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Implementation of an Integrated Online Class Model using Open-Source Technology and SNS

Won Ho[a], Dae-Hyun Lee[b], Yong Kim[c,*]

[a] Div. of Electrical, electronics, and control Eng., Kongju National Univ., 56 Gongjudaehak-ro, Gongju, 31080, South Korea
[b] Intube, Seongsui-ro, Seongdong-gu, Seoul, 04781, South Korea
[c] Department of e-learning, Graduate School, Korea National Open Univ., 86 Daehak-ro, Jongno-gu, Seoul, 03087, South Korea
Corresponding author: *dragonknou@gmail.com

Abstract—Before Covid-19, the class model was divided into online, offline, and blended learning. Due to Covid-19, we have the only online class environment. We need a new online class model under the new circumstances. In the new model, all technology and educational methods need to be well-adapted, organized and harmonized to compensate for the absence of offline learning sessions. In this paper, we propose a new online class model. Because of the absence of offline sessions, the model emphasizes the integration of synchronous and asynchronous activities seamlessly and effectively. The model also emphasizes the instructor's role as a content prosumer because the instructor in the new model is either reusing other's and the one's own contents or supplying those contents for others. This model uses open-source solutions or free services like Moodle, OBS, Tubestory, and Snap Camera for both budget-saving and stability purposes. It actively uses Moodle's monitoring capability and adopts various learning technologies. It consists of three activity sessions: a pre-Zoom session, a Zoom session, and a post-Zoom session. Each session is composed of modules that describe the process and action for the class. The process, methods, and techniques for each module are explained in this paper. The official students survey for class evaluation held by Kongju national university showed that the new class model's application obtained a higher score than the same class of the previous year that is performed by conventional teaching.

Keywords—Synchronous learning; asynchronous learning; Moodle; class model; Zoom.

I. INTRODUCTION

Because we conduct our classes mainly online due to the Covid-19 outbreak, the application of the existing class models, which are Blended learning, Flip learning, or online-offline learning, have become ambiguous. Because most of the teaching models are defined on the precondition that offline session is available, these models are not suitable for use in situations where classes are conducted purely online [1], [2], [3]. Using video for synchronous and asynchronous online education classes are defined on the assumption that offline education exists. For example, when a video is produced and delivered to learners through YouTube, it could be asynchronous. But somebody can play the video synchronously, playing the Youtube video to share the contents during the Zoom session either for short time broadcasting or for real-time commenting as the video plays. It is also possible to reuse the video conference recordings for the learner's reviewing purpose or the next semester's class. In

that way, the boundary between the asynchronous and synchronous teaching methods and applications became blurred and obscured, or mingled [4], [5], [6].

It is necessary to clarify and find a new and efficient classroom model reflecting various application methods, integrating synchronous and asynchronous. The new model needs to provide the following elements; a diversified communication channel, immersive class management skills and technologies, team collaboration, monitoring of learning, and reuse and adequate circulation of contents.

We named it a new term, "Ongoing" class model, which includes the factors above. The tools for these are open-source software or free service except Zoom [7], [8], [9]. These make it easy to implement and access the Ongoing class.

II. MATERIALS AND METHOD

Conventionally, we call e-learning class an online class. In recent years, Blended Learning, which operates by mixing online learning and offline learning, and Flip Learning, which

watch class videos in advance and conduct various learning activities during the learning session, have drawn attention. Each of the current learning model's concepts and the problem are as follows.

A. Online Learning & Blended Learning

"Online learning" in the general sense refers to a teaching method conducted in an online environment. Pure "Online learning" is not yet entirely accepted in the formal education system but is provided by MOOCs or companies that offer pure online services.

There is an advantage in using a mixture of online and offline learning. In the formal education system, online learning is beginning to be accepted as Blended Learning. Online learning service providers or organizations are also interested in providing some or a substantial portion of offline learning as complementary sessions. This change raises the problem of role conflict between Cyber University and formal university. Legal and economic issues need to solve. In the Covid-19 crisis, we can't use the offline learning environment in any case and need technologies and methods to complement or spread the effects of offline learning.

B. Flip Learning

In Flip Learning, learners listen to the class in advance as a video and conduct various learning activities during class. The word "flip" was used as an order reverse meaning compared to the conventional learning model, such as completing an assignment after class time. Likewise, for Flip Learning, we can't conduct the offline session in the Covid-19 situation. Ideas and solutions on how to complement offline session's role and effectiveness with online are highly demanding [10].

C. Open-Source Software and services

Open-source solutions have spread widely in many fields since the development of Linux, and there are many open-source solutions in the education field. Moodle is the best open-source LMS solution, available free of charge, and has been developed over a long time to provide all essential educational functions. As authoring tools, we can use software such as OBS (Open Broadcast Software) and Openshot. For collaborative mind map systems, Tubestory is the right candidate. Scrcpy can share the screen for peripheral devices. Those are open-source software. Services such as Snap Camera are not open-source solutions but free [11], [12].

An essential issue in the Covid-19 crisis is how we can effectively conduct online classes complementing and entirely substituting corresponding offline learning. This method will be more useful and influential if we can achieve it by utilizing open-source solutions and open services. So, it adopts those tools.

D. LMS(Learning Management System)

LMS is the essential infrastructure for online learning. This platform provides the ways to create or manage learning activities, resources, and classes/learners. In general, we think of LMS as a platform for conducting asynchronous learning, but we can use various LMS learning activities even during a synchronous session. In particular, LMS such as Moodle provides multiple functions to monitor learning; completion of learning activities, scores generated from activities, logs related to learning activities, etc. In particular, quizzes can monitor the progress of learners solving quizzes with the creation of various types. It is possible to adjust the learning paths according to the results flexibly. Moodle is the most widely used learning management system globally, and it provides various learning activities and management functions. That was achieved through more than 18 years of development history and enabled us to implement the new online learning model [13].

E. SNS(Social Network System)

Even though LMS provides a mobile app and provides a notification or a chat function, these functions are much insufficient and inconvenient than the professional SNS. SNS can be used as a general communication tool and can be a handy tool for quick and convenient communication calls for individual users and groups for learning purposes. When a video conferencing system such as Zoom encounters a problem, the group call function can even replace it for a class operation. Band is a good SNS service that provides a crucial subset of many LMS-like functions.

F. Zoom(Web conferencing System)

A large part of synchronized activities is performed on a Web conferencing platform. Zoom is the most famous for the stability, speed, and easy interface. Even though there are many other tools like Hangouts and MS Teams, we propose Zoom as the primary Web conferencing system. Equivalent functions can be found from different Web conferencing tools. Even though Zoom is the right solution, the recommended functions would be achievable with the other tools. Zoom is used here to present and show our model's methods and processes easily with simplicity and fewer difficulties. Even though Zoom is used mainly in this paper, the other Web conferencing tool can be used with their matching functions.
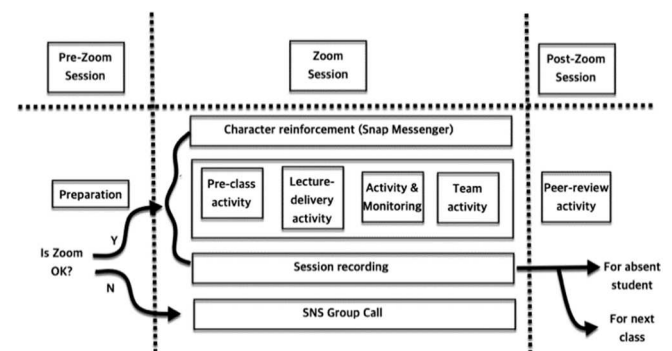

Fig. 1 New online class model

If all classes are conducted only online due to the Covid-19 crisis, an online learning class needs to do more than it was defined as a conventional online class. These tools are repurposed to be used under the new class model, as explained in the next section.

III. Results and Discussion

Fig. 1 shows instructional procedure and method in a diagram. The class model can be divided mainly into Zoom sessions (using Zoom) and non-Zoom sessions. None-Zoom

sessions can be divided into pre-Zoom sessions and post-Zoom session. In a pre-Zoom session, instructors prepare the learning materials for the Zoom session and post-Zoom session. They include videos and learning resources, and activities on the LMS.
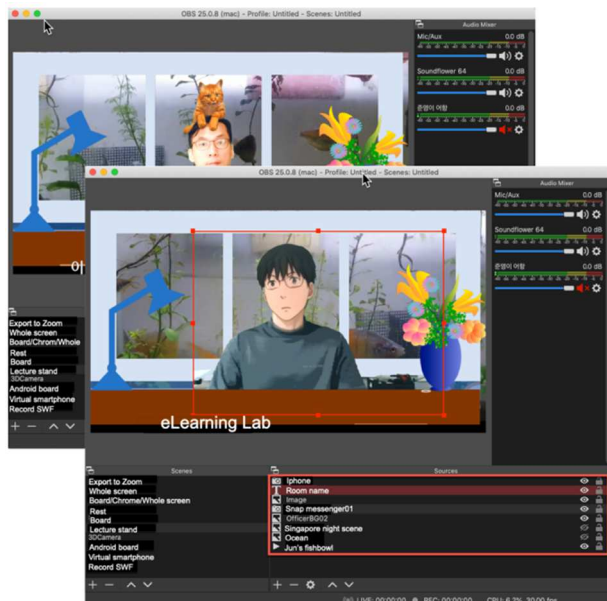

Fig. 2 Using OBS to produce broadcasting quality video

A. Pre-Zoom Session

Video materials are developed using authoring tools and are usually uploaded to YouTube or an internal video streaming server. Commercial software is sometimes used to create videos, but open-source software is available called OBS. Like a professional broadcasting program editing tool, OBS makes it easy to produce high-quality broadcasting quality videos by configuring the camera, background, and layer settings like Fig. 2. To edit recorded videos on OBS, free video editing software, like OpenShot, may be used. Once the video has been edited, it can be used in several different ways. It can be uploaded on YouTube for the learners to watch it at a designated time for asynchronous access. The video also can be played during a Zoom session for synchronous usage. Another way is using the video with H5P [14], with which interactive and engaging quizzes can be added to the video, as shown in Fig.4.

The LMS learning activities used in Zoom sessions are also prepared in advance in the preparation module. Moodle's forum can be used to announce learning missions and explain assignments. Quizzes are created as needed, and students can submit assignments either for simple assignments or peer-review evaluations. Various materials can be uploaded on Moodle using the file or folder features, and URLs and instructional materials can be linked by using a mind map. All those activities and resources are prepared in the "Preparation" module.

B. Zoom Session

What has been prepared in the pre-Zoom session can then be used during Zoom sessions. Throughout all sessions, social media is better to be used frequently. In addition to communicating general information, social media can be used for emergent cases such as network access difficulties or the video conferencing system failure by using the group call feature. Most social media sites provide a group call feature, and it can be used for individuals to communicate with one another through a video call or voice call. There is a "Break room" feature in Zoom, but the group call feature of SNS makes it more convenient to create diverse groups. Also, using the SNS's voice call feature for impromptu groups, a Zoom session can be stably carried out even when Zoom is not working.

Zoom sessions consist of four modules: pre-class activity, lecture delivery activity, activity & monitoring, and team activity. The order of these four modules can be changed or repeated. The resulting variations are shown in Fig. 3.
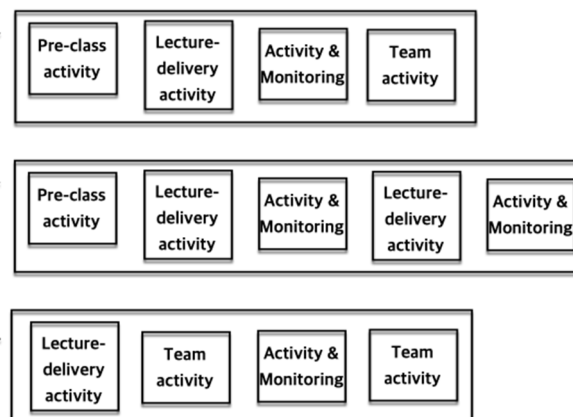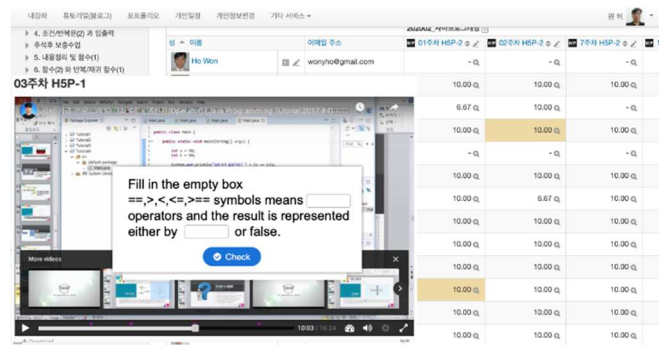

Fig. 3 Various ways to carry out Zoom session

Fig. 4 Using H5P for lecture delivery

1) Lecture delivery activity:

In the lecture delivery module, the lecture can be delivered in various ways. A video conferencing system may be used for synchronous class, or a recorded video or a video on YouTube may be played in real-time. On Zoom, if you enable computer audio sharing, you can deliver the video's sound to other participants in real-time. While doing so, you can use the pause button during transmission to provide a supplementary explanation or answer any learners' questions. You can also use H5P on Moodle to insert an interactive quiz to check the progress. H5P will allow you to check whether your students are focused on the video effectively.

2) Activity & Monitoring:

The subsequent monitoring module comprises monitoring the quiz-solving process, learning activity/resources completion status, and log analysis. These are all feasible

Moodle functions and can be used either in Zoom session or in post-Zoom session. Moodle allows defining completion conditions for any activity or resource; forum post numbers, quiz scores, assignment submissions, or resource clicking. [15]-[20] In Fig. 5, this completion status can be reviewed for each participant.
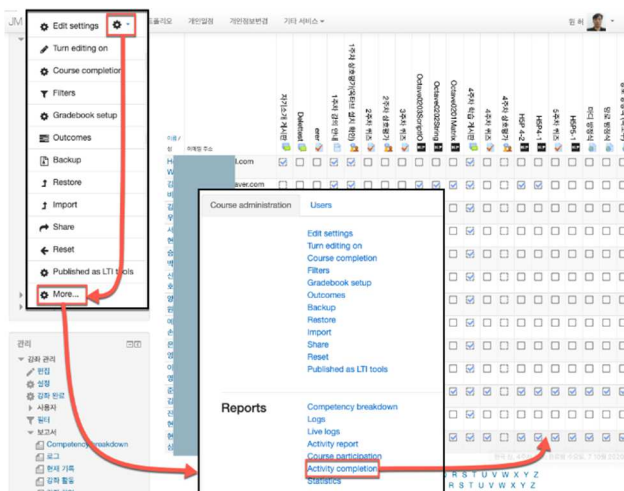

Fig. 5 Activity completion checking interface

Quiz response provides another way to monitoring learners' progress. With the various kind of quiz generation capability, Moodle can monitor each learner's progress in solving quiz like Fig. 6. The instructor can even check the repetition number and the responses of the learner at each repeat stage.
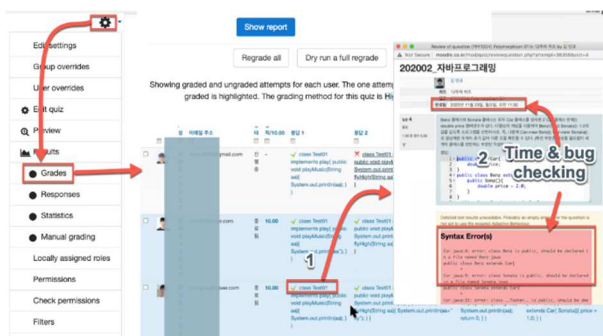

Fig. 6 Quiz response monitoring

The other adequate monitoring function is the log. Moodle provides a record of each learner with information of the time, connect IP address, accessed activities/resources, and more. This log information can be downloaded and analyzed with Excel. Fig. 7 shows the form of Moodle log downloaded, and Fig. 8 shows the log's pivot analysis. This process could be challenging to use in a real-time environment. It is recommendable to conduct that analysis after the Zoom session. It provides a profound understanding of how learners are doing on the LMS system.

According to the monitoring results and analysis, either a private chat feature on the video conference system or the group call feature on social media may be used for personalized learning as a way of feedback.
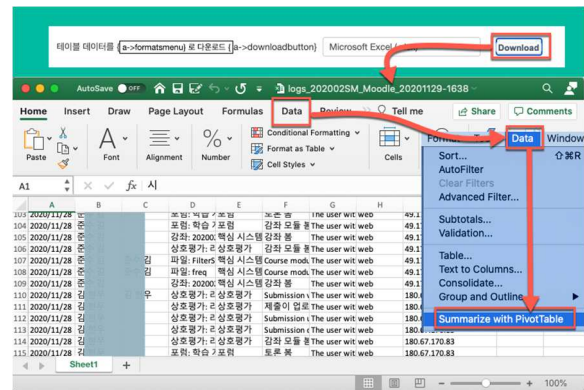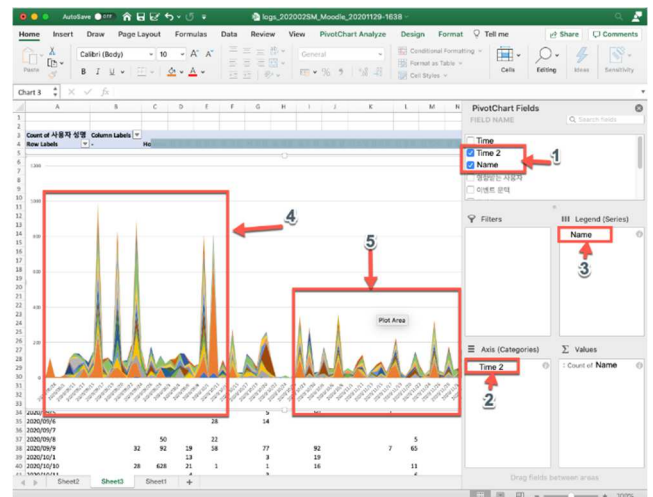

Fig. 7 Downloaded Moodle log as Excel

Fig. 8 Pivot analysis of Moodle log
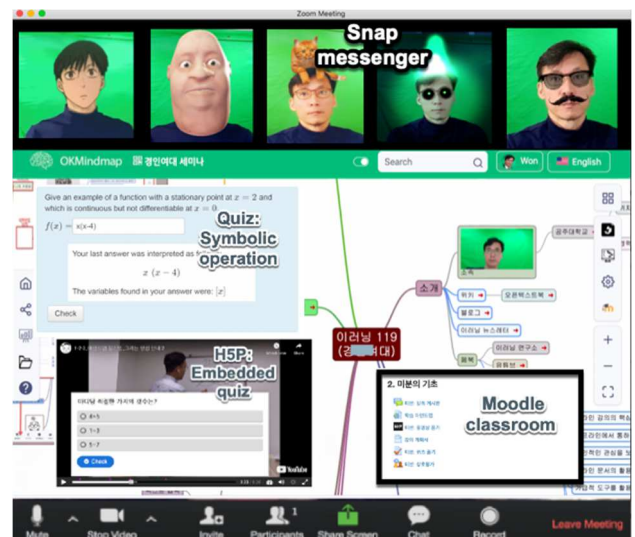
Fig. 9 Using Tubestory in Zoom session

3) Team Activity:

Team activity is significant, especially in the Covid-19 environment. Because there is one instructor for online learning without an offline session, it isn't easy to control and draw many learners' attention. Making teams of 3~5 learners with a team mission encourages the learner's participation. There are many ways to organize team activities.

Using the appropriate tool is very important. Tubestory is a useful tool for collaboration, as in Fig. 9. Many learners can

access the same map to create it together. This map can be used as multimedia content, a collaboration activity, a report, or a presentation.

During team activity, group activities and discussions are encouraged using Zoom's "Break room" function as in Fig. 10. This function allows creating small groups for Web conferencing. The Zoom session is activated, and learners are immersively engaged in-class activity because it provides a higher participatory opportunity for all members.
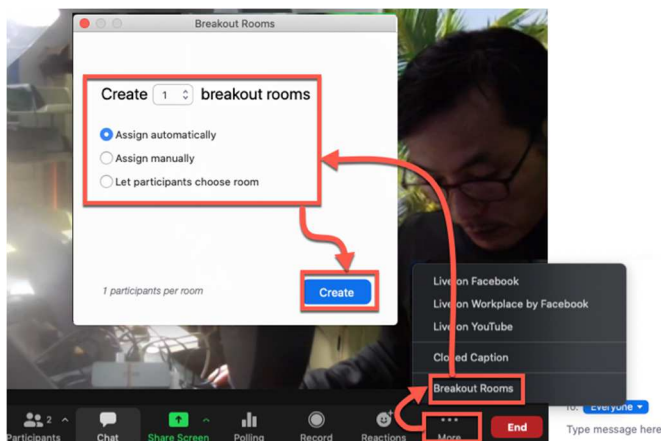

Fig. 10 Break room function of Zoom

4) Use of OBS and Snap Messenger:

In pre-Zoom sessions or Zoom sessions, it is recommended to use OBS and Snap Messenger in combination as a way to diversify your character either for the producing video or Web conferencing system. By changing your character according to the appropriate situation, you can boost your students' interest or change the class atmosphere.
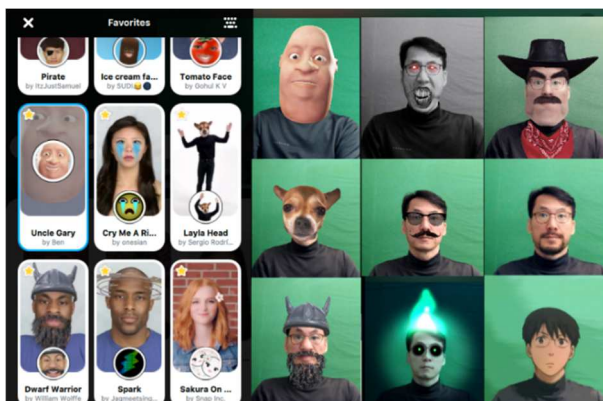

Fig. 11 Use of Snap Messenger for character transformation

In producing a video with OBS, the Snap messenger can be an input video as a scene, overlayered to other display or application window. By layering the scene in this way, the computer graphical effect can be achieved easily. For example, with a green screen, the user can place a character on any of the screens in real-time. Because Snap Messenger provides so many switchable interesting characters for fun, you can select a good character for a video production (or even multiple characters in one video), as shown in Fig. 11.

The OBS also supports virtual window. Users can activate the virtual window, and OBS can be recognized as an input source for the Zoom user's profile video. The other option is OBS can also be shared as an application in Zoom.

C. Post-Zoom Session

Zoom provides a way to record the Web conferencing class like Fig. 12. This record can be saved either on the Zoom cloud server or the user's local computer. The advantage of saving on the cloud is that the video is directly available to the viewer with a web URL. It doesn't need to be uploaded to any video streaming server. Recorded video can be provided to any absent students or who want to review what they learned.
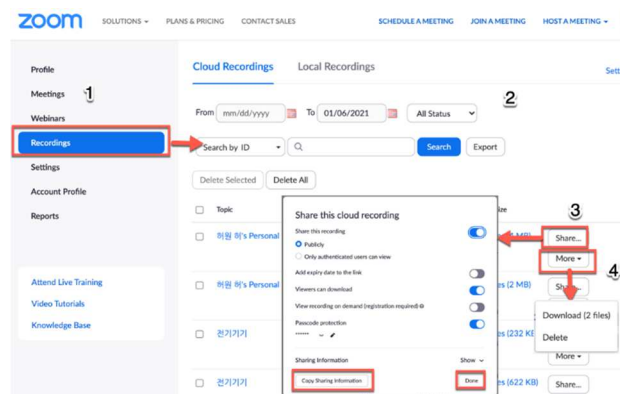

Fig. 12 Accessing recorded video

D. Survey Results for "Ongoing Class Model"

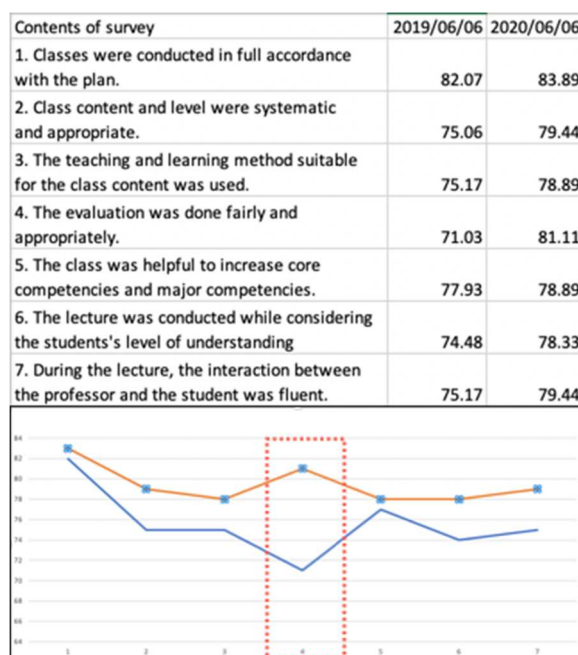| Contents of survey	2019/06/06	2020/06/06
1. Classes were conducted in full accordance with the plan.	82.07	83.89
2. Class content and level were systematic and appropriate.	75.06	79.44
3. The teaching and learning method suitable for the class content was used.	75.17	78.89
4. The evaluation was done fairly and appropriately.	71.03	81.11
5. The class was helpful to increase core competencies and major competencies.	77.93	78.89
6. The lecture was conducted while considering the students's level of understanding	74.48	78.33
7. During the lecture, the interaction between the professor and the student was fluent.	75.17	79.44

Fig. 13 Student's evaluation for the course run by "Ongoing class model"

I ran the Moodle-based Blended learning model for more than five years before the Covid-19 outbreak and had to transit to the "Ongoing class model". In the previous classes, I taught in a blended way with more weight on offline sessions. Mostly 2 hours of the class performed offline, and the rest 1 hour was substituted by an online session. In the online session, the students are supposed to watch the related videos, submit assignments and execute extra class activities. After Covid-19, I changed to the "Ongoing class model".

My university request to complete the class evaluation from the students for every class at the end of each semester. By analyzing the student's evaluation results, it can be found

that the students' absolute preference for the new class model in every evaluation item. As shown in Fig. 13, the student's course evaluation run by the "Ongoing class model" obtained a higher score in every evaluation item. The 2019's class was conducted by Blended learning with 32 students, and the 2020's class was taught by the "Ongoing class model" with 36 students because of the Covid-19 outbreak. It is encouraging that the evaluation score was raised in every item, despite the larger number of learners and purely online learning environment.

Interestingly, there was much confidence in the online exam grading system, which was also conducted online, referred to in evaluation item 4. The students' satisfaction for fairness was significantly higher than the previous year's class exam conducted offline. This was possible because of Moodle quiz's unique feature of randomizing formula equation mainly. Also, SEB(Safe Examination Browser) usage and Zoom camera's multiple students' profile video monitoring function devoted a lot to the score raising. These all numbers show the effectiveness and preference for the Ongoing class model is highly applicable.

IV. CONCLUSION

In this paper, a new class model named "Ongoing class model" is proposed. In Covid-19, all activities are conducted online, and these online environments need to be efficiently and effectively managed and controlled. The Ongoing class model does combine asynchronous modules and synchronous modules seamlessly. It is based on several strategies: immersive multiple character representation, supplementary SNS usage for emergent cases, real-time activity monitoring (including external tools), adaptive remediation of learning path including group activities, real-time video delivery with live commentaries, and usage of reuse of recorded synchronous session for other classes.

It consists of a pre-Zoom session, Zoom session, and pos-Zoom session. In the pre-Zoom session, the instructor prepares the activities and resources. Zoom session consists of pre-class activity, lecture-delivery activity, activity & monitoring, and team activity. In the pre-class activity, the instructor uses various technical services or apps to fortify students' learning. The instructor delivers the lecture either by video, streaming, or mixed in the lecture delivery activity. In the activity & monitory, the instructor monitors students learning accomplishment in real-time and react with it. Lots of collaboration tools are used to encourage the students in a team activity. In post-Zoom, peer-review assignments are used, and the recorded class video is reused for various purposes.

All of the tools used for the class model were either open-source software or free services except Zoom. Considering that most public institutions or organizations usually provide zoom, this model can be easily applied without any budget barrier. The new class model's effectiveness was validated by the students' course evaluation survey executed by the university. All of the students gave a higher score for each evaluation item.

REFERENCES

[1] R. Yilmaz, "Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classroom," Computers in Human Behavior, Volume 70, pp. 251-260, May 2017, DOI: 10.1016/j.chb.2016.12.085.

[2] M. Huda et al., "Big Data Emerging Technology: Insights into Innovative Environment for Online Learning Resources," International Journal of Emerging Technologies in Learning, Vol. 13, No. 1, pp. 23-36, 2018, [Online]. Available; https://www.learntechlib.org/p/182240/.

[3] A. D. Dumford and A. L. Miller, "Online learning in higher education: exploring advantages and disadvantages for engagement," Journal of Computing in Higher Education, Vol. 30, pp.452–465, Apr. 2018, DOI: 10.1007/s12528-018-9179-z.

[4] P. R. Lowenthal et al., "Live Synchronous Web Meetings in Asynchronous Online Courses: Reconceptualizing Virtual Office Hours," Online Learning Journal, Vol. 21, No. 4, 2017, Available; https://www.learntechlib.org/p/183778/. DOI: 10.24059/olj.v21i4.1285.

[5] C. Lisa and Y. Lynch, "Blending Online Asynchronous and Synchronous Learning," International Review of Research in Open and Distributed Learning, Vol. 15, No. 2, Apr. pp. 189–212, 2014, DOI: 10.19173/irrodl.v15i2.1778.

[6] M. Oztok et al., "Exploring asynchronous and synchronous tool use in online courses," Computers & Education, Vol. 60, Issue 1, pp. 87-94, 2013, DOI: 10.1016/j.compedu.2012.08.007.

[7] M. M. Archibald et al., "Using Zoom Videoconferencing for Qualitative Data Collection: Perceptions and Experiences of Researchers and Participants," International Journal of Qualitative Methods, Vol. 18, Sept. 2019, DOI: 10.1177/1609406919874596.

[8] P. Lowenthal et al., "Thinking Beyond Zoom: Using Asynchronous Video to Maintain Connection and Engagement During the COVID-19 Pandemic," Journal of Technology and Teacher Education, Vol. 28, No. 2, pp. 383-391, 2020. ERIC Num.: EJ1257171.

[9] D. H. Lee et al., "A Design and Development of the Learning Contents Management based on the Personalized Online Learning," International Journal on Advanced Science, Engineering and Information Technology, Vol. 8, No. 4, pp.1321-1326, 2018, DOI: 10.18517/ijaseit.8.4.5724.

[10] A. I. M. Elfeky et al,. "Advance organizers in flipped classroom via e-learning management system and the promotion of integrated science process skills," Thinking Skills and Creativity, Vol. 35, March 2020, 100622, DOI: 10.1016/j.tsc.2019.100622.

[11] H. Baytiyeh and J. Pfaffman, "Open source software: A community of altruists," Computers in Human Behavior, Vol. 26, Issue 6, pp. 1345-1354, 2010, DOI: 10.1016/j.chb. 2010.04.008.

[12] D. Kim et al., "Exploring student and teacher usage patterns associated with student attrition in an open educational resource-supported online learning platform," Computer & Education, Vol. 156, Oct. 2020. DOI: 10.1016/j.compedu.2020.103961.

[13] C. De Medio et al., "MoodleREC: A recommendation system for creating courses using the moodle e-learning platform," Computers in Human Behavior, vol. 104, Oct. 2019. DOI: 10.1016/j.chb.2019.106168, [Online].

[14] Singleton R., and Charlton A. "Creating H5P Content for Active Learning". Pacific Journal of Technology Enhanced Learning, Vol. 2, no. 1, Nov. 2019, pp. 13-14, doi:10.24135/pjtel.v2i1.32.

[15] H. F. Hasan, M. Nat, and V. Z. Vanduhe, "Gamified Collaborative Environment in Moodle," in IEEE Access, Vol. 7, pp. 89833-89844, 2019, DOI: 10.1109/ACCESS.2019.2926622.

[16] Y. Zhang et al., "Using Learning Analytics to Predict Students Performance in Moodle LMS," International Journal of Emerging Technologies in Learning, Vol. 15 Issue 20, pp. 102-115, 2020, DOI: 10.3991/ijet.v15i20.15915.

[17] C. R. S. Ventura and E. García, "Data mining in course management systems: Moodle case study and tutorial," Computers & Education, Vol. 51, Issue 1, pp. 368-384, 2008, DOI: 10.1016/j.compedu.2007.05.016.

[18] J. R. A. Rodrigues et al., "iQuiz: Integrated assessment environment to improve Moodle Quiz," 2013 IEEE Frontiers in Education Conference, pp. 293-295, 2013. DOI: 10.1109/FIE.2013.6684834.

[19] S. H. P. W. Gamage et al. "Optimising Moodle quizzes for online assessments," International Journal of STEM Education, Vol. 6, Article No. 27, 2019, DOI: 10.1186/s40594-019-0181-4.

[20] T. M. Blas and A. S. Fernández, "The role of new technologies in the learning process: Moodle as a teaching tool in Physics," Computers & Education, Vol. 52, Issue 1, pp. 35-44, 2009, DOI: 10.1016/j.compedu.2008.06.005.