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DIGITAL RESOURCE TO STUDY MATHEMATICS AND MANAGE THE LEARNING PROCESS OF STUDENTS BY KHAN ACADEMY

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Abstract

This article shortly researches how does it work: one of the popular free online platforms called Khan Academy to study Mathematics in the perspective of methodology of teaching. Khan Academy is free online platform with video tutorials and explanations with exercise dashboard for learning subjects like Mathematics, Science and more. This digital resource provides statistics for teachers to monitor the progress of students. In this article written explanations why it is effective and how it could be implemented to Kazakhstan's schools. The method of research is observing the experiences of overseas schools by analyzing articles and additionally made a personal observation of the platform. Schools in the American continent use flipped classes with Khan Academy to learn Mathematics inside and outside of the class effectively for non-cost. This idea of flipped class for mathematics would be efficient in Kazakhstani schools for secondary school students and also for students who are preparing for taking National Common Test for entrance to university.

Keywords: e-learning, blended learning, online courses, flip class, digital media, education, pedagogy, ICT in teaching Mathematics, preparing for test.

Аңдатпа

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ХАН АКАДЕМИЯСЫ АРҚЫЛЫ МАТЕМАТИКАНЫ ОҚУҒА АРНАЛҒАН САНДЫҚ ҚОР МЕН ОҚУШЫЛАРДЫҢ ОҚУ ПРОЦЕСІН ҚАДАҒАЛАУ

Бұл мақалада танымал тегін онлайн платформалардың бірі «Хан Академия» (Khan Academy) математика пәнін оқыту әдістемесі тұрғысынан қалай жұмыс істейтіні туралы қысқаша зерттелді. «Хан Академиясы» бейне-нұсқаулықтарға, тақырыптарға арнайы жаттығулар мен соған түсініктемелерге толы математика, жаратылыстану ғылымдары және тағы да көп сабақтарға арналған тегін онлайн платформа. Бұл сандық қор мұғалімдерге оқушыларының үлгерімін бақылау үшін статистика ұсынады. Бұл мақалада неге ол тиімді және қалай ол Қазақстан мектептерінде қолданыла алатындығы туралы түсіндірмелер жазылған. Зерттеу әдісі шетелдегі мектептердің тәжірибесі туралы мақалаларды талдай отырып, сол платформаны жеке қадағалау. Америка континентіндегі мектептердегі оқушылар «Хан Академиясын» қолдана отырып, алдын-ала оқу әдісімен математиканы сынып ішінде де сыртта да тиімді әрі шығынсыз үйренеді. Математиканы оқытуға арналған сыныптың бұл идеясы қазақстандық мектептерде орта мектеп оқушылары үшін, сондай-ақ ЖОО-ға түсу үшін Ұлттық бірыңғай тест тапсыруға дайындалатын оқушыларға да тиімді болар еді.

Түйін сөздер: электронды оқыту, аралас оқыту, онлайн курстар, флип-класс (алдын-ала оқыту), сандық медиа, білім беру, педагогика, математиканы оқытудағы АКТ, тестке дайындық.

Аннотация

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ЦИФРОВОЙ РЕСУРС ДЛЯ ИЗУЧЕНИЯ МАТЕМАТИКИ И УПРАВЛЕНИЯ ПРОЦЕССОМ ОБУЧЕНИЯ УЧАЩИХСЯ АКАДЕМИИ ХАН

В статье исследуется, как работает одна из популярных бесплатных онлайн-платформ Khan Academy для изучения математики с точки зрения методологии обучения. Khan Academy - это онлайн-платформа с видеуроками и объяснениями, с панелью упражнений для изучения предметов, как математика, естествознание и многое другое. Этот цифровой ресурс предоставляет учителям статистику для мониторинга успеваемости учащихся. В статье описано, почему оно эффективно и как его можно реализовать в школах Казахстана. Метод исследования заключается в наблюдении за опытом зарубежных школ путем анализа статей и личного наблюдения за платформой. Школы на американском континенте используют перевернутые классы, чтобы эффективно изучать математику в классе и за его пределами без затрат. Идея перевернутого класса по математике была бы эффективна в казахстанских школах для учащихся средних школ, а также для учащихся, которые готовятся к сдаче общенационального единого тестирования для поступления в университеты.

Ключевые слова: электронное обучение, смешанное обучение, онлайн-курсы, флип-класс, цифровые медиа, образование, педагогика, ИКТ в обучении математике, подготовка к тестированию.

Introduction

Education level of schools in Kazakhstan is high, although it might be stressful for both teachers and students. If we talk about mathematics classes at schools, we assume when educator teaches new concept or topic, in each class there are students who learn fast and waits for others, also there are students who need more explanation and differentiated examples with one-to-one connection, and also students who follow the teacher at the same path, but need an assistance (of teacher or peers).

In Kazakhstan status quo of teaching process is like following: when teacher explains new concept, they use blackboard or whiteboard to write formulas or show presentations. Then teacher gives exercises for all the class and walks around to help, if someone needs. Sometimes teachers divide class into smaller groups. In that case students supposed to help each other, but in reality, children help each other by telling the answer, but not the explanation how to solve the problem. In order to avoid it, everyone should get individual tasks. This might consume products and time to make up new equations, finding training books to share the exercises, so teachers need a database with big amount of problems with explanation of the steps how it was solved and instant feedback for errors of students. Next problem is time consumption for teachers, who are going to check the results and ways of solving a problem of each student. If one class approximately consists of 20-30 students, at school there about 2-5 the same age classes (forms) which have 1 or 2 teachers for one subject like Mathematics. Therefore, things like checking the copybooks, writing a feedback, assessing might grab valuable time for working in the class and preparing new materials for each class.

AIM

The aim of this article is to increase awareness of teachers about online educational free platforms to teach children mathematics with different methods. As a new specialists of teaching Mathematics, we have conducted text-based research with Kazakhstani teachers and students who use Khan Academy [1] or similar online Kazakhstani platforms as “Daryn.Online”[2] to ask their experience with working in online digital platforms to change the current results of doing Mathematical exercises. Our tasks are:

- Firstly, we need to explain what Khan Academy is.
- Secondly, we describe its functions as features that makes it useful tool to study Mathematics.
- Last but not least, we will make a hypothesis on how this might be applied to Kazakhstani schools in voluntarily way to teach and study Mathematics.

Introduction To Khan Academy

Khan Academy is free and online website which consists of video materials as short tutorials and exercises to work out on each topic of Science, Mathematics, Test preparations, Computing and more. This online digital platform is mostly used in the United States of America due to the origins in Silicon Valley. The Khan Academy is mostly used for blended-learning classes, where students learn, for example, Mathematics in the class and also at home by themselves. Teachers in this case can track the progress of each student via assignments or their course goal achievements.

The benefits of using Khan Academy was researched by the organisation SRI [3]. Findings from the research of SRI in the schools of California as following below.

First of all, the research was able to show the strong as well as the gaps and weak points on the platform of Khan Academy. Thanks to the feedback sessions in the process of the research that gave an opportunity to make clear a lot of points. Teachers who were participated in the research had similar willings and gratitudes for the app and website due to several advantages that are demonstrated by the learning platform. These are findings that are relevant to our dissertation and could be useful for the teachers in Kazakhstan who will have a willing to implement Khan Academy in CLIL Mathematical classes:

- 1) The number of videos and topics as subtopics are raised, so it is full of resources website which can be as an instructional tool. The topics are divided by grades of a class and also divided by topics and fields like geometry, algebra, calculus and so forth;
- 2) Difficult topics are divided into series of videos to serve as a tutorials for each step and stage in understanding any mathematical concept. So the teachers can use piece of whole video to explain concepts and show the instructions how to do and solve problems;
- 3) It is well designed to connect teacher with students. First of all, the topics covered by grades of a class are correlated with the normatives of the State curriculum which makes it easier to use. However, the curriculum of the USA and Kazakhstan are different by its level of difficulty and differentiation of covered topics year-by-year. Secondly, the analysis and quick feedback reports from assignments on the progress of each student gives demonstrates where the student needs support and when it is not enough exercises for him

or her. So, it shows highly individual approach and less energy consumption than traditional way of checking on the progress of a student.

The website is allowing teachers and students to be independent from electronic device, which means, student or teacher can have an access to their progress and dashboard just by knowing the name of website, their username and password. Every teacher who is moving from one classroom to another can also have an access to the same results from any computer. This is device independence.

Despite of this, the website itself was made based on feedbacks of researched users. The usage of Khan Academy in the beginning was not well designed as it is nowadays. However, during the 2 school years the reports were telling what to make better and what is not working well and how to fix it. As a researcher, I believe by implementing a blended learning, to teach students how to learn independently, we can improve these processes for the better in the cultural understanding of Kazakhstan.

The main important finding is the effectiveness and impact of Khan Academy on academic progresses of the students. 85% of teachers who were under the research reported that they believed into positive impact of Khan Academy, where 42% of teachers reported a strong impact on comprehension of students learning Mathematics [3].

As for the students, 32% of students admitted the positive impact of Khan Academy on the liking Mathematics more since using the website and 45% of students told that they could learn effectively more concepts even without a help of a teacher.

So the findings and results of using a digital resource mostly helped to improve the free of charge online digital platform to learn Mathematics and had a positive impact on users. Teachers have curriculum friendly, user friendly design of the lessons, so they can use it for several purposes, also the function to report. Students can find any topic and assign for themselves a mastery goals and can see infographics of their progress how they are achieving their goal(s). The reports from the teachers and readiness of website owners could change a lot of features to make it better tool to educate a lot of people all around the world in any time, at any age.

Why mostly the USA's schools use this digital platform can be explained by linguistic matter, because the website properly and freely works in the Commonwealth of Independent States (CIS) countries, but the original content is in English. In order to exercise new learnt topic, you need to know English or Spanish, Brazilian Portuguese, otherwise you will not have access to high quality content as exercises, specialist's explanation of topic in the video and so forth. However, it would be beneficial to conduct a researches in CLIL classes in Kazakhstan with using Khan Academy as a digital online resource to learn and teach.

Resources (video materials) of Khan Academy are available in other languages like Russian, which is common language for the CIS. Volunteers all over the world translate the content of each video as much as possible. Although the exercises cannot be translated by each individual, the only thing students who study in other languages than English, Spanish, Brazilian Portuguese - they cannot work out in their own native language. This might be one of the reasons why Kazakhstani schools do not use free and accessible platform Khan Academy to teach and study Mathematics, Science.

The encourages of using and adapting new methods of teaching mathematics

As ex-Minister of Education and Science of Republic of Kazakhstan Erlan Sagadiev said, Kazakhstan falls behind not by quality of education, but by method of teaching. He made reforms that are encouraging students to study by analyzing, not by mechanically memorizing. Before the reforms, students at schools had to take a test after graduation and by the results enter the university and leave the school as in the USSR. However, some subjects' question-answers were repetitive, so the children could learn by heart the answers and pass the test, which is a job of low-quality use of intellect. Nowadays, tests are made as SAT which is appropriate to take and be approved to study at university. The reason why this question matters is this reform shows how students were taught and how it is changing. If we treat students to learn further by their intrinsic motivation, and as educators can teach them how to learn or study concepts, that would be appreciated work for further generations [4].

The new technologies are growing, a lot of new technologies are accessible and free, but the problem is students use them not properly. For example, the application like PhotoMath supposed to help to see the steps how to solve the problems like equations, algebraic problems, but in the reality mostly students use it for solving homework without thinking too much about the problem. What about Khan Academy, it works on laptops, iOS and Android Operating Systems and made to exercise the concepts on Mathematics to drill it better.

Several ideas on how to use online platform in the class of mathematics

There are two solutions how to use Khan Academy for beneficial productivity of students and teachers in Kazakhstan. First solution is to study materials related to Mathematics in English. As Kazakhstan encourages teachers who teach students in English (because of trilingual educational system), it is possible to continue to use Khan Academy as it is in English version. The second solution that is known for sure at this current moment is to create the same or alike platform which will be easy to use on any device (as YouTube, for example), well-designed (so even little children will know how to use it by exploring the website), fulfilled with content on STEM (Science, Technology, Engineering and Mathematics) and other lectures.

Possible effective reasons to implement khan academy

Why this is much more effective than making tests and teaching only in the class. There are few reasons.

First and main reason is children are different. Their learning speed, multiple intelligence (the way how the students learn better) are differ, and this information related to the adults too [5]. When one teacher explains new material in an excellent way for about 25-30 students, often there are students who cannot pay proper attention, need another explanation, need a repetition, afraid to ask questions or maybe they are understood the basic information and need to go faster further and so forth. For one teacher it might be need heroic tranquility to repeat some concepts over and over again, explain by another way to the student (or students) left behind, or to give something interesting for the students who really way ahead of the class at the same time, so mostly teachers focus on majority of class and only after the class they can work with students who need the special attention.

This consumes a lot of humanistic efforts like time, energy and willing. The platform as Khan Academy can help teachers and students. While student forgot the meaning of concept, did not understand the learning material, needs a tutor to check the exercises he or she is doing, digital technology can be as a one-to-one tutor if there is enough database to work with. The students can learn Mathematics outside of school without fear of repeating the question, because they can allow to replay the video when they are by themselves and there is only calm voice of instructor in the video that never changes by time of repeating the concept again and again (and it is totally free of charge). It is like a book but with dashboard and the place where student can train (work out) what he or she understood. If there are questions, there is also provided moderated chat. So, student can learn in safe environment where students can share the questions and write down the answers for the misunderstandings related to the topic and get involved to learning and teaching processes together. Also, the exercises provide step-by-step solution if the student stuck with the problem.

There is a button which asks for help and written beforehand instructions will be shown, so student can exercise the next similar problem. Additionally, there are also quizzes for acquired skills to close the gaps of studied program. The system counts for the time spent on problem, right and not right answers of the student (note, the student cannot skip the question with wrong answer, he or she will see the right way to answer) and more. So, the teacher can see authorized students in his or her class to monitor the progress and work with the students in really effective way, because most of the manual work will be done by database and computer program.

The next reason why this is effective is that student can work outside of the class without being distracted by 40 minutes breaks (in Kazakhstan one class continues for 40 minutes) from one class to another. It is important to stay focused on one activity for a long time with little breaks to have physical activity as walking, stretching, drinking a water. Mostly it is recommended to work on a single task every 25 minutes with 5 minutes breaks and this method called Pomodoro [6]. Nowadays with a lot of distractions like social network platforms as VK, Facebook, Messenger, Instagram and so forth, people are upbringing themselves as easily distracted and hard on staying focused on big texts, amount of works that are big enough as acquiring new skill from the beginning[7]. So, with the case of Khan Academy or digital blended learning, students can choose time how much they want and need to study.

The third reason to get involved into Khan Academy is the developers research how to modify learning tools and get rid of manual work which can be digitized. For example, Khan Academy now (2020) in a partnership with also non-profit organization NWEA working on MAP Accelerator [8] which helps to monitor the progress of the students and then make an individual study plan for each learner there with the help of their own teachers. Most of the researches done By Khan Academy itself about effectiveness of their tool in learning Mathematics. Unfortunately, the researches are done in the realities of the USA, so there are not so much data on how it is used outside of the States.