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Technologies for teaching during a pandemic

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Abstract

The coronavirus pandemic has had a major impact on education. As a result of this crisis, instructors world-wide had to quickly adapt and shift to remote teaching. This paper presents and describes technologies (such as Microsoft Teams, Zoom, Virtual Worlds, etc.) to promote active student learning during a pandemic. It also provides general information about the coronavirus and the learning environment that it created.

Keywords: Pandemic; teaching technologies; microsoft teams; zoom; virtual worlds

1. Introduction

The coronavirus has had a profound impact on teaching and student learning. As a result of this crisis, instructors had to quickly adapt and shift to remote teaching. College faculty in Northern New York State had no advance notice that they would be required to teach their courses online after the February 2020 Spring break. Their colleges immediately closed during the break and only allowed essential workers (like security, information technology staff, etc.) on campus. Lockdown was enforced, so most everything was closed. To help prevent and slow down the spread of the virus, individuals were encouraged to stay home and only go out to buy food, medicine, and necessary items. They were strongly advised to wear masks (especially inside buildings), to keep a social distance of at least six feet from other people, and to frequently wash their hands with soap and water.

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Teaching continued during lockdown. Daycare Centers, K-12 Schools, and Colleges were closed. Therefore, parents and instructors (working from home) had to care for their children and assist them with their online schoolwork and lessons. Students' lives were drastically changed. They had to adjust to online learning instead of being in a classroom and to function without sports, social activities with friends, and the benefits of campus life. Yes. With time, lockdown was lifted, so some educational organizations were able to provide in class and hybrid learning (combination of classroom and online learning) and a limited amount of sports and social events (depending on the status of the virus in specific locations).

2. Teaching technologies used by the authors during a pandemic

The authors (Barry and McGrath of the United States and Kanematsu and Ogawa of Japan) have extensive experience using Microsoft Teams, Zoom, and Virtual Worlds for remote teaching. These technologies (along with Upbeat software) are presented and discussed.

2.1. Microsoft teams

Barry uses Microsoft Teams for a variety of tasks including teaching [1]. She belongs to the STEM (science, technology, engineering, and mathematics) team at SUNY Canton. This platform allows faculty, staff, and students to belong to teams which include separate channels. Each member of the faculty has his/her own special channel (within a team) for carrying out classes, etc. Instructors are also able to access other individuals' channels for collaborative projects. Microsoft Teams has built-in meeting features to successfully hold classes and share documents. For example, power-point presentations, interactive websites, videos, and e-books can be attached to posts. Virtual whiteboards and video calls are available too. Also, One Note (a special note-taking tool) is included with Teams for various lessons and activities.

2.2 Zoom

The authors are familiar with Zoom. They use it for audio/visual conference meetings, the teaching of classes, office hours, student presentations, etc. [2]. Participants are recruited by receiving email invitations. Instructors might mute everyone to prevent distracting background noise or just mute and unmute individuals whenever they want to. Gallery and speaker views are available. This platform allows instructors to meet online with students (a virtual face to face instruction) and carry out synchronous lessons at the normally scheduled class time each week. Some classes are asynchronous, where students work on their own and view recorded lessons.

For the use of both Microsoft Teams and Zoom, instructors are free to conduct their own laboratory activities for the students. Some of us use YouTube videos and simulations. A few carry out science demonstrations online. Others describe experiments in detail and give the results to the students. Then the students use the experimental data to write reports that contain tables and figures. A final goal in Japan is to have remote laboratories for experiments. Director Professor Dr. Kanematsu and members of the K-Drive Virtual Research Center (nationwide) are involved with this effort. It is the use of telecommunications to remotely conduct real experiments.

2.3 Upbeat software

One of the authors (Barry) performed in a band by using Upbeat software during the pandemic. Band conductors and music teachers, working remotely, use Upbeat for playing and recording music with band members and for assisting with music lessons. Upbeat is smart software designed for rhythmic music-making, composing, and for playing music with a group. For example, students are given several compositions of music to practice at home. They use a computer and headphones to listen to a professional performance of each song and play along with it. Each week the band members attend a Zoom meeting for rehearsals with the conductor. When the students feel comfortable playing a particular song, they individually use the Upbeat software to play and record their parts (like

second trumpet part). To carry out this activity, each musician needs a computer, headphones, a microphone, a camera, a recording system, and the Upbeat software. Each student submits his/her recorded music and video to the band conductor, who synchronizes the individual parts into a group recording. Finally, the video of the music performance is made available on YouTube. Figure 1 displays such a performance [3]. Notice that each player is in a square.
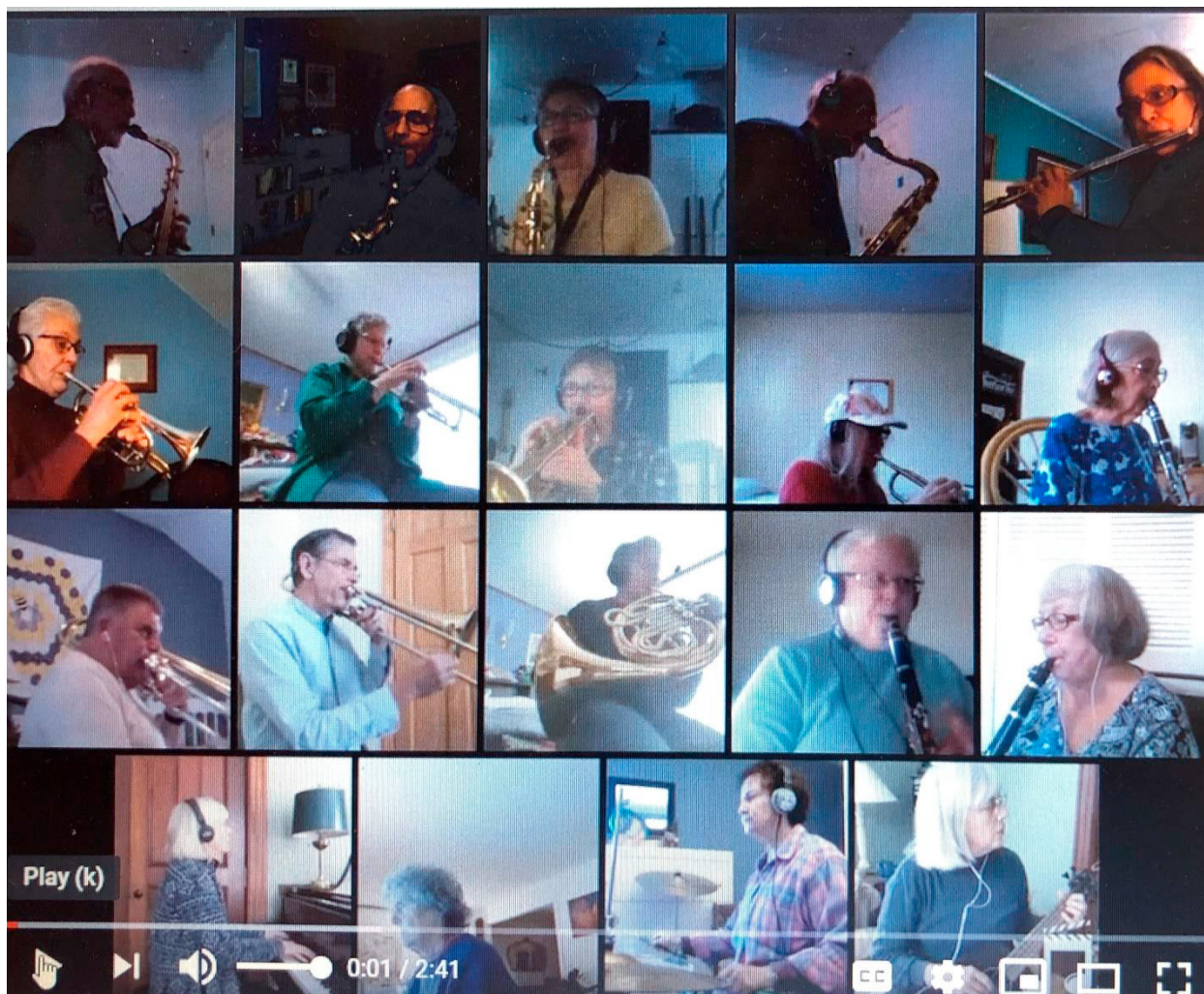

Fig. 1. A photo is displayed of a music performance prepared by using Upbeat software. Each player appears in a square.

2.4 Virtual worlds

Virtual worlds are online three-dimensional communities like Second Life (SL). They provide creative and cheerful environments for student learning. In SL, there are no boundaries for space and time. This means that a lesson could be presented at any time from any location. The authors use virtual classrooms to teach lessons in SL. These classrooms were built on an island owned by Nagaoka University of Technology in Japan. They include red chairs, tables, a podium, and whiteboards (for posters, Power Point presentations, etc.). Communication tools are the "Chat" and "Speech" functions. Instructors and students are represented by avatars (virtual people to represent and carry out activities on behalf of them). Figure 2 shows a virtual classroom in SL with avatars representing the instructor at the podium and the students seated in the red chairs [4].

Fig. 2. This picture represents a virtual classroom on Japan's island in SL.

The authors' students (mostly between the ages of 16 and 18 years old) enjoyed and successfully completed many problem-solving activities in SL [5-6]. A few of these exciting events are mentioned [7-8].The students designed and built a house of the future during the global warming era, an economic car (that is safe, environmentally friendly, and energy efficient), and a special airplane that uses wind energy (a renewable source of energy). Figure 3 shows their special airplane [9]. The participants created three-dimensional, virtual objects (primitives) of specific shapes, sizes, and color to build their houses, cars, and airplanes in the area outside of their virtual classroom. See Figure 4 [10]. It is advantageous to make items in SL. Expensive building materials are not necessary. Potential safety risks are avoided, and a sense of reality is provided

Fig. 3. The instructor's avatar observes students building a plane for renewable energy.

Fig. 4. Students create primitives for their building projects.

3. Additional teaching platforms

Some Northern New York instructors, of various courses and of different student age groups, were asked to complete a short questionnaire about the teaching technologies that they are using during the pandemic. The participants included the following: Pre-K teacher (with 4 year old students) from Lawrence Ave. Elementary School, an Elementary School teacher (for third graders who are 8 years old) from Canton Central School, Middle School Science teacher (for fifth graders who are 10 years old) from Edwards-Knox Central School, SUNY Canton College Professor who teaches chemistry and environmental science, and a College Professor at St. Lawrence University who teaches a course in comparative politics.

Questionnaire (Please answer the following questions.)

1. Name of instructor's school or college: _____
2. Grade / courses taught: _____
3. Do you or have you used special software, interactive websites, virtual labs, technologies like Zoom, Microsoft Teams, etc. while teaching during the pandemic? _____
4. Briefly describe how you use /used special software, technologies, etc. to promote active student learning. _____.
5. Select one answer: Are you successful at promoting active student learning by using special technologies, etc.? Possible answers: A. Very much. B. Pretty much. C. Neutral. D. Not so much. E. Not at all. _____
6. Feel free to provide other comments related to your teaching experiences. _____

Most of the instructors selected choice B (Pretty much) for question 5. They feel this answer best describes their ability to successfully promote active student learning by using special technologies. They believe that in person instruction is best for their students and that special technologies enhance and complement student learning. On the other hand, the professor at St. Lawrence University chose A (Very much) for her ability to successfully promote active student learning by using certain technologies. She plans to use these platforms during pandemics and after they are over.

3.1 Pre-k teacher

The teacher of very young students uses e-learning. She shared an e-learning lesson that she prepared for them. To help her class learn about various animals of the world, she introduced the animals through books and stories. Then the youngsters picked their favourites and found pictures of them on the Internet. Finally, the children took virtual tours to the habitats (examples: countries, continents) of their chosen animals.

3.2 Fifth grade teacher

This teacher also uses e-learning. She created a lesson for innovative e-learning and shared it. She used Google My Maps to design a virtual trip for students (in which they were asked to stop and explore various locations). The pupils were also told to upload research information and pictures (from the virtual tour) into a template prepared by the teacher.

3.3 Third grade teacher

The third-grade teacher uses a variety of software and technologies with his students, especially because he teaches them many subjects. He mainly uses Zoom for remote teaching. Zearn provides online math lessons and Mystery Science has exciting remote science activities. As for reading, Edpuzzle allows teachers to transform video

content from a passive to an interactive experience for students. He also uses Quizlet, an online study application that allows students to study various topics (like vocabulary) by using learning tools and games.

3.4 Professor at SUNY Canton

The SUNY Canton Professor, who teaches chemistry and environmental science (along with their labs), feels that technology helps but does not replace the in-person classroom and laboratory experiences. For fully remote teaching, he mainly uses Zoom, Microsoft Teams and Blackboard. (Blackboard is a web-based learning system used by colleges, etc. It provides students with instructions, online interaction, and educational assessment.) In addition, this professor provides his students with recorded lectures and labs. He has online guest speakers, as well as online office hours and advising meetings.

3.5 Professor at St. Lawrence University

The professor at St. Lawrence University teaches comparative politics and loves using creative technologies. She will continue to use them during and after pandemics are over. In addition to Zoom, this instructor incorporates Sakai, Panopto, InQuisitive, Gradescope, and Perusall into her courses. Sakai, the university's learning management system, is an educational software platform designed to support teaching, research, and collaboration. Panopto is software for recording lectures, screen casting, video streaming, and managing video content. She mainly uses Panopto to record videos that pinpoint areas of confusion and to help students better understand and integrate the materials used for class. InQuisitive is a gaming tool that complements the textbook. Her students like it very much because it gives reasons for why answers are wrong or right. Gradescope is software that enables instructors to grade paper-based assignments and exams online. It also provides feedback for students.

The St. Lawrence University Professor said that Perusall is excellent software to help students puzzle through reading assignments together. It is a social annotation tool for reading that allows students and faculty to collaboratively markup digital textbooks. Students actively annotate documents, etc. and respond to each other's comments and questions. They can start threads which are like chat lines with members of the class. This activity happens in real time and stimulates discussion. Perusall uses artificial intelligence to grade student annotations. This platform includes writing analytics to automatically score students' annotations. It also collects data about student reading and annotation patterns. Perusall evaluates annotations for each assignment and gives every student a score like 3, 2, 1, and 0. The score reflects a student's effort put into studying the text. A few annotations for an assignment usually indicate a low score.

4. Conclusions

The coronavirus pandemic has had a major impact on education. As a result of this crisis, instructors world-wide had to quickly adapt and shift to remote teaching. Many technologies are available for remote teaching and to complement as well as enhance in person instruction. Popular platforms include Zoom, Microsoft Teams, Blackboard, and others. However, instructors should select technologies that are most appropriate for promoting active student learning. Some variables to consider include class size, age of the students, courses taught (especially if they include laboratory activities), and the background knowledge of the pupils. The authors recommend in person instruction after a pandemic is over. This provides the students with opportunities to develop their social skills, interact with friends and to participate in sports, music groups like band, and other extracurricular activities (including science clubs, robotics teams, etc.). However, some instructors may also decide to enhance their courses with useful and relevant technologies.

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References

[1] Henderson, Daisy, Woodcock, Hannah, et al. (October 2020) "Keep calm and carry on learning: Using Microsoft Teams to deliver a medical education program during the COVID -19 Pandemic." *Future Healthcare Journal*. DOI: https://doi.org/10.7861/fhj.2020-0071

[2 Brennan, Jonathan (October 20, 2020) *Engaging Learners through Zoom: Strategies for Virtual Teaching Across Disciplines*, Jossey-Bass (a Wiley Brand)

[3] Photo by Dana Barry

[4] Barry, Dana M., Kanematsu, Hideyuki, Fukumura, Yoshimi, Kobayashi, Toshiro, Ogawa, Nobuyuki, and Nagai, Hirotomo (2012) "Problem based learning for US and Japan students in a virtual environment", in T. Watanabe et al. (eds) *Intelligent Interactive Multimedia: Systems & Services,* Springer-Verlag: 479-488.

[5] Barry, Dana M., Kanematsu, Hideyuki, Fukumura, Yoshimi, Kobayashi, Toshiro, Ogawa, Nobuyuki, and Nagai, Hirotomo (2013) "US students carry out nuclear safety project in a virtual environment." *Procedia Computer Science* (**22**): 1354-1360.

[6] Kanematsu, Hideyuki, and Barry, Dana M. (2016) *STEM and ICT Education in Intelligent Environments*, Springer Switzerland

[7] Barry, Dana M., Kanematsu, Hideyuki, Fukumura, Yoshimi, Ogawa, Nobuyuki, Okuda, Atsushi, Taguchi, Ryosuke and Nagai, Hirotomo (2009) "Problem based learning experiences in metaverse and the differences between students in the US and Japan." *Proceedings of 2009 JSEE Annual Conference:* Nagoya, August 8, 2009

[8] Kanematsu, Hideyuki, Kobayashi, Toshiro, Ogawa, Nobuyuki, Barry, Dana M., Fukumura, Yoshimi, and Nagai, Hirotomo (2013) "Eco car project for Japan students as a virtual PBL class." *Procedia Computer Science* (**22**): 828-835.

[19] Barry, Dana M., Kanematsu, Hideyuki, Lawson, Michael, Nakahira, Katsuko, and Ogawa, Nobuyuki (2017) "Virtual STEM activity for renewable energy." *Procedia Computer Science* (**112**): 946-955.

[10] Barry, Dana M., Kanematsu, Hideyuki, Nakahira, Katsuko, and Ogawa, Nobuyuki (2018) "Virtual workshop for creative teaching of STEM courses." *Procedia Computer Science* (**126**): 927-936.