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LEARNING MEDIATION VIA WEB 2.0 TOOLS IN THE CONTEXT OF SCHOOL HEALTH AND SAFETY

This collaborative project-based learning (CPBL) study concerns the design and development of educational material set by preservice teachers. During the study, Web 2.0 technologies were used as tools to support collaborative knowledge construction in terms of school health and safety. Based on the purpose of the study, mixed method was employed. Qualitative results indicated that CPBL was an appropriate choice for studies aiming to increase awareness and knowledge in a special context. Preparing an educational material set with a wide variety of Web 2.0 tools based on predetermined criteria through CPBL strategy can enable participants to enhance their problem-solving and critical-thinking skills. Moreover, CPBL was effective in increasing the participants' motivation and self-regulation towards technology learning.

Keywords: Web 2.0, school health and safety, collaborative project based learning, preservice teachers, mixed-method research.

Introduction

Today, social concerns about students' safety and health at school have increased due to highly publicised gun-related incidents, violence, bullying, and abuse. Creating and maintaining a safe and healthy school environment includes creating environments in which students can learn and develop freely, whilst not encountering any form of violence (Sprague & Walker, 2010). As a result of research studies undertaken and news in the media about school health and safety, policies are also developed for the taking of appropriate measures related to this area. One of the main points agreed to as the legal basis for the published research is that all components of the school (teachers, staff, students, family) should be considered as a whole, and that cooperation should be sought with the relevant persons, organisations, and society beyond the school gates (Astor et al., 2004; Chiang et al., 2015; Calik et al., 2018; Eklund et al., 2018; Lewallen et al., 2015). The need to increase teachers' awareness has attracted the attention of all stakeholders and has accelerated policy studies in this field. Teacher training programmes have a major role in increasing preservice teachers' awareness of how teachers value health education in school, their intentions and incentives to incorporate health into

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their teaching, their ability to provide information regarding personal health problems to their students, and to influence their students' knowledge and intentions about a healthy and safe school environment (Vamos & Zhou, 2009).

The school environment has several dimensions, including physical, social, and psychosocial aspects. The physical school environment includes the school building and its various physical structures, infrastructure, school equipment and also the environment in which the school is located. In addition, air, water and materials that children may come into contact with, as well as other hazards, constitute the physical environment of the school (Adegbenro, 2007). A safe and healthy school environment refers to the integral nature of school health education, physical education and activity, social services, nutrition services, the health promotion of teachers and staff, and the participation of student families and the wider community (Jones et al., 2007). School health includes the protection of basic needs, be they biological, physical, or social threats. It encompasses the location of the school, the construction characteristics and condition of the school buildings, the materials used, the quality of the indoor air, the water safety, and the hygiene of personnel and spaces. In terms of prevention, this includes the air, water, and materials that students may come into contact with, as well as land usage, roads and other nearby hazards (Lewallen et al., 2015). Of the 17 Sustainable Development Goals set by the United Nations to be achieved by 2030, one is 'health and quality of life' and another is 'qualified education'. Health and education are also considered important indicators of economic development (United Nations, 2019). The causal relationship between health and education is said to be related to low-level enrolment of unhealthy children and their high likelihood of later becoming unhealthy adults (Curtler & Lleras-Muney, 2006). The concept of a safe school is generally addressed in the context of protecting students and school staff from undesired behaviours such as acts of crime, violence, aggression, or theft, and from alcohol, tobacco smoking and drug abuse, physical or mental abuse within the school or the local environment, and providing personal life safety in emergency situations (e.g., armed attack, fire, earthquake) that may create a crisis environment at the school (Bucher & Manning, 2005; Cornell & Meyer, 2010; Varjas et al., 2009).

In order to address this gap in Turkey and to support governmental studies and initiatives, the researchers of the current study conducted a project with preservice teachers at a university in Turkey in order to both increase their awareness about school health and safety, and to help them increase their awareness of all related stakeholders on this issue. In order to achieve this, the affordances of Web 2.0 technologies directed researchers to conduct an interdisciplinary project, as there is a diverse ubiquity of Web 2.0 tools in today's education system due to their ease of application in different fields. Besides, to meet the requirements of today's digital age, teachers must possess basic technological knowledge and be digitally literate. In some cases, they should be able to create digital content for their own context, from their teacher education to professional development. For this reason, collaborative project based learning (CPBL) was chosen as the instructional method which allows groups experience active learning while developing products for extended periods. In this study, by requiring different collaborative tasks through Web 2.0 from participants it was aimed to ensure them to use technology to construct knowledge.

Collaborative project based learning (CPBL)

Collaborative learning (CL) requires students to work as a group in order to resolve problems or to create a product together with active involvement of each individual. CL is an instructional method in which students with diverse backgrounds and of various performance levels share a mutual interest and work towards a common goal (Laal & Ghodsi, 2012).

Roberts (2005) classified the benefits of CL under three headings as academic, social, and psychological. Academic benefits were highlighted as improving critical thinking; involving students actively in their learning processes; improving classroom results in terms of achievement, attendance, attitude, self-management, completing assignments; and modelling appropriate student problem-solving techniques. Social benefits were summarised as developing a social support for students; building diversity understanding among students and staff; and creating a positive atmosphere for cooperation. Psychological benefits were reported as increasing self-esteem and developing positive attitudes towards teachers. In addition to these benefits, CL ensures developing communication skills (McConnell, 2005) and improving cognitive development (Zurita & Nussbaum, 2004). These benefits imply the necessity of incorporating CL into higher education. Additionally, since university students share concerns related to finding a job, increasing their group-working skills through CL is essential 'so that students can become effective "team members" and better employees' (Witney & Smallbone, 2011, p. 102).

As highlighted by Collis (1997), CL in a project-based context focuses on in-group and inter-group interactions, where each individual takes responsibility for learning while studying as a group. Thus, CPBL is an active learning approach, where groups work towards developing products or solutions for extended periods (Alharbi et al., 2018) to deal with real-world problems (Donnelly & Fitzmaurice, 2005). Since CPBL ensures researching, debating, sharing and designing, meaningful learning is therefore preordained which is of critical importance given the context of the study. As this study focused on school health and safety, which is both a serious and real-world problem of today's education system, CPBL was selected since it allows participants to actively work in collaboration in order to develop awareness-raising products. In addition, participants' collaborative efforts on the given tasks were expected to promote knowledge construction in school health and safety and interdisciplinary working skills.

Web 2.0

Web 2.0 technologies have been affecting daily, academic, and educational life since their inception in 2005. Especially, Web 2.0 has considerably contributed to education, with changes implemented to pedagogical approaches that focus on user-generated collaborative learning. Research has gained momentum in the pedagogical utilisation of a wide range of Web 2.0 tools (Alsmari, 2019; Deng et al., 2018; García-Morales et al., 2020; Newland & Byles, 2014; Teo et al., 2019) owing to advantages such as their zero/low cost, ease of use, and widespread accessibility (Harris & Rea, 2009) for use both in traditional and innovative learning environments. According to various studies, advantages of Web 2.0 tools for educational practices are the increasing of interactivity among students (Dalvi-Esfahani et al., 2020; Huang et al., 2014), improving learning performance (Alsmari, 2019; García-Morales et al., 2020), facilitating student self-regulated learning processes (Kitsantas & Dabbagh, 2011; McLoughlin & Lee, 2010), and connecting the world (Kitsantas & Dabbagh, 2011).

The popularity and prevalence of Web 2.0 technologies in recent years has motivated scholars to exploit these tools for the benefit of educational practices in higher education (Chu et al. 2017; Deng et al. 2018; Neuman & Hood, 2009; Zheng et al., 2015). Researchers have found innovative ways to use Web 2.0 for systematic engagement and for the promotion of collaboration and interaction. Due to the proliferation of Web 2.0 tools and the promising results of the aforementioned studies, Web 2.0 has become an integral part of today's educational system. The results of these various studies have provided insight as to how powerful Web 2.0 technologies can be in changing academic teaching (Newland & Byles, 2014)

and learning. As highlighted in a report by the Committee of Inquiry into the Changing Learner Experience [CLEX] (2009), being involved with Web 2.0 helps to comply with 21st century skills such as 'communication, collaboration, creativity, leadership and technology proficiency' (p. 6) both for learning and for employability. However, studies using multiple Web 2.0 tools to mediate learning in a higher education context have been limited, with notable exceptions by Deng et al. (2018) and Laru, Näykki, and Järvelä (2012). Instead, most studies have primarily focused on specific Web 2.0 technology such as wikis, Facebook, or podcasting. In order to address this gap in the research, the researchers developed the current study so as to explore how preservice teachers can employ multiple Web 2.0 tools to produce information and products.

The Study

On the basis of the strengths of Web 2.0 technologies and the benefits of CPBL, the current study is concerned with the design and development of educational material set during the 2018-2019 Spring term by preservice teachers from two undergraduate courses (*Special Teaching Methods and Turkish Education System and Management*) and from two different disciplines (*Instructional Technology and Classroom Teaching*).

During the study, Web 2.0 technologies were used as tools to support collaborative knowledge construction in terms of school health and safety. The educational material set developed by the preservice teachers ensured their usage of a wide variety of Web 2.0 tools in producing the information and products. Before the study, the researchers applied to the Institutional Review Board (IRB) to obtain the necessary permissions to conduct such a study. The 64 participant preservice teachers were organised into groups and then tasked with developing storyboards, videos, infographics, posters, and brochures as products. All the materials were required based on two purposes. First, the preservice teachers were tasked as being responsible to formulate their own method of understanding school health and safety. Due to the importance of this topic, as preservice teachers, irrespective of their discipline, they should each be aware of the related politics and detailed information that will be essential throughout their professional teaching career. In addition, they should possess the required basic knowledge in order to educate their own students and to increase their awareness. Thus, during the project each group was required to research about the politics and to produce the required materials so as to create an awareness. Second, the preservice teachers were each tasked with being responsible to improve their own skills in the effective usage of Web 2.0 tools in terms of materials design. In order to meet the requirements of today's digital age, teachers should possess basic technological knowledge and be digitally literate. Being able to use Web 2.0 technologies effectively will also add value to their professional development.

In order to achieve the goals of the study, the researchers conducted a meeting at the outset of the study. They introduced the project, topics to the participants, and the two groups of preservice teachers to each other as student peers. A total of 14 groups of four to six preservice teachers were created randomly by the researchers to include students from both Instructional Technology (IT) and Classroom Teaching (CT) disciplines. At their second meeting, the project groups were informed about the basic concepts of the study, then they were assigned their topics related to school health and safety. Each group was responsible for the completion of their assigned tasks based on certain given dates, and were responsible for arranging themselves to work collaboratively. Collaborative working sessions were required to be face-to-face, since the students did not have the opportunity to collaborate at their homes or student dormitories. Some of these sessions were achieved through weekly classes,

but students also met on a weekly basis according to their schedule, and recorded videos as evidence of their meetings. In addition, the students were responsible for researching about the available Web 2.0 tools needed for completion of the required tasks. Since IT students were naturally more familiar with Web 2.0, they were given the responsibility to research the Web 2.0 tools and in deciding on the most appropriate available tool. The researchers informed the participants about the criteria for each task and their responsibility to develop certain materials by following established visual design principles. Table 1 presents the Web 2.0 tools utilised by the students according to different tasks.

Table 1. Web 2.0 tools used in the study

Task	Web 2.0 Tool
Storyboard	StoryboardThat (all groups)
Video	Edpuzzle (9 groups), Animoto (5 groups)
Infographic	Canva (4 groups), Easel.ly (4 groups), Visme (3 groups), Picktochart (3 groups)
Poster	Canva (8 groups), Padlet (6 groups)
Brochure	Canva (all groups)

Weekly face-to-face lectures were conducted in order to provide brief information for each task, to check the preservice teachers' progress, and to inform them of product criteria where necessary. The researchers provided strong guidance during these meetings, whilst the preservice teachers continued to work collaboratively. At the end of the project, the preservice teachers presented their materials in the university's conference hall with the participation of both faculty members and the remaining education faculty student body (from all disciplines). Figure 1 graphically illustrates the end-to-end process of the study.

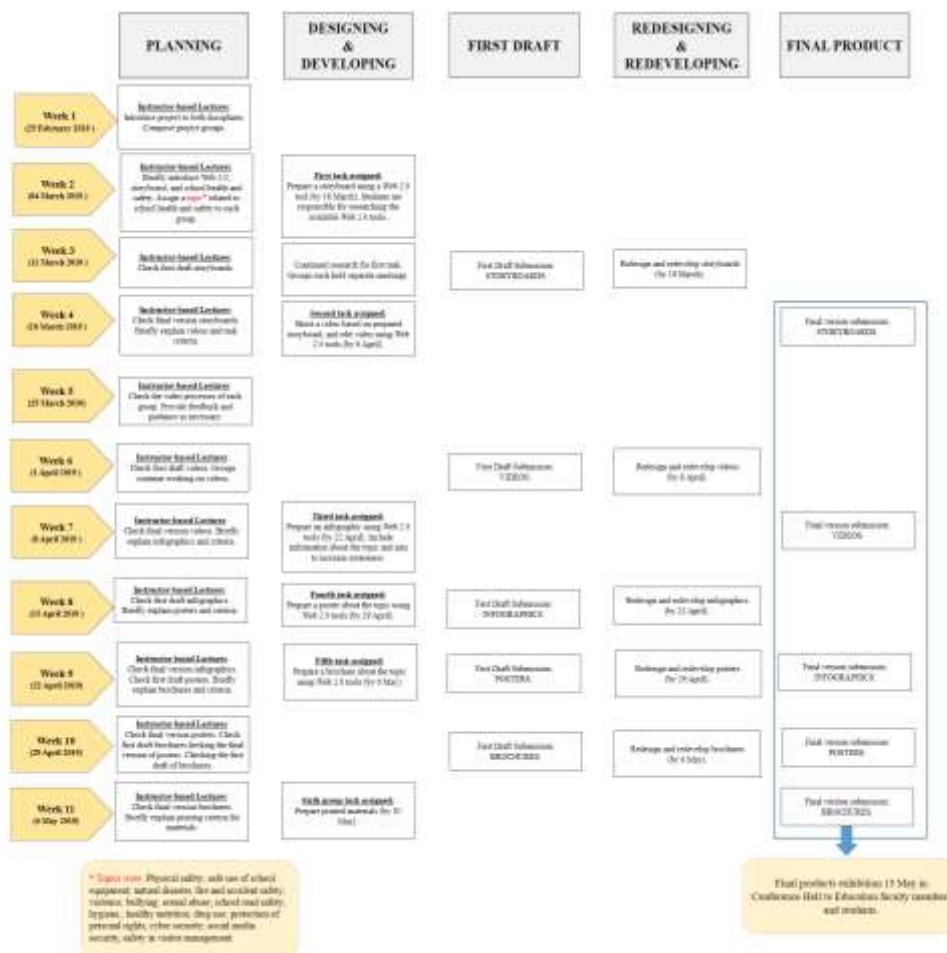


Figure 1. Procedure of the Study

Method

Research design

Based on the purpose and nature of the current study, a parallel mixed-method research design was employed. In a parallel mixed-method research, both qualitative and quantitative data are used to approximately the same degree and time based on the systematic structure of the study. The main objective is to employ qualitative and quantitative data gathering without focusing on any particular sequence or stage (Creswell, 2008).

According to the purpose and nature of the current study, the following research questions were derived:

1. What were the experiences of the participant preservice teachers during CPBL?
2. How successful were the participant preservice teachers in terms of using Web 2.0 tools for designing materials to construct knowledge on the topic of school health

- and safety?
3. What was the effect of CPBL on the participant preservice teachers' motivation and self-regulation towards technology learning?

Participants

The participants of the current study were comprised of preservice teachers from the Classroom Teaching (CT) and Instructional Technology (IT) departments studying at a university in Turkey. A total of 64 preservice teachers developed an educational material set, working collaboratively in small groups during the 2018-2019 academic year. Quantitative data were gathered using the 'Motivation and Self-Regulation towards Technology Learning Scale' from each of the 64 participants, and also with two different rubrics used to evaluate the participant-produced materials that were completed by three independent raters (assessors). The qualitative data of the study were gathered through three focus group interviews held with a total of 18 preservice teachers, as well as from observation forms completed by the researchers.

For selection of focus group members, the researchers first evaluated the completed rubrics, which provided information about the quality of the produced materials based on the criteria of the study. As all the groups were deemed to have been successful, the researchers appealed for volunteers to participate in the interviews. A total of 18 preservice teachers volunteered, which the researchers then grouped into three focus groups, with each including preservice teachers from both departments.

Demographic information of the participants is presented in Table 2, which provides information about the general technology familiarity of the participants. More than half of the participants had prior knowledge about Web 2.0; however, they had not previously used such technology to produce knowledge prior to the study.

Table 2. Participant demographics

Gender	Female		Male				
	n	%	n	%			
	40	62	24	38			
Department	CT		IT				
	n	%	n	%			
	32	50	32	50			
Prior conceptual knowledge of Web 2.0	Yes		No				
	n	%	n	%			
	36	57	28	43			
Technological devices owned	Smart-phone	Computer	Tablet PC	Camera	Smart Watch		
	n	n	n	n	n		
	62	51	17	3	3		
Daily time spent online (hour)	1-2	3-4	5-6	7-8	8-10	11-12	
	n	n	n	n	n	n	
	17	18	13	5	4	5	
Purpose of Internet usage	Research	Shopping	News	Music	Games	Communication	Social Media
	n	n	n	n	n	n	n
	45	35	20	48	24	34	19

Data collection tools

- (1) Semi-structured interview schedules: A first version of the interview protocol was piloted and followed-up with any necessary editing. Then, the revised version was sent to two experts who were asked to check the clarity, validity and organisation of the interview protocols. The final interview protocol included questions about the general experiences and opinions of the preservice teachers in terms of their collaborative learning, Web 2.0 technologies, as well as the content and process of the project.
- (2) Observation forms: The study involved prolonged observation of the participants. Holistic description of events was undertaken by three researchers. During the face-to-face lectures, the researchers completed the observation forms. Field notes were also taken based on the collaborative learning exercises.
- (3) Rubrics. Two rubric forms were developed by the researchers in order to evaluate the participant-produced materials. Whilst the first rubric was developed to evaluate the infographics, posters and brochures, a second rubric was developed to evaluate the videos. The reason for using two separate rubric forms was the marked difference in criteria for the videos. Prior to developing the rubrics, an extensive literature review was conducted in order to assess information related to the topics of study. The developed rubric forms were sent to four experts and then finalised based in accordance with their suggestions in order to ensure the forms' construct and content validity.
- (4) Motivation and Self-Regulation towards Technology Learning Scale (MS-R). The scale, developed by Sekerci (2017), includes 37 items related to technology learning self-efficacy, technology learning value, technology active learning strategies, technology learning self-regulation implementation, technology learning goal-orientation, technology learning self-regulation triggering, and technology learning self-regulation implementation factors (Sekerci, 2017). The item-total correlation values of the scale for each item varied between .46 and .64. As a result of Confirmatory Factor Analysis (CFA), the value determined that the obtained goodness of fit index had compliance at a sufficient level (GFI = .90, AGFI = .83, SRMR = .051, RMR = .070, RMSEA = .050).

Data analysis

The collected data were analysed using both qualitative and quantitative data analysis techniques. Content analysis was performed for the qualitative data in order to define the patterns most frequently used, whilst the quantitative data was analysed with the MS-R scale (Sekerci, 2017) and with paired sampled *t*-tests. For the categorisation of the qualitative data, a seven-stage model of learning group development (Johnson & Johnson, 1997) was used. Thus, the content analysis of the data was based on a strong theoretical framework. Besides, three of the researchers performed the frequency analysis and their inter-rate reliability was assessed to be .83, which is above .70 and therefore deemed 'sufficient' according to Miles and Huberman (1994), and the most common frequencies were accepted.

Rubrics were presented descriptively. Three different raters evaluated the participant-produced materials after they were exhibited to the faculty. Including values for three different raters assured the validity of the scores. The evaluations were performed at independent times and places. The correlation factors of the raters values show that the raters evaluated the participant-produced materials with high scores (three raters correlation: video: .89-.91 / infographic: .95-.99 / poster: .88-.91 / brochure: .94-.99).

Results

Participants' experiences during CPBL

Interviews and observation forms were categorised systematically based on Johnson and Johnson's (1997) seven-stage model of learning group development. The findings are depicted in Table 3 along with the frequency of mention.

Table 3. Participants' experiences towards CPBL

	(¹)	(²)	(³)	(⁴)	(⁵)	(⁶)	(⁷)	Total
	<i>f</i>							
Group ₁	1	2	2	2	2	5	2	16
Group ₂	3	2	2	3	3	5	4	22
Group ₃	2	2	2	3	-	2	4	15
Total	6	6	6	8	5	12	10	53

(¹) Defining and structuring procedures and becoming oriented; (²) Conforming to procedures and getting acquainted; (³) Recognising mutuality and building trust; (⁴) Rebellious and differentiating; (⁵) Committing to and taking ownership of the goals and other members; (⁶) Functioning maturely and productively; (⁷) Terminating.

(¹) This stage is concerned with informing the study's participants in terms of the rules and procedures of the study. After attending the first meeting, the participants expressed having felt anxious about the requirements and the process of the project, especially those who were not previously aware of Web 2.0 functionality. They felt that they would not be able to develop the materials due to an inherent fear of technology and their lack of knowledge. Also, they stressed that the requirements were perceived as being above their level, and that learning about these requirements at the first meeting caused them to feel overwhelmed.

(²) In this stage, the group members established basic communication between themselves and decided the details pertinent to the processes of the project. For this purpose, the groups started to conduct their own group meetings. At this stage, the participants gained more positive experiences related to CPBL due to their level of communication and discourse, and subsequently changed their opinions about the concerns they had raised in the first stage. They pointed out that they understood they had been mistaken in their prejudice towards the rules and for feeling overwhelmed. During the group meetings, while sharing their experiences with other group members who each had diverse backgrounds, they felt a sense of belonging to the group and believed that they should work to finish the required tasks. This change was reportedly because, during their group meetings they came to realise that they could discuss anything about the project, and thereby the group collaboration increased their basic knowledge in terms of school health and safety and also of Web 2.0. In general, the results of this stage presented the preservice teachers' perceptions toward Web 2.0, and thus toward CPBL as being more positive, as can be seen in the following quote:

Six people, six brains, and six different opinions. We have started to think of many points that we could not think of before. Our friends from IT enlightened us about the technological side of the project and we contributed to helping them theoretically and aesthetically [implying the design issues]. [Group 3]

(³) This stage is about forming the group dynamics as they progressed through the activities with which they were tasked. All of the participants were satisfied with CPBL as they progressed. As each group started to get to know each other better, they figured out that they could achieve all of the assigned tasks on time by actively taking responsibility. The participant preservice teachers realised each other's potential in addition to their own potential, and that their effective collaboration ensured a positive group atmosphere. Group

confidence was increased as a result, and group members saw the project as their common responsibility, as demonstrated in the following quote:

During the process, our eagerness for actively joining in increased. We realised that we were achieving the tasks, and we felt increased responsibility to the group members and also to our instructors. Interactivity was very good during our group meetings, which increased our awareness about toward the content. [Group 3]

(4) This stage is about having disagreements while completing activities. This is actually an expected situation, and which is useful for achieving the best results during activities. The most striking comment for this stage was with regards to the contribution of CPBL to the group's productivity, and the problem-solving and critical-thinking skills of the group members. Considering the premise of productivity depends on the existence of different ideas, it reveals that different ideas were transformed into a common goal during the study. When problems were encountered, the group members were able to negotiate whilst continuing their studies. This finding is significantly critical considering the purpose of the study, and which helped the preservice teachers move one step ahead in their professional development as preservice teachers. As they emphasised, trying to produce different kinds of material and focusing on the visual design principles enhanced their problem-solving and critical-thinking skills. This was because they were not only required to design, but also that they had to design based on certain principles which triggered their attention to focus more and to think critically.

(5) This stage refers to the determination of individual study-based activities within the group, checking that they were achieved in a timely manner and then converted into a group product. The participants expressed their positive experiences regarding being able to meet the requirements of the project within a trust-based environment. This finding can be associated with the step-by-step nature of CPBL, the structured activities that the participants were tasked with, and the ease of use of Web 2.0 tools. By progressing in a step-by-step manner with the assigned structured activities and by receiving regular feedback from the instructors, the participants were afforded the opportunity to realise their potential. Since the preservice teachers discovered what they could achieve what was required of them, they gained both in self-confidence and in group-confidence. The participant preservice teachers believed that they were now able to utilise Web 2.0 tools for the designing of materials, and achievement which can later be reflected throughout their professional career. In addition, the structured activities required a step-by-step approach, which ensured the participants' systematic engagement in group meetings. As expected, achieving one task and then moving on to the next increased the participants' commitment to CPBL. The inevitable result of such positive experiences, especially increased confidence, ensured the success of the preservice teachers, as demonstrated in the following quote:

Throughout the study a responsibility awareness occurred. We already have to communicate effectively in accordance with our profession, and we were also able to gain the skills of this particular type of communication too. Since we were grouped as two different disciplines, it pushed us to maintain our responsibility awareness. [Group 2]

(6) This stage is about expressing opinions about the products and effectively finalising the products when approaching the end of the project. The participants emphasised that CPBL ensures hands-on practice while constructing knowledge. The structure of the assigned tasks ensured the active participation of each group member. Since each group member took an active role during the hands-on practices, they were able to take value of each other's opinion, and became aware of each other's contribution. As a result, the participants indicated that the collaborative form of working improved their democratic attitude as participants.

(7) At this final stage, the products are expected to be shared with different stakeholders. The participants' overall experiences were gathered after the materials had been exhibited in the university's conference hall, where they were viewed by other students from the Education Faculty as well as the faculty teaching staff. The preservice teachers favoured CPBL in terms of its impact on increasing self-regulated learning, and improving both their problem-solving and critical-thinking skills. All of the participant preservice teachers held positive perceptions and experiences towards Web 2.0's role in improving their collective group knowledge construction in the area of school health and safety. By collaborating as two different disciplines, the preservice teachers encountered peer learning that led to effective learning practices. The most emphasised effective learning practice was the participants' ability to increase self-regulated learning. This was attributed to feelings of commitment towards the group, and that they were able to maintain control over their responsibilities in the pursuit of long-term goals. The participants stated that collaborating with others from diverse backgrounds ensured that they remained productive throughout the process, and that the different fields of expertise increased the overall effectiveness of the products and the positive experiences realised by the preservice teachers. Moreover, the participants emphasised that CPBL increased their problem-solving skills since the tasks were process driven. In essence, the participants indicated that their awareness of global school health and safety issues increased with the help of technology.

Evaluation of student-produced materials

The range of mean scores of the products were found to be approximately 15 points ($\bar{x}_2 - \bar{x}_1 = 95.9 - 71.4 = 15.5$). The group with the lowest scores was determined as the second group, whilst the highest was the 10th group. When the mean scores of the groups were examined, the most successful product was determined to be a poster, yet the scores for the infographic and brochure products were also close to the scores of the poster. All groups were found to be successful in achieving the assigned objectives based on the set criteria. The success criteria of the current study was to produce materials of an acceptable level, or higher, based on the rubric evaluation which requires a minimum of 50 points being scored. Table 4 presents the mean scores for each of the groups' products.

Table 4. Mean scores for group products

		Video	Infographics	Poster	Brochure	Total
Group no	School Health & Safety Issues	\bar{x}	\bar{x}	\bar{x}	\bar{x}	\bar{x}
Group 1	Physical safety	76.7	75.3	75.7	70.7	74.6
Group 2	Safe use of school equipment	66.0	70.7	75.7	73.3	71.4
Group 3	Natural disaster, fire & accident	80.7	84.7	91.3	85.3	85.5
Group 4	Violence	97.0	80.7	87.0	83.3	87.0
Group 5	Bullying	84.0	90.7	92.0	93.3	90.0
Group 6	Sexual abuse	84.7	83.3	83.3	80.0	82.8
Group 7	School road safety	75.0	74.7	77.3	74.7	75.4
Group 8	Healthy nutrition	81.7	82.7	83.3	81.3	82.3
Group 9	Hygiene	85.3	94.0	95.7	94.0	92.3
Group 10	Drug use	93.3	96.7	97.0	96.7	95.9
Group 11	Protection of personal rights	85.3	85.3	86.7	85.3	85.7
Group 12	Cyber security	80.7	85.3	88.7	85.3	85
Group 13	Social media security	90.7	92	95.3	94.7	93.2
Group 14	Safety in visitor management	80.7	86.7	91.3	85.3	86.0

Effect of CPBL on motivation and self-regulation towards technology learning

There was a significant difference seen between the pre-test and post-test mean scores obtained from the MS-R scale administered to the CT and IT preservice teachers [$t(2: 5,677) = 31$; $t(2: -9,717) = 29$, $p < .05$]. Examination of the range of mean scores indicated that the maximum difference was between the MS-R scale scores of the IT preservice teachers ($\bar{x}_2 - \bar{x}_1 = 1.15$), while the minimum difference was between the CT preservice teachers ($\bar{x}_2 - \bar{x}_1 = 0.79$). Table 5 presents the pre-test and post-test scores of the two disciplines.

Table 5. Comparison of group pre-test and post-test scores

Department	Scale		n	\bar{x}	SS	SD	t	p
CT	MS-R	Pre-test	32	3.01	.573	31	-5.677	.000
		Post-test	32	3.80	.434			
IT	MS-R	Pre-test	30	3.04	.436	29	-9.717	.000
		Post-test	30	4.19	.499			

MS-R: motivation and self-regulation

There was a significant difference found between the mean pre-test and post-test scores obtained from the MS-R scale's factor measurements following the scale having been administered to the CT and IT preservice teachers. The examination of the range between the mean scores showed that the most significant difference was between the Technology learning self-efficacy factor scale scores of the CT ($\bar{x}_2 - \bar{x}_1 = 0.86$) and IT ($\bar{x}_2 - \bar{x}_1 = 1.10$) preservice teachers. Table 6 presents the pre-test and post-test score comparison of the Group Motivation and Self-regulation factors.

Table 6. Pre-test and post-test score comparison of Group Motivation and Self-regulation factors

Factors of MS-R	Dept.		CT					IT							
	Test	n	\bar{x}	SS	SD	t	p	n	\bar{x}	SS	SD	t	p		
Technology learning self-efficacy	Pre-test	32	2.82	.425	31	-	5.699	.000	30	3.16	.418	29	-	8.338	.000
	Post-test	32	3.68	.672					30	4.26	.623				
Technology learning value	Pre-test	32	3.25	.599	31	-	4.857	.000	30	3.43	.409	29	-	9.336	.000
	Post-test	32	4.07	.600					30	4.47	.534				
Technology active learning strategies	Pre-test	32	3.20	.557	31	-	-4.271	.000	30	3.31	.346	29	-	5.876	.000
	Post-test	32	3.85	.571					30	4.05	.613				
Technology learning self-regulation implementing	Pre-test	32	2.93	.531	31	-	-5.632	.000	30	3.34	.476	29	-	-4.577	.000
	Post-test	32	3.78	.465					30	4.00	.621				
Technology learning goal-orientation	Pre-test	32	3.09	.617	31	-	-3.913	.000	30	3.19	.373	29	-	-9.319	.000
	Post-test	32	3.79	.618					30	4.28	.573				
Technology learning self-	Pre-test	32	3.21	.573	31	-	4.504	.000	30	3.35	.442	29	-	8.097	.000
	Post-test	32	3.79	.618					30	4.28	.573				

Factors of MS-R	Dept.	CT						IT					
	Test	n	\bar{X}	SS	SD	t	p	n	\bar{X}	SS	SD	t	p
regulation triggering	Post-test	32	4.01	.754				30	4.41	.584			
	Pre-test	32	2.97	.561				30	3.05	.426			
Technology learning self-regulation implementing	Post-test	32	3.44	.626	31	-2.877	.007	30	3.87	.728	29	-5.230	.000
	Pre-test	32	2.97	.561				30	3.05	.426			

Discussion

The current CPBL study was concerned with the study participants’ design and development of an educational material set in order to facilitate knowledge construction. The findings of the study were found to support previously published research in terms of the benefits of CPBL and Web 2.0 in creating effective learning practices.

The primary finding of value from the current study was the construction of new knowledge – using Web 2.0 for designing materials in school health and safety– that was derived from the participant preservice teachers’ own investigations and exploration. One critical point to note is that, at the beginning of the study, the participants felt overwhelmed due to the anticipated workload required of them for completion of the study. However, as the participants indicated, they later acknowledged having had a positive experience since being able to produce materials and construct meaning within a group learning setting. In general, from the preservice teachers’ experiences of knowledge construction, it could be seen that they appeared to enjoy using Web 2.0 as a result of their collaborative teamwork.

The principle reason for the positive change of direction was attributed to the promising finding of the study, which was that the preservice teachers were able to establish a good level of communication and discourse between them, which resulted in an effective learning environment. As pointed out by prior research, good communication skills plays a critical role in-group learning (Donnelly & Fitzmaurice, 2005; Livingstone & Lynch, 2000), which can be ameliorated with collaborative learning (McConnell, 2005). This issue corroborates the arguments of Baser, Ozden, and Karaaslan (2017), who conducted an interdisciplinary CPBL study and found that CPBL led the students to communicate effectively and finish the tasks on time. From time to time, the participants had disagreements during the study; however, they counterbalanced each other’s arguments with the exchange of ideas and views. The participant preservice teachers were able turn this negativity into a positive situation by developing a democratic attitude, which is considered critical for the participants as it is important for them to understand the consequences of their actions. This is also in line with the study of Jacobowitz and Sudol (2010), collaborative learning can be used as a strategy in order to improve democratic attitude and behaviours. In addition, as an expected outcome of good communication and discourse, the participants were able to conduct effective time management (Donnelly & Fitzmaurice, 2005). The aforementioned issues are the essence of the professional career for candidate teachers, since they are also key elements to become better employees (Witney & Smallbone, 2011).

As the participants progressed, they had more positive experiences as their skills improved in problem solving and critical thinking. Throughout the current study, the preservice teachers were active participants in the learning process, as they were required to design materials according to visual design principles. By discussing how to go about creating effective materials, the participants were able to increase their problem-solving and critical-thinking

skills. This finding corroborates the arguments of Bell (2010) and Neo (2003), who indicated that collaborative learning environments inculcates problem-solving and critical-thinking skills.

The other reason that affected the preservice teachers' positive thinking was related to the step-by-step approach and structure of the project, which helped to ensure success among the preservice teachers. In the current study, the researchers structured the CPBL systematically, from the planning stage right through to the final product evaluations. After completing each task, the participants were provided with feedback from the instructors. Also, accomplishing a task and gathering feedback ensured that the participants experienced a level of acknowledged success. As supported by the literature, structured activities can result in higher levels of knowledge construction (Murphy, 2004; Kanuka et al., 2007).

The findings revealed that most of the preservice teachers recognised and valued the benefits of using Web 2.0 tools, a finding supported by previous research concerning the pedagogical rationale (Alsmari, 2019; Lim & Newby, 2021; McLoughlin & Lee, 2010; Newland & Byles, 2014). In actively constructing knowledge through Web 2.0, the participant preservice teachers gained a deeper understanding of both Web 2.0 tools and the assigned topic of school health and safety. Similarly, Alsmari (2019) found that integrating Web 2.0 into the writing class was found to be highly beneficial in developing foreign language learners' writing abilities. Different from other studies in the literature, the current study ensured the usage of a wide variety of Web 2.0 tools.

In the current study, the preservice teachers received high-level scores based on the rubric evaluations of the materials they had designed. The materials were considered as meeting the requirements of the study, which supported the qualitative findings of the study as the preservice teachers were able to progress successfully.

Firstly, the participants conducted the study within a framework of legal legislation in order to create content related to their own specific subject areas. Despite the existence of legislation, there have been notable information and perception deficiencies in its implementation (Çalık et al., 2018; Hernandez et al., 2010). For this reason, integrating appropriate content into the materials design and construction was an important area of critique, which was successfully achieved by the preservice teachers. The findings here support that integrating CPBL into teacher training programmes might pave the way for improved collaborative working during candidate teachers' subsequent professional careers at the individual, institutional, and societal level in terms of health and safety awareness (Chiang et al., 2015; Eklund et al., 2018; Lewallen et al., 2015; Twemlow et al., 2002). As suggested by Donnelly and Fitzmaurice (2005), CPBL should be used with real-world problems in order to combine knowledge and skills, which was successfully accomplished in the current study.

Secondly, the study's participants were required to learn about the relevant Web 2.0 tools in designing their educational materials. Thus, the effect of CPBL on motivation and self-regulation towards technology learning was investigated quantitatively, and the findings showed this to be an effective strategy. As argued by Liou and Kuo (2014), students who do not increase motivation and foster self-regulation to technology will also demonstrate less interest in other fields. Considering the purpose of the current study, which aimed to increase participants' knowledge in school health and safety through technology learning, it was deemed critical to increase the participants motivation and self-regulation in technology learning. Thus, the participants were able to reflect their positive outcomes with technology learning according to the knowledge construction of school health and safety. This also supports other studies in the literature that suggested high levels of motivation and self-

regulation reveals learning performance (Liou & Kuo, 2014; Velayutham et al., 2012). As mentioned by Järvelä and Järvenoja (2011), students can improve in motivation and self-regulated learning within collaborative learning groups, and through the expenditure of consistent efforts to regulate their commitment to learning.

Implications and Conclusion

The findings of the study support previous research in terms of the benefits of using CPBL as a strategy and Web 2.0 tools to mediate learning. Especially, it can be concluded that CPBL is an appropriate choice for studies aiming to increase awareness and knowledge within a certain context. Preparing an educational material set by utilising a variety of Web 2.0 tools based on predetermined criteria with CPBL strategy may enable participants to enhance their problem-solving and critical-thinking skills. Additionally, CPBL was also found to be effective in increasing the participants' motivation and self-regulation towards technology learning. Thus, CPBL has certain affordances for learning a new subject, and also for increasing both motivation and self-regulation.

The promising results of the current study related to a well-designed CPBL, which featured a systematic structure with step-by-step activities. By including relative context and technology in CPBL, the researchers were able to successfully progress learning, which produced promising results in this instance for the participant preservice teachers. Due to the significant importance of school health and safety for preservice teachers, both for their academic and future professional life, integrating strategies such as CPBL into teacher training programmes may lead to more effective academic gains.

In order to meet the requirements of the digital age, today's teachers must possess basic technological knowledge and be digitally literate. In some cases, they should be able to create digital content for their own context, starting from their days in teacher education through to their professional career development needs. In the current study, by requiring participants to work on different collaborative tasks using Web 2.0 technologies, it was aimed to ensure that they utilised technology in order to construct knowledge. In teacher training institutions, in order to increase the fluency of authorship of preservice teachers, Web 2.0 tools can be supported with interdisciplinary collaborative studies to ensure the integration of technology with pedagogy and field knowledge. It may therefore be suggested that instructional technology faculty members support and direct the use of Web 2.0 tools in teacher education programmes. Including collaborative tasks with structured activities in different contexts may thereby ensure the effective usage of Web 2.0 tools. Courses that allow for the development of skills can be added to training programmes for preservice teachers. Awareness can therefore be provided to preservice teachers through the provision of support to instructors in utilising different Web 2.0 tools in their lessons.

One limitation of the current study was the inherent dependency on Internet availability and connectivity. As the participants did not all have the opportunity to connect to the Internet from their homes or student dormitories due to the technical infrastructural limitations, students held face-to-face collaborative working group meetings. Thus, Web 2.0 tools were used as the mediator for knowledge construction, rather than for the collaborative tasks themselves. However, the natural features of Web 2.0 includes the potential to conduct collaborative tasks using both mobile devices (i.e., smartphones or tablet computers) rather than desktop computers at a fixed location. From this perspective, both computers and mobile devices are suggested to be used to support the collaborative tasks to be implemented in the teaching of school health and safety as a topic of study.

The other limitation of the study relates to the language of Web 2.0 tools. Since most of those tools are available only in English and without a Turkish language option, some of the participants experienced difficulties understanding the interface of the programs.

Lastly, it is suggested to conduct a similar study to include the collaboration of students, teachers and policymakers from different universities and institutions. Such a comprehensive study could include utilising a portal for the collaborative products. Thus, it would be possible to more effectively increase the widespread impact of the study.

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Conflicts of interest

The authors declare that they have no conflict of interest.

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