalities and tools	Incentives								
	By the subjects of interests		By the type of need (non-material)					By the way of action	
	Collective	Individual	Social	Moral	Creative	Socio-psychological	Self-assertion	Enticement	Compulsion
Subject-subject relationship with the teacher		+	+			+			
Activity log		+							
Exchange of comments	+					+			
Labels (hashtags)	+							+	
Checklists (task lists)		+							+
Progress bar		+		+					
Independent design of their card by the students		+			+				
Assigning participants to tasks (cards)									+
Participation in the management of the board (each member is an administrator)	+		+						
Teacher assessment of work				+				+	
Approval, positive comments		+		+				+	
Stickers («likes», «hearts» etc.)				+		+		+	
The independent type of work		+			+		+		
Creative Label		+			+			+	
Creative Collection Box		+			+				
Communication with the team	+					+			

Creating a favorable climate, an atmosphere of mutual cooperation and healthy competition	+		+		
Exchange of ideas, useful materials, links	+		+	+	
Demonstration of learning outcomes				+	
Deadlines for completing tasks					+

The structuring process is essentially a decomposition of the project, dividing it into smaller components. That is, if we consider the Trello virtual board as an educational platform for learning the subject, the structuring is similar to building a curriculum by topic or calendar lesson plan. Figure 2 shows a general view of the virtual Kanban board from foreign literature. Its structure includes the following lists: online library for 11th grade; set of tasks for 11th grade; individual cards of 11th grade students; 11th grade photo gallery; online library for 10th grade; set of tasks for 10th grade; individual cards of 10th grade students; 10th grade photo gallery.
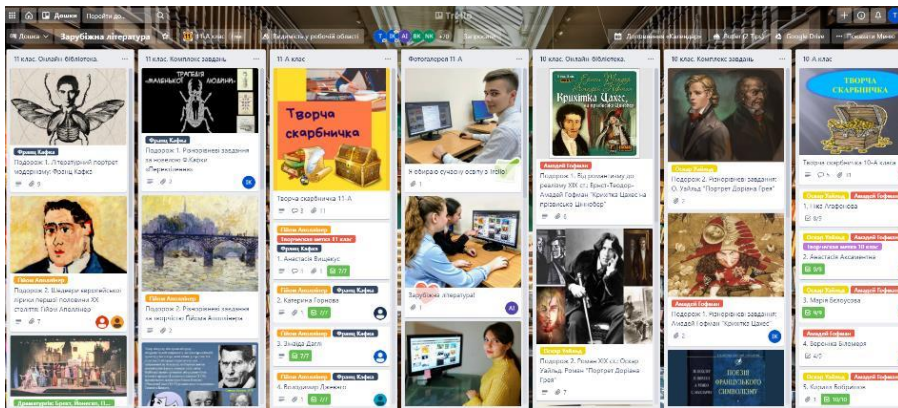

Figure 2. Virtual kanban board "Foreign literature" in Trello

Trello is a flexible tool that allows users to customize the board for their needs. Therefore, the content of the virtual board can be different, depending on the purposes for which it is created.

Figure 3 presents an example of the "reverse side" of one of the cards of the online library "Journey 4. Ernest Hemingway" with theoretical material and multimedia resources.

In the description field, a user can add text of various formats, images, links. We also recommend adding a cover to the card. Cover cards give the board a more complete look and arouse students' interest.

It is possible to add and view members of the card. If the user has not been a member of the boards before, then in the appropriate window enter his e-mail address to which he will be sent a letter with a message. The cardholder can be deleted at any time. The option of adding participants is useful for assigning responsible team members, executors to project tasks or, for example, identifying topics or tasks that should be given special attention by specific students.

In the Attachments section, a user can attach a document from a computer, Google Drive, Dropbox, OneDrive, insert any link to a source on the Internet, etc. This section makes it possible to fill the educational and methodological complex with multimedia materials.

When creating a checklist, a user can enter as many items as he wants. After completing each item, a user can put a check mark next to it. As a result, the percentage of completed tasks will be shown. The end date is the date the teacher sets when there is a deadline for completing the task or learning the topic.
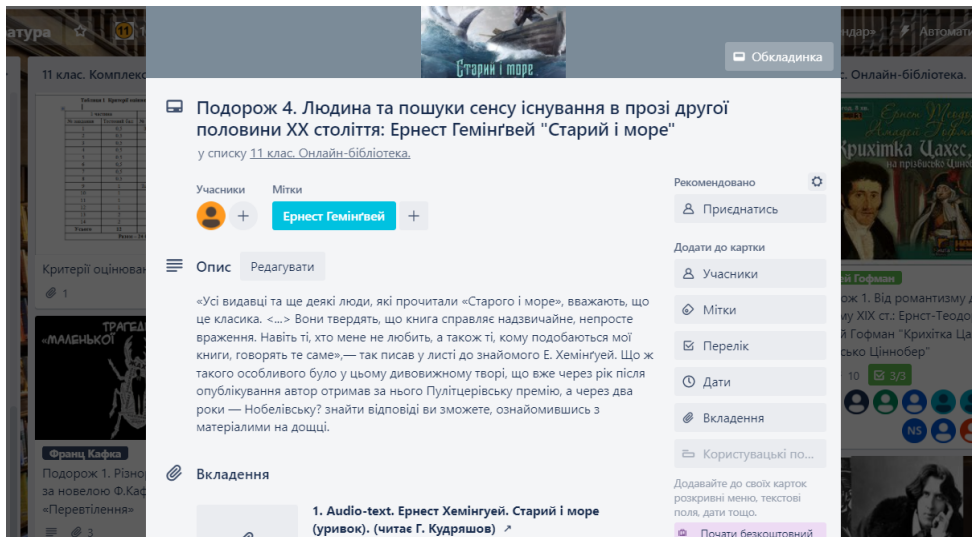

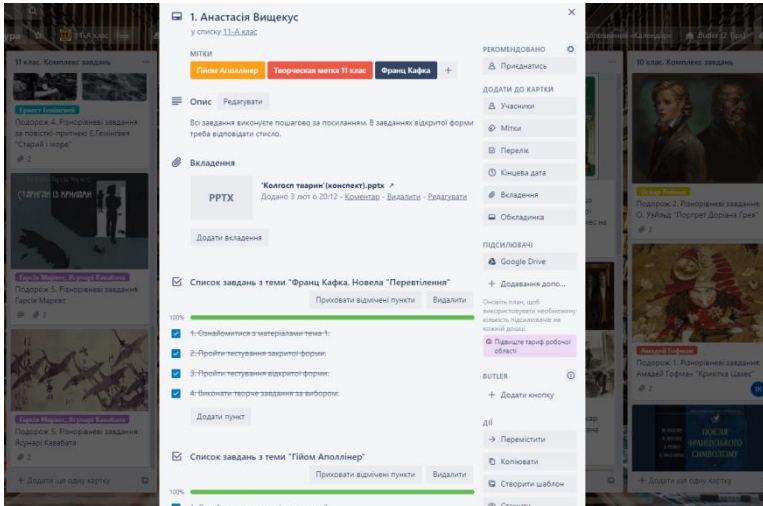**Figure 3.** Example card in the online library

Figure 4. Students' card. Checklists. Labels (hashtags)

Clicking the "Labels" section on the card opens a window that displays multi-colored labels that user can edit and name. Tags are used to classify cards and work on the principle of hashtags (keywords).

Figure 4 shows an example of an individual student card. The student fills in his card by himself, adding the completed tasks in the form of attachments. A checklist for the course topics is created by the teacher, and the student marks the tasks he has completed. The teacher puts the labels on the card when he checks the completed tasks.

According to the experiment plan, the uniformity of the experimental and control groups was verified at the beginning of the experiment. To analyze the homogeneity of the experimental data, the hypotheses about the equality of the average values were verified using Student's t-test. The results of the statistical analysis showed the equality of the average values for the two examined groups (Table 2). The critical value of the Student's t-test for our sample is 2.007 at a significance level of 0.05. The critical value of the Student's t-test is greater than the experimental one (Table 2), therefore the hypothesis of equality of the average values of the skills development level in the control and experimental groups was confirmed at the significance level of 0.05.

Table 2. Checking the equality of the average values of the lifelong learning skills development level (input control)

| Indicators of Lifelong Learning Skills	Student's t-test	Control group			Experimental group		
		Number of senior students	Average	Variance	Number of senior students	Average	Variance
Goal setting	0,21	25	3,69	2,34	29	3,82	2,18
Self-Regulation	0,20	25	3,68	1,49	29	3,76	1,19
Motivation	0,34	25	2,99	0,45	29	3,04	0,5
Time Management	0,00	25	3,20	1,88	29	3,21	2,39
Self-directed learning	0,14	25	1,90	1,1	29	1,95	1,15
Collaboration skills	0,55	25	125,12	25,59	29	130,12	30,59
Self-development	0,61	25	34,53	4,9	29	35,53	4,95

Senior students in the control group studied foreign literature in the traditional way during the school year without using the Trello platform, and senior students in the experimental group used the Trello platform to organize the educational process. To guarantee the validity of the experimental results, all the main factors of influence (preparation level, organizational conditions and conduct of the research) in the control and experimental groups were the same, except for the use of the Trello platform in the experimental group.

After using the Trello platform in the learning process, a repeated diagnostic was carried out. After obtaining the test results, the data were statistically processed. First, frequency tables are constructed by absolute values. Taking into account the different number of senior students in the control and experimental groups, a table of frequencies in percentage was constructed. Table 3 shows the levels of development of indicators of lifelong learning skills of students of control and experimental groups at the levels they received.

Table 3. Levels of lifelong learning skills in control and experimental groups (%)

Indicators of Lifelong Learning Skills	Short name	Levels of the development					
		high		middle		low	
		EG	CG	EG	CG	EG	CG
Goal setting	GS	31,0	28,0	62,1	48,0	6,9	24,0
Self-Regulation	SR	34,5	32,0	58,6	52,0	6,9	16,0
Motivation	M	41,4	24,0	48,3	48,0	10,3	28,0
Time Management	TM	31,0	4,0	55,2	68,0	13,8	28,0
Self-directed learning	SDL	24,1	12,0	62,1	56,0	13,8	32,0
Collaboration skills	CS	37,9	16,0	58,6	52,0	3,4	32,0
Self-development	SD	27,6	12,0	65,5	64,0	6,9	24,0

The development level of lifelong learning skills in the control and experimental groups is illustrated on the diagram (figure 5).
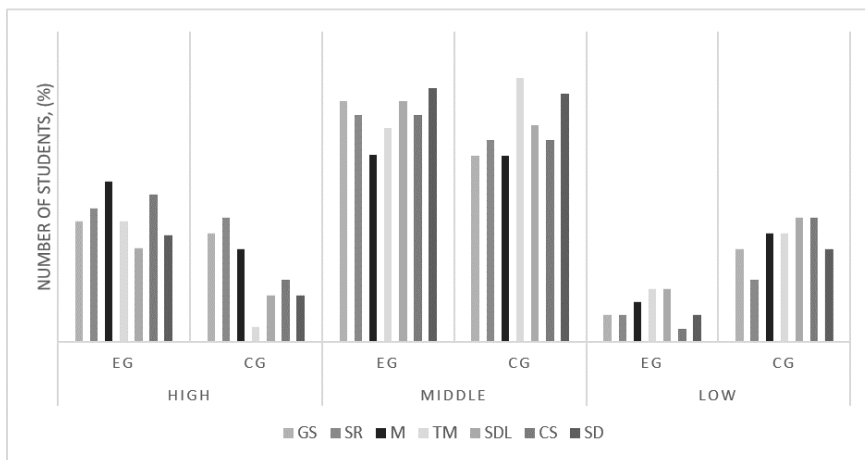
Figure. 5. Diagram of the lifelong learning skills development level in the control and experimental groups (%)

To analyze the experimental data of the control experiment, the hypothesis of the difference in the average values was tested using Student's t-test. The results of the statistical analysis showed the difference in the average values for the control and experimental groups (Table 4). The critical value of the Student's t-test for the sample is 2.007 with a significance level of 0.05. The output test showed a different level of lifelong learning skills for the two examined groups, as shown in Table 4.

Table 4. Checking the equality of the average values of the lifelong learning skills development level (output test)

Indicators of Lifelong Learning Skills	Student's t-test	Control group			Experimental group		
		Number of senior students	Average	Variance	Number of senior students	Average	Variance
Goal setting	2,81	25	3,44	1,16	29	4,31	1,11
Self-Regulation	2,44	25	3,80	1,08	29	4,55	1,18
Motivation	2,67	25	3,68	1,14	29	4,59	1,35
Time Management	2,49	25	3,24	0,93	29	3,90	1,01
Self-directed learning	3,62	25	3,00	0,96	29	3,93	0,92
Collaboration skills	5,05	25	112,20	44,60	29	167,07	33,40
Self-development	2,85	25	41,76	7,05	29	47,79	8,50

The calculated values of the Student's t-test are more critical, therefore, the average values of the level of lifelong learning skills in the control and experimental groups differ significantly (significance level 0.05). Thus, the conducted experimental study confirmed the effectiveness of using the Trello virtual board as a tool of development lifelong learning skills of senior students.

5. Limits and Discussions

In the study we aimed to substantiate the use and experimentally prove the effectiveness of Trello project management system as a tool for development lifelong learning skills of senior students on the example of studying foreign literature. During our scientific investigations, we are convinced that the learning process has a lot in common with project management. Consequently, when teaching different disciplines, it is appropriate to apply project management methods, in particular agile methods. This is confirmed by scientists working in the same field of study: López-Alcarria et.al. (2019); Fernanda et al. (2018); Lazorenko, & Krasnenko (2020); Belando-Montoro and Carrasco Temiño (2017); Mansur et.al. (2019) etc. However, it was difficult for us to find studies dealing with the application of these methods in secondary schools. This is the first limitation we encountered.

For the purpose of integrating the Kanban method of project management into the teaching of humanities disciplines, the Trello system was chosen as the most appropriate according to the criteria that were outlined in the analysis of the online systems for collaborative work. Further, we developed the Model of interaction of the subjects of learning in the Trello environment. The implementation of this model took place in a real-life learning environment in a secondary school. And in the process we faced some difficulties. In general, the main detected impasses were related to new technologies that participants needed to use in their learning activities. We worked with pupils with different backgrounds and levels of motivation. Therefore, not everyone understood how to work with the Trello board and not all students were well-motivated, some did not understand the necessity of using this tool. The 10th and especially 11th graders are overworked with preparations for the External Independent Evaluation, and they often find it difficult to allow time to explore the new learning tool. The introduction of Trello took place in foreign literature classes as an interdisciplinary research, which was a challenge for some senior students. Luckily, however, most of the students responded positively to the innovation and were satisfied with the interaction both with the Trello board and with the team of classmates. This is evidenced in the promo video "Modern Education with Trello" which was filmed by senior students studying foreign literature at school # 5 in Mariupol, Ukraine (https://youtu.be/Vkjxgk2x96Q). According to the students, "Trello board is a new approach to studying familiar school subjects. This resource helps to systematize information and share knowledge. The most important thing is that our teacher works with us on an equal level in a team. And that increases our responsibility".

The website was chosen as the data collection method, which we developed specifically for the purpose of surveying students. According to the chosen survey methodology, the website contained 5 tests to measure the indicators of life learning skills, which had to be completed in Google Forms: test 1 contained 8 questionnaires, test # 2 contained 6 questionnaires, test # 3 contained 6 questionnaires, and tests # 4 and # 5 each contained 1 questionnaire. We assume that the diagnostic results and the data collected based on them may not be entirely correct, because pupils may have felt tired when answering such a large number of questions and may have weakened their attention and concentration. Also, in our opinion, some participants may not have been responsible enough for the task and answered the questions at random. Therefore, we will take this into account in future studies and recommend that other researchers choose or design

smaller survey methodologies, taking into account the age of the test participants.

It should be noted that this study was limited to one control group and one experimental group who studied foreign literature for one academic year. Future researchers need to base the same study on a larger sample size to end up with more correct results.

However, in order to avoid these limitations affecting the results of the study significantly, we tried to create conditions to guarantee the validity of the results: the main influencing factors were similar in the two groups under study. The only different factor was the use of the Trello system in the experimental group.

6. Conclusions

Based on the studies of foreign and domestic scientists on the problem, it has been found that a person has to possess skills: goal setting, self-regulation, motivation, time management, self-directed learning, collaboration skills, self-development. Therefore, due to the common approaches to project management and educational process management, the use of online systems for collaborative work in the organization of the educational process in secondary schools, that support the Kanban methodology for project management was suggested.

The analysis of project management systems for educational purposes allowed us to choose the online service Trello, which is appropriate for the planning and demonstration of learning outcomes, the carrying out of a variety of educational projects. To demonstrate the interaction between the subjects of the educational process, we developed a model of interaction between the subjects of learning in the Trello project management system, which consists of the motivational process, the process of communication and structuring process. On the example of teaching foreign literature in the 10th and 11th grades, the model of interaction between the subjects of learning in the Trello project management system was implemented. The developed system of teaching foreign literature based on the Trello online project management system has an educational and controlling function and realizes the idea of individually-oriented learning. The Trello online project management system creates the conditions for the senior student to build a personalized learning trajectory with the teacher's assistance and then independently. Trello ensures the organization of various types of educational activities aimed at developing the creative potential and critical thinking of the senior student, the development of the ability to make self-optimal decisions, self-discipline and self-control, the ability to effective

teamwork, as well as the ability to learn and acquire knowledge, using new information technology.

Based on hypothesis in this research, the level of lifelong learning skills of senior students using the Trello platform in the process of teaching foreign literature is higher than students who were not using Trello platform, which indicates that the hypothesis is accepted. Based on hypothesis in this research, the level of lifelong learning skills of senior students using the Trello platform in the process of teaching foreign literature is higher than students who were not using Trello platform, which indicates that the hypothesis is accepted. The Indicators of Lifelong Learning Skills score using Trello's virtual learning method increased on 26%. The mean of Collaboration skills using Trello's virtual learning method was 167, while the mean group score using conventional learning method was only 112. There is a difference of 54. Therefore, the efficiency of using the Trello virtual board as the tool of development lifelong learning skills of senior students is proved. The statistical significance of the differences between the results obtained in EG and CG was confirmed by Student's t-test. Therefore, the efficiency of using the Trello virtual board as the tool of development lifelong learning skills of senior students is proved. The statistical significance of the differences between the results obtained in EG and CG was confirmed by Student's t-test.

The findings lead us to support the assumption that the use of professionally-oriented project management environments will develop lifelong learning skills, maintain interest and motivation for learning, achieve learning objectives and facilitate teamwork among subjects of education.

When considering the possibilities of this study, we recommend to pay attention to the practical application of the model of interaction of the subjects of learning in the Trello environment. It describes the basic processes and content of the Trello board using in teaching and learning. Therefore, it can be adapted for teaching other subjects in schools or higher education institutions using the Trello Kanban boards.

The study does not cover all aspects of the problems associated with the development lifelong learning skills using the Trello project management system. The prospects for further research are the identifying methodological specificities of teaching senior students of secondary schools of general education in the Trello environment. There is also further interest in expanding the subjects and skills covered by the experiment.

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