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Re-designed flipped learning model in an academic course: The role of co-creation and co-regulation

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ABSTRACT

In traditional flipped classroom (FC), learning of new content mostly occurs through watching videos and transferring information from instructor to students utilizing technological tools. The present study devised and examined a novel extension of the FC model. This model adds components that acknowledge the roles of instructor, learners, peer assessment, and embedded evaluation. Moreover, it highlights the value of technology and digital tools in supporting and enhancing active individual and collaborative learning, and the development of self-regulated strategies in in-class and out-of-class settings. The model was investigated in a qualitative study, which was conducted in a blended academic course, including synchronous and asynchronous lessons. The participants were 36 graduate students who were studying towards a Master Degree in Education. The paper analyzed learning experiences and their interpretations by the students. In contrast to traditional FC model, the findings revealed active learning of students in both in- and out-of-class settings that took place before, during, and after the lesson. The instructor promoted extensive independent learning, learning regulation, continuous dialogue and collaborative interactions among peers. The re-designed model highlights co-creation of the course content and of digital learning outcomes by students, self-regulation and teamwork co-regulation, which are rare in higher education.

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1. Introduction

Digital technologies have become an integral part of the teaching and learning processes in academic courses. This process enables to incorporate Information and Communication Technology (ICT) in a variety of teaching and learning methods in higher education (Johnson, Becker, Estrada, & Freeman, 2014). The integration of digital technologies in teaching and learning is related to the awareness of changing the nature of education in general and higher education in particular and the necessity to properly prepare students for future work and lifelong learning in the information society (Chen, Wang, & Chen, 2014). Appropriate use of technology can promote the construction of new knowledge based on its link to students' previous knowledge (Levin-Peled, Kali, & Dori, 2007; Linn & Eylon, 2011) and enhance differentiated learning and teamwork (Blau, 2011; Shamir-Inbal & Blau, 2016a).

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One of the alternatives for today's typical course setting, which evolved to address the changes in the nature of education related to technology integration, is a pedagogical model commonly referred to in education literature as “flipped classroom”. Flipped classroom (FC) refers to the model in which direct instruction is delivered outside of the classroom, mostly through videos, while class time is then available for deeper discussions of the topic, peer collaboration, and personalized instructor guidance (Francl, 2014). While according to the claims in the research literature (Chen et al., 2014; Francl, 2014; Hwang, Lai, & Wang, 2015) most of the flipped learning papers are based upon K–12 experiences, several versions of the FC models have been implemented in higher education, and the debate on their pedagogical value has been ongoing in recent years. For instance, the *holistic flipped classroom* suggested by Chen et al. (2014) and detailed below, refers to learning that occurs in a physical classroom and in online synchronous and asynchronous environments that students can access at home or from mobile devices, all being used in a holistic and harmonious way. Our study analyzes traditional and holistic models of flipped classroom, as well as proposes a re-designed model of flipping the learning process, and explores the added value of its components for teaching and learning in higher education.

The literature review first discusses the advantages and disadvantages of the traditional FC model and presents its recently proposed holistic version. Following, we analyze the role of self-regulated learning in out-of-class flipped learning model.

1.1. The traditional flipped classroom model

As stated above, the flipped classroom model inverts traditional teaching and learning processes. Whereas in traditional instruction the acquisition of a new knowledge takes place inside the classroom and practice is conducted at home, in the *traditional flipped classroom (FC) model*, students acquire new content independently at home prior to coming to the classroom (Francl, 2014). In FC, new content is available for students through digital apps, mostly through PowerPoint presentations, videos of pre-recorded lectures, and texts (Moffett, 2015).

The research literature shows a variety of benefits of the FC model to teaching and learning processes (for review see: Giannakos, Krogstie, & Aalberg, 2015). In contrast to one-time explanation of a new content in the traditional classroom, the FC model enables learners to review recorded or written learning materials several times, or to skip the content they have already mastered. Since students can access learning content at their own pace, learning out-of-class is flexible and can occur at any time and place according to the choice of the learners, matching their academic levels and individual needs (Moffett, 2015). In addition to flexibility and individualization, the FC model encourages development of self-regulation strategies in regard to learning processes taking place at home (Gerstein, 2012). Self-regulated learning will be discussed in more details below.

During in-class learning, students are engaged in inquiry and problem-solving activities, construct their knowledge, work with peers, and reflect on the learning process. Such practices allow richer learning opportunities and deeper exploration of the content during in-class learning (Chen et al., 2014; Moffett, 2015; Vaughan, 2014). Thus, the FC model decreases the amount of time devoted to frontal lecturing and frees the time for active learning, practicing, discussion, asking questions and teamwork (Chen et al., 2014; Houston & Lin, 2012; Kong & Song, 2015).

Consequently, the in-class practices require a shift from the instructor-centered to student-centered pedagogy (Hwang et al., 2015). It is important to notice that in FC instructors are not replaced by technology. On the contrary, the role of professional instructors becomes even more crucial in the FC model than in the traditional teaching model (Chen et al., 2014). In the FC model, the instructor functions as a guide whose role is to meet different needs of individual learners. Thus, during in-class activities, instructors can increase communication with students, answer their questions, differentiate the level and the amount of practice, monitor and scaffold individual progress, and provide immediate feedback (Moffett, 2015). Correspondingly, some studies which examined the FC model (for review see: Thompson, 2011) reported improvement in student achievement and especially in learning motivation; the increase in learning motivation is explained by students taking responsibility for the learning process. In addition, Thompson noted that teachers in FC report higher level of satisfaction from teaching and improved time-efficiency during lessons.

However, some studies failed to demonstrate advantages of the FC model over the traditional classroom and even reported several disadvantages (Chen et al., 2014; Jensen, Kummer, & Godoy, 2015; Keengwe, 2014). For instance, the comparison between active learning in the FC model versus the traditional classroom (Jensen et al., 2015) showed similar learning gains. According to Jensen and colleagues, it is more likely that the quality of learning in both conditions was the result of the *instruction method* (active learning) rather than the FC model per se. However, changing the teaching method can be stressful and cause confusion among both teachers and students (Blau, Peled, & Nusan, 2016). For *teachers*, those who have difficulty giving up their traditional role of “information holders” and who perceived their main role as “transmitters of information” to students, might struggle promoting independent learning and transferring the responsibility for learning to their students (Blau & Presser, 2013; Peled, Blau, & Grinberg, 2015). For *students*, those who are familiar and comfortable with traditional instructions do not show willingness to take responsibility for their learning and to monitor their own progress (Johnson et al., 2014; Talbert, 2015). There is a concern that students who do not prepare before the lesson will not be able to actively participate in learning activities during the lesson. In addition, research has shown (Kim, Kim, Khera, & Getman, 2014) that if the support of students in the FC is not structured enough, it might lead to their frustration and low learning motivation. With regards to all of these findings, it seems that the FC model is not fully suited for students who are less inclined to self-directed learning at home in general and to learning new content through digital tools in particular (Kalman & Blau, 2017; Keengwe, 2014).

An additional concern is related to the alternative summative *assessment types* of FC. Peer and self-assessment that offer new opportunities for flipped learning in academia, has shown inaccurate grading – on average 7% higher than staff assessment and prone to be biased – students from the same country received higher grades compared to peers from different countries (Kulkarni et al., 2015).

Finally, the traditional FC model is more focused on content planning than on activity delivery and often perceives the technology as a replacement of traditional in-class instruction through watching videos (Kim et al., 2014). Hwang et al. (2015) explain the *role of technology in FC* based on the Taxonomy of Educational Objectives proposed by Bloom (1994, pp. 1–8) and modified by Anderson, Krathwohl, and Bloom (2001). Out of the six levels of the Taxonomy (remembering, understanding, applying, analyzing, evaluating, and creating) students' learning out-of-class focuses on remembering and understanding, that is, on the lower levels of cognitive learning. Instruction from video is used in FC model to express the basic contents of the target subjects. In contrast, in-class learning cultivates the higher levels of cognitive learning, such as applying, analyzing, and evaluating (Francl, 2014; Hwang et al., 2015). Such approach might miss the main reason for using ICT in education – enhancing pedagogy by promoting active learning, knowledge construction by students, problem-based learning, peer collaboration, preparation of creative learning outcomes, and embedded assessment (Blau & Shamir-Inbal, 2017; Shamir-Inbal & Blau, 2014a; Shamir-Inbal, Dayan, & Kali, 2009). Although the acquisition of new content at home develops important self-regulation strategies, learning by watching videos of lectures is not an innovative pedagogy, since technology is used in a traditional manner - for transferring information from teachers to students (Liu, Lu, & Dai, 2014). Instead, technologies need to develop the “core competencies” in education or 5C: Communication, Collaboration, Critical thinking, Complex problem solving, and Creativity (Hwang et al., 2015; Lai & Hwang, 2014).

In conclusion, findings regarding the utility of the traditional FC model are inconclusive. Thus, some extensions were proposed. Before exploring the extension of the flipped learning, Fig. 1 summarizes the core components of the traditional FC model discussed above separately for in-class and out-of-class learning.

1.2. The holistic flipped classroom model

In order to address the critique presented above, several authors extended the traditional FC model. For instance, Hwang et al. (2015) discussed how the 5C competences could be promoted by mobile technology-enhanced flipped learning of school students in Taiwan. As the *holistic model of flipped classroom* (Chen et al., 2014) shifts the focus from lectures to *learning activities*, there is more emphasis on what sorts of activities should be completed, and how these activities should be delivered in class and conducted at home. Derived from the synchronous classroom concept (Blau, Weiser, & Eshet-Alkalai, 2017; Clark & Mayer, 2016), the holistic FC model refers according to Chen and colleagues to a set of different environments including synchronous, asynchronous, home, and physical classrooms, all being combined in a harmonious way. Students can preview or review course lectures, post their reflection, attend synchronous sessions, and discuss course content with the instructor and with classmates. In addition, all learning activities in holistic FC are recorded in a platform's system log and can be monitored by instructors. However, the holistic model still does not emphasize *the added value of technology in FC for enhancing pedagogy*, promoting students' input into the learning process and reflecting on their knowledge and learning

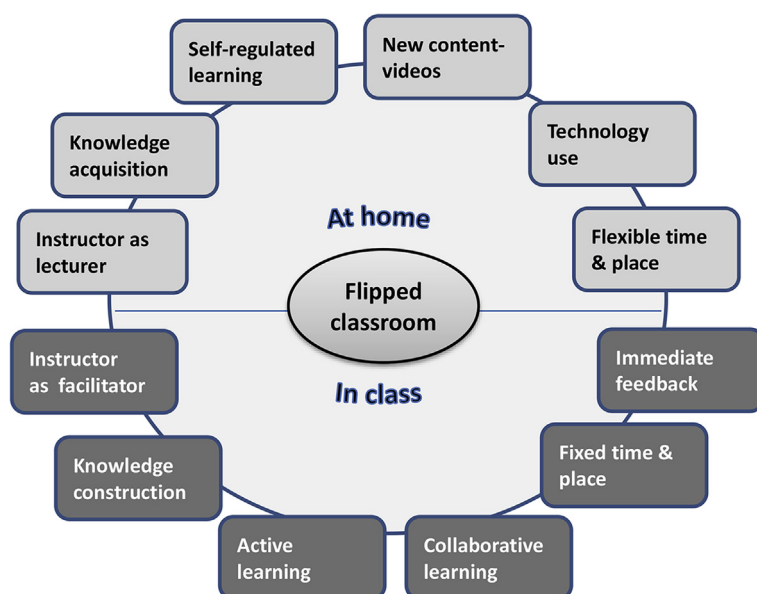


Fig. 1. The components of the traditional flipped classroom model.

experience. In addition, the holistic model does not address the role of technology in supporting and enhancing active individual and collaborative learning, embedded evaluation and peer assessment, and the development of self-regulated strategies in in-class and out-of-class settings. Therefore, we believe that it is important to carefully analyze the role of technology in designing teaching-learning-assessment processes in FC.

Notably, although some authors utilize different terms (e.g., FC as a “learning ecosystem”, [Giannakos et al., 2015](#)), careful analysis of the described components used to differentiate the model they suggested from the traditional FC reveals traditional use of technology for lecture recording and practice. Some researchers (for example, [Hwang et al., 2015](#)) propose to use the term “*flipped learning*” instead of “FC” and adopt the definition suggested by the [Association of Flipped Learning Network \(2014\)](#) in order to emphasize changes in pedagogy: “Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter.”

Although the term of “flipped learning” is indeed more appropriate to use, its definition in the quote above is too vague and describes “good learning” in general rather than addresses its specific components. In practice, flipped learning/classroom is “an educational technique that consists of two parts: (1) active learning activity inside the classroom, most of the times in groups focusing on critical knowledge and (2) well-defined self-regulated learning outside the classroom assisted by technology and focusing on fundamental knowledge” ([Giannakos et al., 2015](#), p. 106).

1.3. Digital environments, self-regulated learning, and co-regulation

FC model both requires and cultivates self-regulation abilities of student learning independently before the lessons ([Hewitt, Journell, & Zilonka, 2014](#)). Self-regulated learning (SRL) refers to one's ability to monitor his or her learning and think meta-cognitively, motivationally, and behaviorally ([Zimmerman, 2001](#)). While learners carried out self-regulation processes, they had to use a range of strategies such as goal setting, monitoring, self-evaluation, help seeking, and time management ([Williamson, 2015](#)). Students need to analyze learning situations, plan learning processes, set meaningful learning goals, determine which strategies to use for achieving them, and manage their efforts ([Nodoushan, 2012](#)). When using these metacognitive strategies, it is important for students to reflect on the learning process, constantly evaluate their performance, modify understanding of the topic, and monitor learning motivation ([Svinicki, 2010](#)).

When individuals work collaboratively in teams, at least three types of regulation come into play ([Winne, Hadwin, & Perry, 2013](#)): (1) each group member takes responsibility for regulating his or her learning (SRL), (2) each student supports other group members in regulating their learning (co-regulated learning), and (3) the group collectively regulates learning processes (shared regulation of learning). Shared regulation refers to group members' deliberate and strategic adaptation during phases of collaborative planning, task performance and reflection ([Järvelä, Malmberg, & Koivuniemi, 2016](#)). Järvelä et al. argued that for productive collaboration to occur, individual self-regulation needs to be in the service of the group task and accompanied by co-regulation and shared regulation.

A considerable volume of research has established that tools available in digital learning environments are particularly useful in supporting SRL ([Johnson & Davies, 2014](#)). [Puzziferro \(2008\)](#) argued that, in addition to autonomously accessing web-based resources, learners in digital environment must manage and pace their learning processes and strategies. Because of the variety of SRL strategies needed for successful learning in digital environments, such as open-ended hypertext or collaborative learning spaces, traditional conceptions of technology-enhanced learning have to be re-designed ([Azevedo, 2005](#); [Broadbent & Poon, 2015](#)). For successful SRL in such environments, it is crucial that students understand the requirements of the task to be completed, the skills to be demonstrated, and/or the content to be learned. Teachers can support students' SRL by using technology for providing detailed directions and specific instructions ([Johnson & Davies, 2014](#)).

Several studies address the role of SRL in the flipped classroom model. A previous study ([Sletten, 2015](#)) showed that SRL strategies were significant predictors of achievement in flipped course, beyond student GPA, flipped course perceptions, and previous FC experience. [Critz and Knight \(2013\)](#) reported that a FC model helped students in succeeding to regulate and direct their own learning. Comparison of learning strategies between flipped and traditional classroom ([Vliet, Winnips, & Brouwer, 2015](#)) showed that only students who participated in flipped classes improved their critical thinking, task value, and peer learning between pre- and post measurements. Unfortunately, these effects of FC pedagogy were short-term – they appeared only in the post-course questionnaire, but not in the delayed questionnaire that students completed five months after finishing the course. To make effects on metacognition and collaborative-learning strategies sustainable, Vliet and colleagues propose repeated use of flipped classes in a curriculum.

In order to help students develop their SRL skills, teachers need to set appropriate learning goals, scaffold the learning process, and share the evaluation criteria with students in advance ([Azevedo, 2005, 2014](#); [Svinicki, 2010](#)). A carefully designed online environment that integrates learning analytics data in a simple, graphical meta-level representation of learning (e.g., the representations of what I need to know, what I need to do, and how I am going to do it) promotes the development of student SRL within complex FC courses ([Reidsema, Kavanagh, Fink, Long, & Smith, 2014](#)).

Some authors use different frameworks to address SRL in the FC model. For instance, [Kim et al. \(2014\)](#) based their research of flipped learning on the Community of Inquiry framework ([Garrison, Anderson, & Archer, 2010](#)). They revised the original Community of Inquiry framework by adding to its three components of academic course – cognitive presence, social

presence, and teaching presence – a fourth component of learner presence, which reflects the concept of SRL and highlights its importance for the flipped learning model.

1.4. *The research goals and questions*

The present study explored the core elements of pedagogical design in FC, as well as SRL elements. The study was conducted in a graduate blended course and analyzed how the course's students mapped out both teaching and learning processes. The research questions were:

1. How do students in an academic course analyze flipped teaching and learning processes with respect to the following components: the role of the instructor, the role of the students, assessment methods, and the role of technology?
2. How are elements of SRL, co-regulation, and shared regulation integrated, and to what extent are they necessary for successful flipped learning processes in an academic course?

2. Method

2.1. *Participants and context*

The study involved 36 students at the Open University of Israel, who in spring 2015 attended the advanced academic course in the graduate program in Education: Technologies and Learning Systems. The course dealt with the concept of knowledge in psychological and philosophical aspects that are relevant to the field of education in the information society. The course was attended by 27 women and 9 men from various ethnic groups in Israeli society – Jewish, Arab, and Druze. The participants' age ranged between 28 and 54. Twenty-seven of the students (75%) were in-service teachers in elementary or secondary schools, and the rest of the participants were digital content designers in training programs in various organizations.

This blended course was largely based on self-regulated learning and teamwork, but also included face-to-face, asynchronous, and synchronous lessons. During one face-to-face lesson the students were studying in groups and planned the ways of working in virtual teams that took place later in the course. One asynchronous lesson included digital self-presentation of the participants and watching the recorded lecture that explained major themes of the course, learning methods, and the way of working with various apps throughout the course. During four synchronous videoconferences, the instructor highlighted and discussed complex or controversial issues covered by the course content, and the students presented their learning outcomes and shared insights. Face-to-face and synchronous lessons lasted 2-h each.

The course website combined several technological platforms. Google Apps for Education platform supported most of the learning processes and outcomes that easily allow students to create, edit, share, and collaborate on documents, spreadsheets, and presentations (Shamir-Inbal & Blau, 2014b). The synchronous lessons were held via Zoom videoconferencing that allows two-way communication during the lessons through watching (digital camera), speaking and listening (microphone and headphones), and sharing screens for presentation and teamwork (Blau et al., 2017; Weiser, Blau, & Eshet-Alkalai, 2016). Asynchronous discussions and individual assignments were carried out through course forum assignment system on Moodle platform.

In order to understand the context in which this study was conducted, Table 1 presents the components and learning activities of the course, as well as the pedagogical rationale underlying the activities. This pedagogical rationale was the basis for the re-designed flipping classroom model introduced later in this paper.

2.2. *Instruments and procedure*

The research was conducted using a qualitative research paradigm based on the description of the experience and its interpretation as presented by the participants (Bowen, 2008; Guba & Lincoln, 1994). This provides understanding of the phenomenon in its context and enables analyzing the data in accordance with the principles of the Grounded Theory approach (Strauss & Corbin, 1998). In this approach, data analysis reveals a number of main themes, which facilitate the development of the initial concepts. Following that, the coding reveals secondary concepts and categories. Finally, these main themes and secondary concepts are categorized to reflect the relevant components presented in the research literature (Charmaz, 2002).

Upon completion of the course, students were asked to write a reflection document. The reflection described how the teaching and learning characteristics were put into practice during the course activities. Students also reported on the role of technology, if there such a role, in these processes. Finally, students reported on the experiences, both beneficial and challenging, they were going through during their learning, as a result of the pedagogical design of this course.

The study was approved by the institutional Ethics Committee. In order to ensure the sincerity of answers, during the course students were unaware that their reflections would be analyzed. The informed consent was emailed to students after receiving the course grades. It was clear to students that the participation was voluntary and their decision to participate or

Table 1
Course components, learning activities and their pedagogical rationale.

Course components	Learning activities	Pedagogical rationale
Course website	The website contained the course readings and videos, guidelines for assignments, schedule, forums, links to collaborative documents, recorded lecture of the instructor, recordings of synchronous lessons, presentation files, and learning outcomes shared by the students. At the beginning of the course, the students were required to watch the recorded lecture that explained learning methods, the components of the course website, and the way of working with different apps.	Availability of the information at any time and place enables flexibility and ubiquitous learning. Learning through the variety of media in order to match different learning styles of students.
Course content open for editing of students	Students were able to enrich and update the course content through linking to new information and sharing their insights.	Openness of the course content for editing and updating by students – co-creation of the content. Reaching the higher levels of Bloom's taxonomy: applying and analyzing.
Discussion forums	The students were required to discuss various study topics through forums: to address the guiding questions of each discussion topic, expand the ideas of classmates, ask questions, express their opinions, and share their own experiences.	Active construction of knowledge through social interactions with instructor and peers in online learning community. Bloom's taxonomy: applying and analyzing.
Collaborative documents (Google Drive document)	Each course topic had an attached collaborative document called "Document for thinking and discussion". Students, in groups of three, summed up the discussions that were held in forums, so that it was possible to separate the wheat from the chaff and to present the main point of discussion corresponding to different course topics. Students, in groups of four, were asked to analyze the statements that appeared in forums according to the theories that they learned during the course and create an array of insights that they have reached throughout the analysis.	Learning by doing - mapping the course material and students' insights in order to create advanced organizers. Bloom's taxonomy: applying, analyzing, evaluating, and creating. Teamwork through asynchronous collaboration with peers.
Collaborative database (Google Drive spreadsheet)	Students, in pairs, analyzed the examples of selected ICT-enhanced activities according to the underlying learning theories: mapped out the type of knowledge acquired, characteristics of collaboration, etc.	Learning by doing – creating a joint database as a tool for further data analysis and synthesis. Bloom's taxonomy: applying, analyzing, and evaluating. Asynchronous collaboration with peers.
Assessment criteria	Each course assignment provided evaluation criteria for each section. Students were asked to assess their performance according to the criteria. In several course activities, the students were asked to assess activities performed by their classmates, to comment on the presentation of classmates groups' learning outcomes, to raise questions, and to suggest improvements.	Monitoring of learning, promotion of meta-cognitive thinking, evaluation of performance, embedded assessment. Peer assessment; communication in learning community. Reaching the higher levels of Bloom's taxonomy: analyzing and evaluating.
Zoom video- conferencing platform for synchronous e-learning	Synchronous lessons through the videoconferencing platform were used for discussion of the course topics, presentation of learning outcomes by students, and sharing personal and group insights with classmates.	Developing digital competences of effective synchronous e-learning, e-communication, and presentation. Active learning and collaboration – teams of students lead the lessons.

not participate in the research cannot affect their studies. Surprisingly, all students except one agreed to the analysis of their reflections on the course and their own learning experience.

The analysis of teaching-learning practices usually refers to the processes of teaching, learning and assessment. In addition, the context of blended technology-enhanced learning raises the need to address the role that technology plays in these processes as well as the importance of regulation conducted by students. Accordingly, the reflections of students were mapped out in correspondence to the following categories: (1) characteristics of teaching and the role of the instructor, (2) characteristics of learning and the role of students, (3) types of learning regulation, (4) and characteristics of assessment in order to promote learning, SRL and co-regulation, as well as (5) contribution of technology in supporting teaching, learning, and assessment.

Research assistants, who were trained by the researchers, yet unaware of the research questions or the identity of the participants, conducted the coding. In order to test the inter-rater reliability, two judges conducted the thematic analysis independently. Approximately 3% of the items, for which there was no agreement, were discussed with a third judge and the final categorization is a result of full agreement between the judges.

Table 2

Quotes that describe the categories.

Categories	Representative quotes
<p><u>Teaching</u> processes and the role of the instructor: Orchestrating, Scaffolding, Motivating, Promoting SRL, Promoting teamwork, Promoting interactions in online community</p>	<p>A- “The role of the teacher hardly included teaching the material, it was more like orchestration – management of forums and virtual lessons, design and scaffolding, guidance and clarifications, providing tools for independent and collaborative work of students. ... We studied the content in advance without instructor’s aid, so during the lesson she had the time to clarify important and/or problematic points of the course topics, and also to answer the students’ questions.” NR- “The instructor ... was following comments and questions in different forums ... Her remarks ... encouraged our progress in learning the course materials ... All this was done in order to turn students that were used to passive studying to become active learners.” DU- “The role of instructor in such a course is to encourage and provide motivation for participating in virtual discussions.”</p>
<p><u>Learning</u> processes and the role of students: The entire Bloom’s taxonomy: remembering, understanding, applying, analyzing, evaluating, creating. All 5C. SRL, co-regulation, shared regulation.</p>	<p>A- “Student needs to provide “earnest payment” ... because the requirement to self-study the materials of the course and apply our knowledge creatively in learning outcomes creates great demands.” NR- “Collaborative work brought out several characteristics in me, such as: taking personal responsibility for learning, managing division of labor, performing tasks through interdependence, taking into consideration characteristics of our team members, contributing to the group learning processes and outcomes.” R- “There is a requirement to perform collaborative tasks, and in order to do so one needs a variety of social skills: respect and listening to others, understanding, cooperating, and avoiding conflict situations.”</p>
<p><u>Assessment</u> processes: Promoting SRL, co-regulation. Bloom’s taxonomy: analyzing and evaluating. Core competences: Critical thinking, collaboration, communication</p>	<p>A- “A significant part of all course assignments was ongoing self-evaluation and reflection. This encouraged meta-cognitive thinking, as well as monitoring learning strategies and collaborative work.” R- “Throughout the course I’ve evaluated my progress and participation in the learning activities ... I had to explain and provide specific examples in order to justify my self-assessment and peer assessment.” DU- “The assessment was conducted regarding learning processes and outcomes by both instructor and students – by peers inside small teams working on the same learning outcomes, and by classmates from other groups. Important part of the learning process was carried out during the analysis and evaluation of classmates’ outcomes, and by addressing their comments to our outcomes.”</p>
<p>The role of <u>technology</u> in supporting teaching, learning, and assessment: Promoting all 5 core competences: Communication, Collaboration, Critical thinking, Complex problem solving, and Creativity. Supporting SRL, co-regulation, shared regulation. Supporting the entire Bloom’s taxonomy.</p>	<p>A- “The technology facilitated students’ collaboration and communication among themselves and with the instructor. It created organized learning environment that made online self-study and the use of collaborative documents made teamwork easier.” DU- “The technology allowed the experience of being a part of learning community. We were exposed to the variety of technology-enhanced activities that promoted online collaboration, communication, and creativity through participating in forums, using collaborative documents, presentations, spreadsheets, and creating learning outcomes. Usage of the forums and Zoom lessons provided an opportunity to discuss in deep the course material and learning experiences, share insights, get detailed feedback from the peers and facilitation from the instructor.” P- “The course website [mostly on the Google Apps for Education platform with Moodle’s discussion groups and individual assignment system] served as a core learning environment. All the information and course materials, including the recordings of the synchronous lessons, were available at the website; forums were there, and collaborative outcomes also were planned, created, discussed with peers, evaluated by classmates, and edited in that learning environment.”</p>

3. Results

3.1. Teaching, learning, assessment, and technology in flipped classroom

During the course the students were required to learn independently or in small groups, while both time and place were flexible. They were expected to monitor personal learning processes with the help of the lecturer and classmates throughout the course. Table 2 presents quotes that illustrate the components of the course and represent general views of most of the participants. The data refers to the general categories: teaching processes and the role of the instructor, learning processes and the role of students, assessment, and the role of technology in supporting these processes, as well as to the secondary categories (in **bold** in the left column). The analysis revealed that regulation is not a distinct category, but is embedded in the rest of the general categories.

Table 3
Learning regulation as an integral part of the FC model.

Learning regulation	Flipped classroom
Flexibility in time and place of learning that promotes independent learning and teamwork	Learning materials are available online and new content is studied independently at home
<p>A- "All the materials are on the website, and I had to read relevant articles and/or view videos before the lesson and come prepared." P- "We worked in well-organized digital environment that was rich, varied, full of learning materials, such as articles, summaries, presentations, and videos, and one could navigate through it quite easily." M- "Self-study was carried out at my own pace, at the time that was convenient for me. Everything was available and accessible in advance, thus both self-study and teamwork were flexible."</p>	
Student actively controls the way of learning, chooses and develops strategies according to the task and his or his peers' characteristics	The responsibility for studying the new content is on the learner
<p>P- "The course required me to be a responsible and active learner, and so happened that at the beginning of the course, when I didn't visit the course website for several days, I found out that part of the forums has already been closed, and I cannot participate in them anymore. Later I learned to be responsible and regularly follow what is happening on the website. In order to perform group tasks I learned to be active, to initiate contacts with classmates, and to try different strategies with different peers in order to successfully accomplish team activities." M- "Students, who chose not to be active in this course, could not learn the material. This course required to carefully organize my learning and come prepared to the lessons. Group tasks required planning teamwork, analyzing the potential input of other students, and looking for the best way to accomplish tasks with them. Taking control of my own learning and sharing control with peers for our teamwork was the only possible way to succeed in the course."</p>	
Monitoring and regulation of individual and group learning processes	Repeated review of the learning materials according to the needs of students
<p>R- "As a student, I faced a lot of responsibility in self-study. I had to stay concentrated and avoid distractions, although there were many of those. I had to read the relevant material over and over again and carry out the assignment ... When I felt that I don't understand something, I was able to review the relevant materials over and over again." R- "Initially I experienced overload, lost the motivation, and couldn't progress in the way I wanted to. Slowly I figured out how to organize my learning in this course and things changed ... Throughout the course I (or in teamwork - students in my group) had to regulate my/our learning and constantly decide what I/we needed to improve, and how to do it." DU- "The learning in this course required a lot of discipline and self-motivation, taking responsibility for the learning process and for organizing my time. I had to work alone, I had to use different technologies, and I also had to learn how to manage online teamwork and communicate effectively with other students in course."</p>	
Teacher as a moderator that provides learning scaffolds and individual guiding, and promotes peer learning	Teacher as a guide – personalized learning, defining assessment methods, and optimal utilization of time
<p>N- "The assessment methods were clear, I understood what was expected, when, and how I should do it ... The instructor provided examples and guidelines, but also encouraged helping each other. And sometimes by trying to answer peer question in the course forum I could answer my own question." NU- "Instructor's availability for questions allowed kind of one-on-one guiding between instructor and students."</p>	
Discussions in learning community and collaborative teamwork	Discussions and collaborations <i>during lessons</i>
<p>N- "I created new social and professional connections thanks to the discussions in forums, assignments, and the final project." P- "I felt highly committed to my team, which was leading in preparation of collaborative outcomes, both in delivering on time and in their quality." D- "One of the most important skills I've acquired during the course is online communication skill. Additionally, it was nice to see and discuss during the online lessons learning outcomes of other students that were rich in content and well-presented. It was interesting to realize how students in each group found their unique way of working together effectively."</p>	
Authentic learning promotes motivation for learning	Promoting motivation for learning
<p>P- "My motivation for learning was high. This course for me was authentic, engaging, and pertinent; it gathered together and put into practice a variety of concepts, principals, and approaches. I've learned so far during my degree studies." M- "I realized that the instructor can and should motivate students to learn, through encouragement of persistence, development of learning skills and meta-cognitive thinking." NI- "Studying the course was fun and served to illustrate most of the theoretical materials studied in this and previous courses, as well as to show the potential of technologies to enhance learning."</p>	

3.2. Regulation processes in flipped classroom

Analysis of students' statements that described their learning experiences and interpretations revealed that self-regulated distance learning, co-regulation and shared regulation were integrated in FC model throughout the course activities (as presented in Table 1). Table 3 shows how the course participants experienced the integration of learning regulation and FC model. The quotes selected represent general views of most of the students in the course.

4. Discussion

In this section, we offer a re-designed perspective on flipped learning in higher education based on the components of the traditional flipped model listed above and its expanded version – holistic FC model presented by Chen et al. (2014). In addressing this re-designed model, we first discuss, in regard to *the first research question*, the role of different participators and components of the flipped learning – instructor, students, technology use, and assessment process, and their

manifestation in homework and in class activities. Based on findings focusing on the *second research question*, we emphasize the necessity to acquire strategies of SRL, co-regulation, and shared regulation in order to succeed in flipped learning during the course. This combination of elements set our re-designed perspective on flipped learning in higher education.

Previous studies reported both benefits and disadvantages of the traditional FC model (Davies, Dean, & Ball, 2013; Gerstein, 2012; Moffett, 2015; Thompson, 2011). Some of the authors (Chen et al., 2014; Hwang et al., 2015; Kim et al., 2014) presented a more holistic idea of flipped learning and argued for a wider use of technologies to promote seamless learning and “learning by networking”. In the traditional FC model, learning of new content occurs through watching videos and transferring information from instructor to students via technology. Contrarily, the course analyzed in this study promoted active learning of students in both in- and out-of-class settings, and construction of knowledge by students took place before, during, and after the lessons. Extensive independent learning was supported by the instructor’s guidance and scaffolding and was combined with continuous dialogue and collaborative interactions among peers. Such a holistic pedagogical design enhances the involvement of students in the learning processes and increases their motivation and learning satisfaction (Kidron & Kali, 2015; Levin-Peled et al., 2007).

The re-designed flipped model of learning presented in Fig. 2 arises from our findings based on the reflection of the students on the course components and the role of its participants (Tables 2 and 3). Fig. 2 merges the traditional FC model presented in the research literature (highlighted in gray rectangles) and the additional components of flipped learning revealed in our study (in white rectangles). Similarly to previous studies (e.g., Giannakos et al., 2015; Hwang et al., 2015; Kong & Song, 2015), the components of the model are analyzed separately for in- and out-of-classroom learning.

Our analysis of students’ reflections on the course components and learning processes suggests that the re-designed model of flipped learning goes beyond the concept initially presented by Khan (Davies et al., 2013; Khan, 2011) and its recent holistic modification (Chen et al., 2014). The rectangles that are marked in light gray in the upper part of Fig. 2 present traditional components of students’ *out-of-class learning* that are described both in the FC research literature (e.g., Hwang et al., 2015; Johnson et al., 2014; Moffett, 2015; Vaughan, 2014) and revealed in our study. It includes acquisition of the

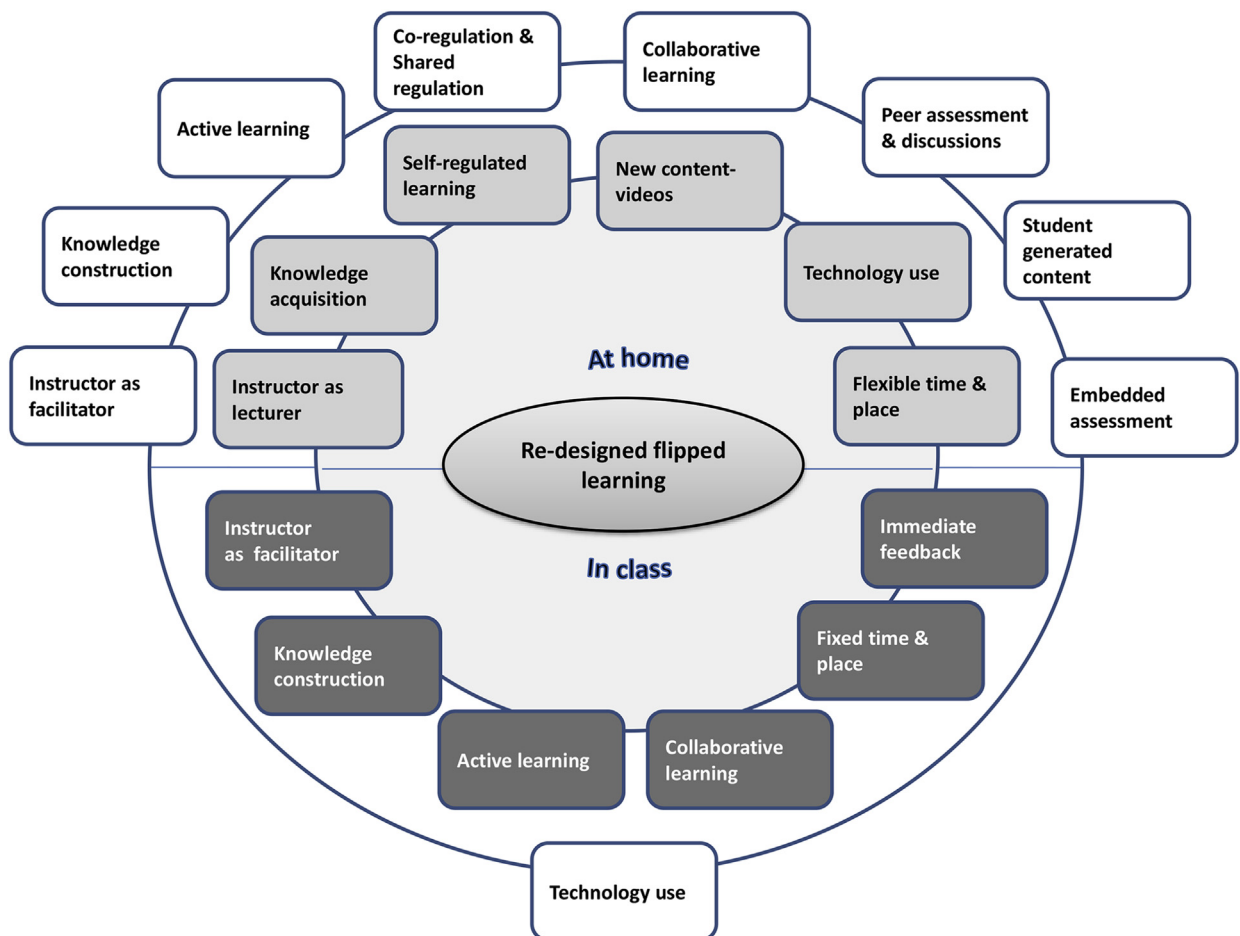


Fig. 2. Re-designed model of flipped learning.

new content, mostly through presentation apps and video lectures recorded by the instructor, and requires from students to take responsibility for their learning, which becomes flexible in time and place, and in some cases, to conduct peer assessments. Education in the digital society poses new challenges and requires alternative approaches to teaching and learning (Kidron & Kali, 2015; Shamir-Inbal & Blau, 2016b). Consequently, students who learn through and with technology need to analyze learning situations, set meaningful learning goals, determine which strategies to use, assess whether the strategies they use are effective, and reflect on the learning episodes in order to modify their understanding of the topic in relation to the task complexity (Azevedo, Moos, Greene, Winters, & Cromley, 2008).

The rectangles that are marked in dark gray in Fig. 2 present traditional *in-class learning* activities reported both in the research literature and by participants in our study. During lessons, traditional FC allows students to be active learners who are engaged in inquiry and problem solving, ask questions, act collaboratively, and reflect on their learning (Moffett, 2015; Vaughan, 2014). Similarly to previous studies (Moffett, 2015; Svinicki, 2010), our findings demonstrated that during lessons the instructor scaffolds the construction of knowledge by students and facilitates their independent and collaborative learning.

The white rectangles in Fig. 2 present components that were revealed in our study and *expand the traditional use of flipped classroom*. One of the objectives of FC model is promoting *self-regulated learning* (Hwang et al., 2015; Sletten, 2015). Consistent with previous research, this was manifested in our study in the ability of students to monitor learning episodes, determine which strategies to use, assess whether the chosen strategies were effective in meeting learning goals or required adjusting, and evaluate their emerging understanding of the learning topics. In addition to self-regulation, as described in the FC literature, our findings showed (see Table 3) two types of *group regulation*: *co-regulation*, in which each student supports other team members in regulating their learning, and *shared regulation* – collective regulation of team learning (Järvelä et al., 2016). Note that in contrast to individual self-regulation, the co-regulation revealed in this study seems to be very rare in higher education research and practice, even in graduate courses (Shamir-Inbal & Blau, 2016b). Ongoing evaluation, meta-cognitive thinking, monitoring learning strategies, and reflection on peers' learning and team learning were a significant part of the course assignments and activities. Note that the participants were graduate students relatively skilled in self-regulated learning; the methods of promoting self-regulation implied in the pedagogical design of this course are even more crucial for undergraduates.

As for *technology*, the traditional model mostly uses technology at home as a channel for transmitting information to students, while in the classroom it applies a constructivist pedagogy *without* using technology. Contrarily, the inclusion of technology in the white rectangles at the bottom part of the re-designed flipped learning model highlights the important role that digital tools played in in-class activities in this study. Based on the analysis of FC pedagogy in schools according to the updated version of Bloom's Taxonomy, Hwang et al. (2015) claimed that technology is used in out-of-class learning to promote remembering and understanding. In contrast, with in-class learning activities teachers are able to focus on the applying, analyzing, evaluating, or even creating levels, depending on the learning objective. However, in our study technology was used for supporting learning on all levels of Bloom's taxonomy. Students used one-to-one technology in both face-to-face lessons and synchronous videoconference sessions. The technology supported offline and online discussions; shared documents, spreadsheets, and presentation apps enabled technology-enhanced collaborative learning activities in- and out-of-class. Students used one-to-one technology for working in teams in face-to-face lessons, while in synchronous lessons, a videoconferencing system was used for presentation of collaborative learning outcomes by teams and for peer feedback. Note that from a pedagogical point of view, the analogy of the activities in synchronous lessons to face-to-face classroom would be identical – technology-enhanced presentations of digital learning outcomes by teams of students, followed up by whole-class discussions led by the team members. Using technology in this course allowed not only flexibility in the learning process and content accessibility, but also transformed Dewey's "Learning by Doing" to "Learning by Networking" (Chen et al., 2014). While e-accessibility of the learning content and active learning by individual students has become almost an academic standard, *co-creation of the course content* by students and *co-creation of learning outcomes* by virtual teams of students remain very rare for higher education, even though these activities can benefit students in both the learning process and in the future workplace.

Similarly to seamless flipped learning of school students reported by Hwang et al. (2015), the use of digital tools in our study facilitated *ubiquitous learning in different contexts* – offline and online. Our results are also consistent with previous findings on embedded use of one-to-one technology in a professional development program for in-service teachers in Hong Kong on the topic of e-learning (Kong & Song, 2015). In Kong and Song's study, using one-to-one technology as a tool for supporting flipped learning promoted reflective inquiry, group interactions, and experience of sharing understanding with peers and instructors. Thus, it resulted in deepening of the learning process and advancing teachers' professional growth.

In addition, the use of technology in our study also supported the *shift in the role of the instructor* towards facilitator of students' learning. For instance, the screen-share function of the videoconferencing system was transferred from the instructor to the team of students, who utilized it to present their collaborative learning outcomes and hold group discussions during synchronous lessons. This was perceived by the students as a symbol of changing the traditional power status quo and *giving up information ownership* usually held by lecturers.

As the upper white rectangles in Fig. 2 show, re-designed flipped learning produced a rich and active learning experience not only in-class, as happens in traditional FC, but also in out-of-class learning. Our findings demonstrated that the course provided numerous opportunities to develop higher-order skills through active learning and knowledge construction by students as well as through interactions with others – peer teamwork, conducting discussions, creating and sharing learning

outcomes with classmates, receiving peer feedback, and editing drafts according to the results of peer assessment. Aiming at those higher-level abilities, international organizations such as UNESCO, the E.U., and the OECD have been placing special emphasis on the curriculum development of the “core competencies”—5C in education (Hwang et al., 2015; Lai & Hwang, 2014). Discussing how 5C could be promoted by flipped learning of school students in Taiwan, Hwang et al. (2015) argued that 5C competencies are closely related to such an extent that there is no need to distinguish which ability is being cultivated, since one ability can be enhanced through another. Consistent with this argument, in our study, technology-enhanced collaboration and teamwork on student-generated content (i.e., planning, preparing, presenting to classmates, and editing collaborative digital learning outcomes according to peer feedback) helped improving students' communication skills, critical thinking, and the ability to solve complex problems. Moreover, teamwork in our study required development of group self-regulation strategies in order to monitor, assess, and adjust learning processes not only of individual students, but also of teams. This type of out-of-class activities and skills presented in the re-designed flipped learning, with especial emphasis on *co-creation of the course content, collaborative co-creation of learning outcomes, co-regulation, and shared regulation*, is substantially different from the traditional self-learning from videos before the class, which is reported in the FC literature.

Regarding the *role of instructor* in flipped learning, the instructor in our study not only designed the digital learning environment, but also participated in discussions, monitored the progress of group learning outcomes, encouraged peer interactions, promoted the development of regulation strategies, and provided scaffolding for students' independent and collaborative learning throughout the entire course. This approach of the instructor encouraged higher levels of cognitive learning behaviors categorized in Bloom's taxonomy, such as applying, analyzing, evaluating, and creating (Gorsky & Blau, 2009; Hwang et al., 2015; Spencer, Wolf, & Sams, 2011). Our findings in an academic setting is consistent with Chen et al. (2014) argument regarding the role of teacher in flipped learning in schools. Chen and colleagues claimed that a professional educator should encourage students to ask questions, to discuss various viewpoints with peers, to follow up on topics raised by teacher or students, and to be open for sharing learning outcomes with classmates.

5. Conclusion

This study suggests a re-designed model of flipped learning and discusses the added value of technologies in promoting higher order thinking skills presented in Bloom's taxonomy, such as applying, analyzing, evaluating, and creating during both in- and out-of-class learning. The re-designed model emphasizes the crucial role of technology in supporting the development of each of *five core competences*—5C (Hwang et al., 2015) for successful learning and functioning in digital era. In addition, the re-designed model places a special emphasis on *technology-enhanced embedded assessment*, which combines individual reflection with peer feedback, on collaboration, and on *co-creation of course content and of learning outcomes* by students in order to develop *regulation* strategies in both individual learning (i.e. self-regulation) and teamwork (i.e., co-regulation and shared regulation).

As explained above, pedagogical design of technology use in synchronous lessons analyzed in this study is not unique to e-teaching and could be adopted as is in face-to-face classrooms. We recommend incorporating the re-designed model of flipped learning suggested in this paper in a wide range of higher education courses, regardless of being delivered face-to-face, as hybrid learning, or fully online. Further investigation of its impact on an innovative culture of teaching and learning at academia may deepen our understanding of changes occurring in the role of lecturer and students. This model might be especially beneficial in exploring changes related to co-creation of a course content and learning outcomes, self-regulation and co-regulation, collaboration among peers in learning communities, and the added value of digital environments to flipped learning and pedagogy.

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