



Blended Learning Opportunities in Ukrainian IT Public Education

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Received: 22.07.2017; Accepted: 29.08.2017

Abstract: *Based on previous surveys the usage of ICT and blended learning is at a low level in Ukraine. To catch up with the European average, it is important to familiarize the students and teachers with blended learning in the secondary school. The information technology classes provide the best opportunity to introduce the blended learning, because they are well equipped with computing devices. This choice is positively affected by the new Ukrainian IT curriculum. The aim of this paper is to introduce the available options for blended learning in Ukrainian secondary IT education. By examining the curriculum, the possibilities of using the online space in the educational process has been determined. The blended learning methodology has been tried in practice as well.*

Keywords: blended learning, Ukrainian, secondary education, IT education

Introduction

Entering the information society of the 21st century, education has changed radically. Online education opportunities have emerged; firstly in corporate trainings then higher education as well. So at first the older generations were familiarized with the educational innovations. However, it is obviously more efficient if the digital education opportunities are introduced to the younger (z generations, who are already susceptible to computing innovations) generations earlier. Thus they would use it confidently in labor market and in higher education.

Secondary education is one of the best environments for pupils to get to know new teaching techniques. Ukrainian students learn the basic skills required to use the electronic education system in the 5th or 6th grades of secondary school. The next chapters deal with the various existing opportunities to use e-learning in the Ukrainian IT education.

Blended learning in secondary education

Pure e-learning it is rarely effective in corporate training or higher education, not to mention public education. In designing an appropriate learning environment, the student community and personal interaction in a teacher <-> student and student <-> student channels is important. Learning requires an orderly and cooperative environment in formal and informal education (Jennings & Greenberg, 2009). Neither the pure offline nor the online learning methods are completely appropriate, it is necessary to integrate the modern and traditional tools into education. In the following section the possibilities of flipped classroom model will be discussed. Benefits and barriers of flipped classroom are the next:

- ❖ More time for student-teacher dialogue
- ❖ It supports the differentiated teaching form
- ❖ Students could control the learning intensity, location and time (Szimkovics & Bujdosó, 2016)
- ❖ Motivating for students, because they like to use computing devices
- ❖ Barriers:
- ❖ The method presumes that students are equally have access to internet and computing devices at home
- ❖ Some students may have difficulties in learning from screen
- ❖ Synchronous communication is not available between teacher and student in the online space
- ❖ It requires additional work to develop the curriculum and support the students in the digital space

Ukrainian e-learning status

The secondary education blended learning is rather underdeveloped in Ukraine compared to the European average (Barbour et al., 2011). In the "International Association for K-12 Online Learning" survey, the quality of K-12 online learning was assessed in more than 60 countries. According to the report the situation in Ukraine is the following: distance learning backwardness in primary and secondary public schools, computing infrastructure is out dated for online education. The above mentioned research was based on the 2006 data collection. Since then progress has been made towards e-learning. E-learning systems (Moodle, Tutor) first spread in higher education. The Massive Open Online Courses (MOOC) have also appeared in higher education (Андрєєв et al., 2013). However, secondary public schools are still far from catching up, progress has been made for digital education:

- ✓ The partial digitization of educational administration;
- ✓ The Ministry of Education introduced the subject of Informatics in 2-4 grades of primary school and increased the number of lessons in secondary schools;
- ✓ Designing a web page has been made compulsory for all (to design the web page free domain and hosting services were provided);
- ✓ System administrator position appeared in secondary public schools.

Further required steps:

- ✓ Update hardware and software tools in the educational institutions;
- ✓ Internet accessibility and speed improvement;
- ✓ Upgrade the teachers' ICT knowledge
- ✓ Increase the number and quality of digital teaching materials.

According to our experience, blended learning projects can be started under these circumstances as well. In our pilot project we used blended learning only at the IT lessons, because at the IT classes the computing devices are given and the ICT skills of the teachers are at an appropriate level. In addition, the new IT curriculum also provides a great opportunity for e-learning in IT education. The next chapter will introduce the various opportunities to use blended learning in the different topics of the curriculum.

In Ukraine the secondary school IT education is based on three curriculums. The IT education of 10-11 graders is based on the 2004 curriculum. For 5-9 grades curriculum was created in 2010. The latest (update in 2016) curriculums are made for 2-4 graders¹. The following table (Table 1) describes informatics topics for 5-9 grades.

Table 1. Informatics topics for 5-9 grades in Ukrainian public education

Topics	Number of lessons per class					
	5. class	6. class	7. class	8. class	9. class	
Information and messages, information processes	4				2	
Basic operation with computer	10					
Computer graphics	9				6	
Editing presentation	9				6	
Algorithms and Programming		7	9	28		
Basic concepts of Operating System		6				
Multimedia		4		6		
Word processing		8		6		
Computer networks		8			4	
Electronic mailing			4			
Data modelling			3		6	
Spreadsheet			8	10	10	
Solve complex problems			4	5	7	
Project work			4	4	8	
Coding data				3		
Computers hardware				5		
Digital information security					4	
Digital publishing					5	
Online information environment design					8	
Repetition	3	2	3	3	4	
	35	35	35	70	70	Σ
	One lesson per week			Two lessons per week		

¹ In our article we examined the basic curricula not that are with made for specialized IT schools. The Ukrainian Ministry of Education website <http://mon.gov.ua/activity/education/zagalna-serednya/navchalni-programy.html>, both types can be found.

Table 2. Informatics topics for 10-11 grades in Ukraine

<i>Topics</i>	<i>Number of lessons per class</i>		
	10. class	11. class	
Algorithms and Programming		5	
Information Technologies in Education	4		
Word processing	8		
Editing presentation	6		
Spreadsheet		11	
Database management		9	
Digital publishing	6		
Internet services	7		
Network communication		8	
Repetition	4	2	
	<i>35</i>	<i>35</i>	Σ

The tables above include the topics which are taught to students. Examining the tables, it can be considered that for which topics and classes blended learning can be applied.

First of all, it is difficult to find appropriate age groups for who blended learning can be used effectively, for example: it cannot be expected from 7-8 years old children to connect to an e-learning interface from home. So the question is: Which are those basic attitudes that are inevitable for the flipped classroom model from the perspective of students? A part of contents and instructions are delivered online to the teacher-student or student-student synchronous and asynchronous information channels. For this, students need the following knowledge:

- Operation with files and folders on computer and online space;
- Using browser;
- Internet communications;
- Using e-learning system.

It can be seen that the fifth formers familiarized with the necessary basic knowledge, except from the “Using e-learning system” topics. Missing knowledge can be easily compensated, so the online space is used from sixth grade. Let’s review each of the IT topics and find out their blended learning solutions.

Review the 6-11 grades topics

Pupils learn the algorithms and programming topics for the first time, in the sixth grade. Algorithms and programming. To acquire the practical part of the topic the curriculum recommends the Scratch software. Scratch is suitable for working at home because it is available online as well (see Figure 1). Created games and animations can be easily shared either in a link or file form. If we want to compete the students they can register the code.org site, where they are able to solve visual blocks programming tasks similar to Scratch (see Figure 2). The code.org website gives game like

experience (gamification) where students may level up and complete with each other.

Figure 1. The Scratch programming community website

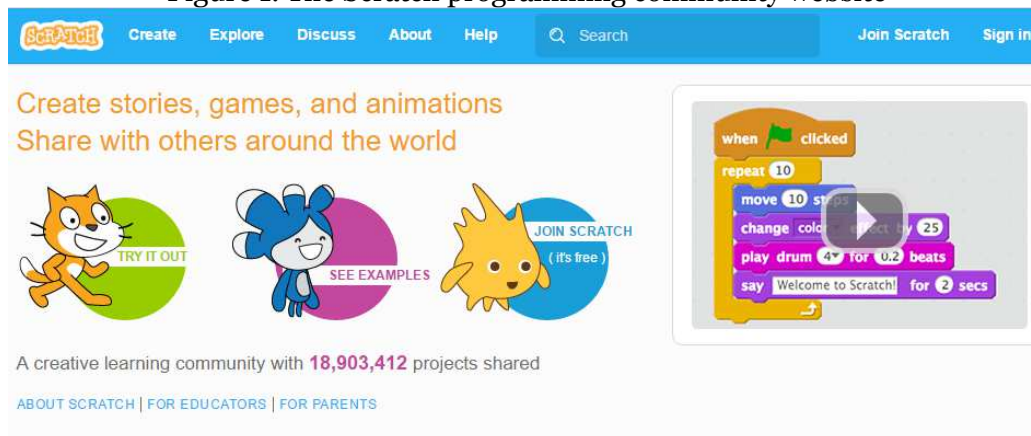


Figure 2. The code org website:
Teacher interface where the results of students can be found

Név	Előmenetel	Szint 2: A labirintus	Szint 5: A művész	Szint 7: A művész 2	Szint 9: A Farmer	Szint 11: A művész 3	Szint 13: A Farmer 1	Szint 15: A	Szint 17: A	Szint 19: A
Zsanett	9	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████
Viki	14	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████
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Norbert		██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████
Marika	4	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████
Szinti		██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████
Sanyi	16	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████
Dániel(T)		██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████
Dániel(K)	5	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████	██████████

The second topic is the basic concepts of Operating System. It also includes the repetition of the file operations. For students we can show how to create their own folder structure to use cloud service (or within the e-learning system).

Only four lessons are given for multimedia topics. Thus, only the use of image viewer and editor programs belongs to this topic. But if we use the plus e-learning lessons it can taught, how to use video and music player and cutting programs. Students can be gathered in small groups where they can create simple animations and movies. The finished works can be published online in a single gallery.

Word processing. The office software has always been a major part of the IT curriculum. Documents The cooperative editing of documents is a new opportunity, which is recommended to introduce in an e-learning form (Johnson & Renner, 2012). Obviously, it can be used not only in the cooperative editing, but in other office programs too (spreadsheet,

presentation). For example, within Google Docs. It is a great tool for planning projects, brainstorming and to support group work.

Examining the topics of seventh grade suitable themes for blended learning also can be found. Students are beginning the seventh class with topics of electronic mailing. This is the best time to introduce to the students, how to use synchronous and asynchronous communications in an e-learning system.

The second theme of the seventh class is the data modeling, where the mind map editors can be used. Mind map creating² and finding the necessary graphical and textual information can also be e-learning tasks, which the teacher can oversee online. Topics in the 6-7 grades are repeated in eighth grade only more fully. The last two topics (Project work, Solve complex problems) can be found in 7-9th classes.

It's a didactic task to teach correctly the above two topics in F2F form, not to mention the e-learning. The topics mentioned above are important, because users need to know how to manage more software to complete a task, also in real life this is practice. Study project work topics are connected to the complex tasks, because to create the project it is necessary to use more software. For example, a preparation of a presentation that contains its own data and results:

- Creating the project plan - mind map editor;
- To create elements of media shown in the presentation - hardware use;
- The formatting and editing of the media files - media editing and processing programs;
- Representation of the research results and data - spreadsheet programs;
- Presentation of the project - presentation editor software.

It's a difficult task to find some interesting research project or work aim, in which all members of the group would participate actively. However, if it is realized, several important skills can be developed during the project work, such as: data modeling, problem solving, communication, teamwork, cooperation, creativity, information search and filtering skills. For students it is worth to introduce the latest topics of ninth grade. These are the following:

- Digital information security;
- Digital publishing;
- Online information environment design.

In the blended learning education, it is needed to develop the student's own information space (reliable sources of information, web pages saving in bookmark, documents saving in cloud storage, find high-quality forums and professional blogs, etc.). Usually the solutions of IT tasks would be manifested in an intellectual product. Therefore, it is important for the students to correct and publish these intellectual products appropriately. During the usage of secondary sources, it is essential to take into consideration their copyrights.

² On the mindmup.com site can create mind maps and share; the service is free to use with some limitations.

In the 10th grade the first theme is the "Information technologies in education". The 10th grade is the last but one grade in Ukraine. For students, it might be important that besides school e-learning system, they would be able to locate other e-learning sources, which would help in their own professional development. The sources of online education include different online courses, open courses (MOOC), which are popular in the Ukrainian higher education (Андрєєв et al., 2013). Other topics (office software, digital publishing, Internet services) of 10th grade has already been discussed above.

The first IT topic in the 11th grade is the "Algorithms and Programming", but only five lessons are given to acquire this topic, which is enough just for the basic concepts.

E-learning system can be applied in practical exercises. For students³ the necessary programming environment is available online. Suggesting the appropriate MOOC courses might mean a great help for students. The other themes (office software, network communication) have been discussed in the 6-9 grades section.

Research of blended learning solution in Ukrainian IT public education

Aims of the Research

The main aim of project is to develop the skills of online learning in community. These skills later would help students in online learning (corporate trainings, higher education or self-instruction). Moreover, the project aimed at establishing a good practice, which would promote the spread of blended learning in public education. This research tries to prove that it is possible to teach Informatics effectively with the help of blended learning in Ukrainian secondary schools. New Ukrainian curriculums support the blended learning solutions. However, there is a serious lack of good practices, especially in Hungarian schools.

Methods

The introduction of blended learning has been started with surveys. Firstly, the students' home computing equipment and internet connection quality was examined. This was necessary because the flipped classroom method requires appropriate home computing devices and Internet connection. It was also surveyed that which topics would be preferred within informatics among the students. The online space can be applied parallel with the curriculum, but there is a possibility to use informatics as an extracurricular activity (Szimkovics & Bujdosó, 2016). In survey is based on questionnaires. Hundred and fifty questionnaires have been filled out by secondary and high school students. The examinees were from

³ For example, in the <http://www.w3schools.com/> site, students get to know the web programming languages. The <http://demovpl.dis.ulpgc.es/> site, pupils may to try out 16 different programming languages in Virtual Programming Lab for Moodle system.

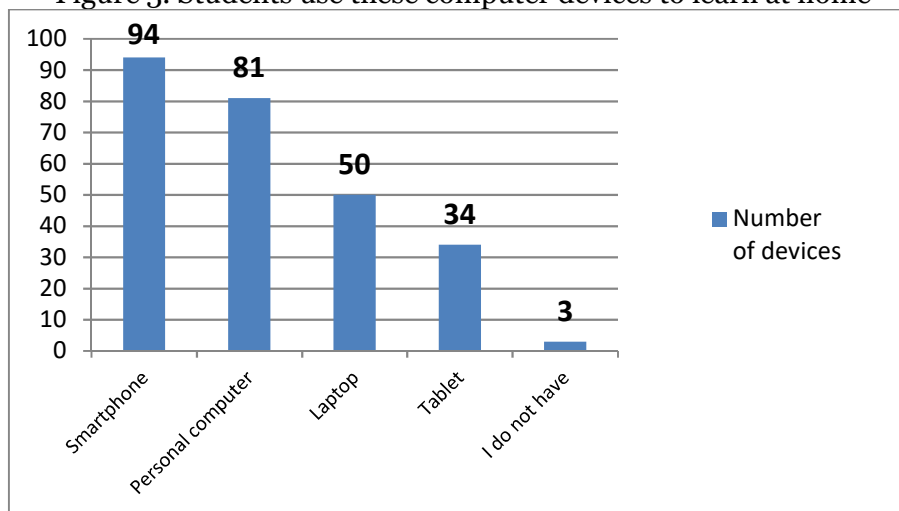
5th to 11th graders (75 female and 78 male). The students who participated in the research were selected from the following Ukrainian schools: Dayka Gábor №10 School of Uzhorod, Hungarian High School of Uzhorod, Kossuth Lajos №4 School of Beregove, II. Rákóczi Ferenc Vocational Schools of Beregove (Szimkovics & Bujdosó, 2016).

The second step was the selection of the e-learning system. The "G Suit for Education" e-learning system have been chosen, because it is free, cloud technology based and supports the necessary functions. Teacher and student accounts were created. Student and teacher groups were created. We prepared the courses were prepared and the first lessons and teaching materials were uploaded into the courses. After having read first lessons for students, the possibilities of e-learning system have been presented: communication, course registration, profile settings. Then experimental groups have been formed in following classes: 6A, 6B, 7, 8A, 8B and 11. To 6th graders, the algorithms and programming and computer networks topics have been taught, to 7-8th graders - the project work themes, to 11th graders - the web design.

Results

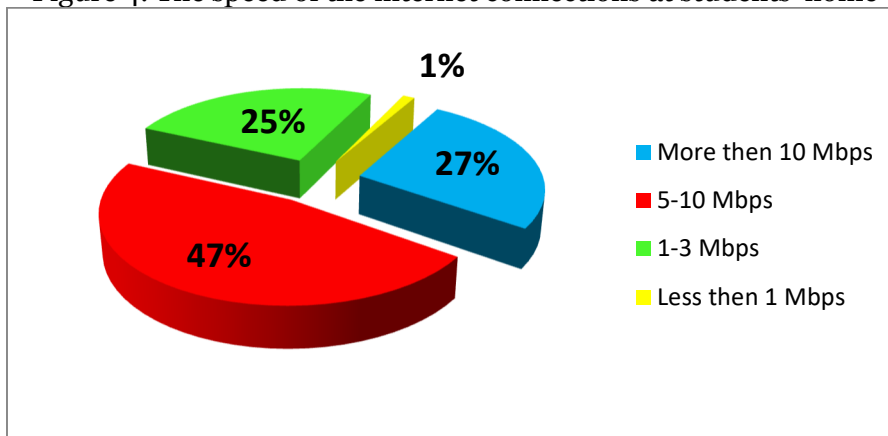
Questionnaire survey showed that the majority of students have Internet access at home. Only four students do not have internet connection at home out of one hundred and fifty. The majority of the respondents use smart phone and desktop computer for home study (Figure 3).

Figure 3. Students use these computer devices to learn at home



Most of the students (74 percent) have wireless Internet connection at home through which they can learn from mobile devices. Students require a fast internet connection in order to access the learning materials and to communicate with other students or tutors. Only one percent of the respondents have slower than 1 Mbps Internet connection (Figure 4). However, the results are influenced by the fact that the respondents are living in a city, where the internet connection is usually better.

Figure 4. The speed of the internet connections at students' home



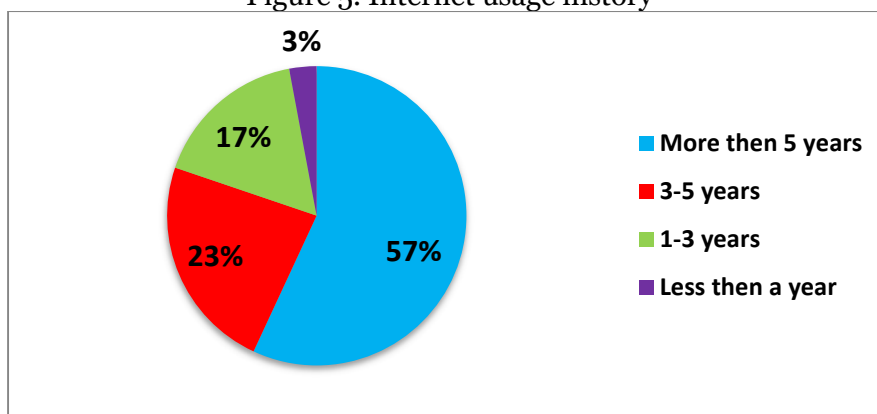
In the second part of the questionnaire the computer and internet usage habits were examined (1. Table).

Table 3. Places for internet usage by students

<i>Frequency</i> \ <i>Place</i>	<i>school</i>	<i>home</i>	<i>acquaintance</i>	<i>Internet cafe</i>	<i>mobile internet</i>
<i>Every day</i>	27 %	89 %	14 %	8 %	45 %
<i>Several times a week</i>	25 %	7 %	33 %	16 %	18 %
<i>Once a week / month</i>	25 %	3 %	32 %	29 %	11 %
<i>Never</i>	23 %	1 %	21 %	46 %	25 %

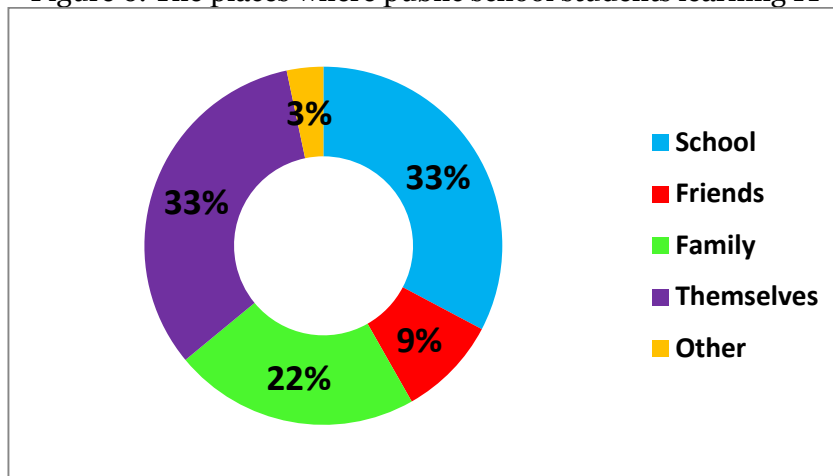
It can be seen from the table that most of the students are using the Internet at home. Forty-five percent of students use mobile Internet every day. The previously popular internet cafes are no longer attractive to students, because of the high-quality home internet connection. Most students have been using internet for more than five years (Figure 5).

Figure 5. Internet usage history



According to the students the proportion of the independent and school-based IT learning is equal (6. Figure).

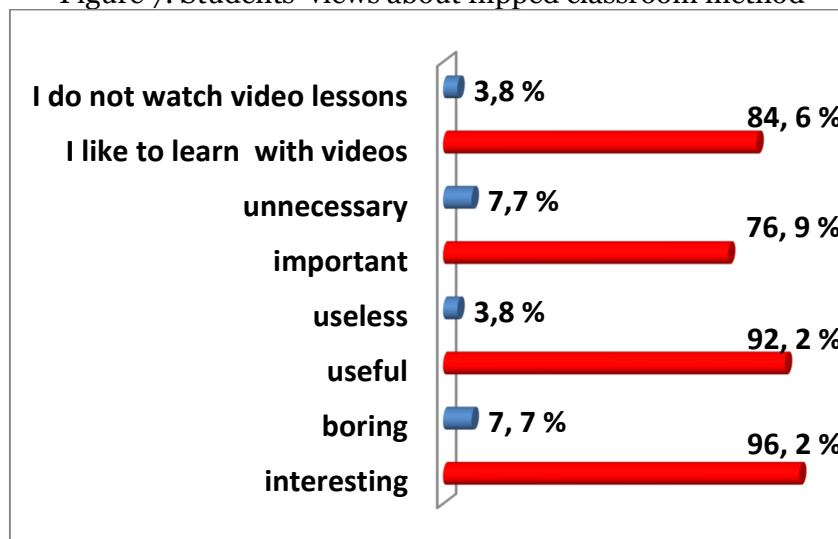
Figure 6. The places where public school students learning IT



School is not the only and main source of education of information technology. Based on the latest Organization for Economic Cooperation and Development surveys (OECD, 2015), using computer technology to study at home has a positive impact on students' mathematics and literacy. Blended learning is also helping to develop the right online learning culture.

Students were asked to characterize the flipped classroom method at the end of the school year. The graph (Figure 7) shows the results. As it can be seen the students' opinion is positive.

Figure 7. Students' views about flipped classroom method



The survey with the control and experimental groups will be continued in the following school year, because this sample is not enough for significant results.

Summary

Students' home computing equipments have been examined, which proved to be appropriate for blended learning. Analyzing the 6th to 11th grade

curricula several opportunities have been found for using blended learning. Seemingly, the new curricula (class 5-9) are more suitable for blended learning than the older ones (10-11 class).

The blended learning has been successfully introduced in a Ukrainian Secondary School. Developing an online learning habit has proven to be a problem when the project had been started. For example: students often hardly or partially watch the video lessons. This problem later has been solved. The skipping option in videos has been disabled and quiz questions have been embedded into the videos, which helped to monitor students' activity. There was also a problematic lack of proper financial background in the creation of e-learning content.

Further goal would be to extend the blended learning project for more subjects as well as more educational institutions and continue the survey with the control and experimental group in the following school year.

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