# Construction of a New Learning Motivation Model in an Online Lecture Environment

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## Abstract

In this paper, we discuss the use of information and communication technologies (ICTs) in an online lecture environment to motivate students to learn, as practiced at Advanced Institute of Industrial Technology. Although online lectures are widespread in the field of coronavirus infection disasters, an environment in which interactive communication is further enhanced is crucial to motivate learners and enable them to learn autonomously. Therefore, we propose an ICT-based learning cycle and learning motivation model.

*Keywords:* Learning motivation model, Distance lectures, Autonomous learning

## 1  Introduction

This research aims to establish a new lecture method that realizes digital transformation by utilizing information and communication technologies (ICTs). During the coronavirus disease (COVID-19) pandemic period since 2020, distance lectures were widely implemented not only in Japan but also in the world for emergency education in quarantine. The Advanced Institute of Industrial Technology has conventionally prepared a distance learning environment for students by introducing a Learning Management System (LMS), satellite offices, lecture video distribution systems, and so on. However, considering the challenges posed by the COVID-19 pandemic, all lectures that had previously been given in person were changed to a format that utilizes online conferencing tools. Although the quality of education has been ensured through university-wide efforts, further improvements are needed regarding how to effectively use these tools and how to instruct students. As a result of one such effort, the University was selected for the "Plan for the Advancement of Education at Universities and Colleges of Technology Using Digital Technology," a project subsidized by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) under the FY2020 Subsidy for University Reform Promotion (Digital Education Advancement Project), and is actively working to improve lecture environments that utilize digital technology [1]. The authors are actively working on the development of a digital lecture environment.

As a trial for establishing a method for recording learning instruction and measuring and verifying educational outcomes, we introduced a digital tool that records the results of teamwork and allows instructors and students to freely view and question the results. Furthermore, we aimed not only to increase opportunities for communication between instructors and students, but also to create a lecture environment in which instructors and students can connect interactively, through activities such as sharing insights among students and recording learning activities. As

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we proceeded with this project, we found that it was difficult to expect learning outcomes simply by introducing digital tools. In conclusion, to further boost the learning outcomes, it is necessary to provide incentives to students to actively use digital tools, and thus, the lectures should be designed accordingly.

Based on this insight, this study explores interactive lectures that utilize a discussion support system and a presentation support system, which were introduced as tools to support learning exercises.

## 2    Previous Studies on Learning Models

### 2.1  Self-Regulated Learning Theory

"Self-regulated learning" is a theoretical system in educational psychology that has been proposed by Zimmerman et al. According to Zimmerman's definition, self-regulated learning is the process of systematically arousing and sustaining cognition, behavior, and emotion in order to achieve learning goals [2]. The learner's spontaneous process of achieving the learning goal can be considered to have a significant impact. Therefore, it is not determined by the learner's origin or environment. Self-regulated learning theory involves strategies to promote autonomous learning based on the learner's motivation management. It is believed that a learner become an autonomous learner primarily through a cycle based on the following three steps [2].

1. Establishment of learning objectives

2. Formulation and implementation of learning strategies

3. Self-monitoring of learning progress

The idea is that learning progresses through a cyclical process of returning to Step 1 after reflection and improvement based on the self-monitoring process described in Step 3. In particular, Step 1 assumes that motivational beliefs about the self, such as self-efficacy, expectations for learning outcomes, intrinsic interest, and value of the task, interact with the setting of objectives and the planning of learning strategies as actual actions. In other words, it is assumed that self-efficacy, intrinsic interest, and other factors will influence the level and content of the objectives set, as well as the specifics of the strategy plan.

On the other hand, in Step 3, the results of the actual actions are confirmed by the participants themselves, which provides feedback on self-efficacy based on their sense of satisfaction and self-evaluation. This is assumed to have an impact on motivation in Step 1 in the next cycle. Therefore, in Step 3, if the learning planned and executed in Steps 1 and 2 is successful, or if the learner is satisfied with the results even if they are not successful, factors related to motivation will be stimulated in a positive direction, and the learner's motivation will be influenced in the following cycle. This will lead to a positive cycle of self-improvement of learning outcomes, as the learner is stimulated in a positive direction, and the learning objectives for the next cycle are further enhanced.

## 2.2   Theories of Independence and Autonomy

According to Jung et al., the theories that have supported distance education can be categorized into three positions [3], namely theories of independence and autonomy, theories of industrialization of teaching, and theories of interaction and communication. In this section, we will focus on theories of independence and autonomy. In distance education, unlike face-to-face education, learning cannot proceed passively, following the instructions of a professor who is present. Therefore, while it is not easy for the learner in that it requires active participation, it is possible to view distance education as a learning environment in which the learner can enjoy the benefits of independence and autonomy. The theories of independence and autonomy emphasize this point. This point has been actively advocated as research to confirm the superiority (or not inferiority) of distance education. Moore's theory of exchange distance, which will be introduced in the following section, can also be considered as an attempt to support autonomous learning through dialogue that compensates for the rigidity of education.

## 2.3   Transactional Distance Theory

Transactional distance theory is a theory about distance education proposed by American distance education researcher Michael Moore in the 1970s and is still widely used today [4]. Moore regarded distance education as a pedagogical concept that refers not only to the geographical distance between learners and teachers, but more importantly, to the world of teacher–learner relationships. He then proposed the theory of exchange distance, which theorized the distance between the learner and teacher in terms of psychological rather than geographical distance.

According to Moore, the exchange distance is determined by the highs and lows of dialogue and structure. Dialogue is an interaction between an educator and a learner, and the more intense the dialogue, the shorter the psychological distance. The more intense the dialogue, the greater the psychological distance. Dialogue can be realized not only through direct synchronous interaction, but also through e-mail or postal mail, the immediacy and frequency of which will affect the psychological distance. Structure, on the other hand, indicates the degree to which subject goals, teaching methods, and evaluation methods were robust or flexible (at the time the theory was proposed). The looser the structure, the greater the responsiveness to individual needs; moreover, the more robust the structure, the farther the psychological distance. In other words, the more flexible the structure and the more intense the dialog, the shorter the interaction distance was defined.

Moore also incorporated autonomy, which is essential for learners in distance education, into the exchange distance theory. In particular, he pointed out that distance affects the level of autonomy that learners are expected to have, or are able to exercise. The greater the interaction distance, the less direct instruction the learner will receive; under such circumstances, it can be assumed that the learner will not be able to complete the program without sufficient autonomy. This points out the importance of designing a mechanism to realize appropriate interaction distance in distance education; it provides a framework that can be applied to not only distance education but also face-to-face classroom instruction.

# 3    Necessary Elements for Learning Motivation

Based on previous studies, this section now examines what we believe is necessary to motivate students to learn through the use of ICT.

We initially thought that the introduction of digital tools would increase communication opportunities between instructors and students, and that it would be feasible to create a lecture environment in which instructors and students could connect and interact [4]. However, we realized that it would be difficult to anticipate learning outcomes simply by introducing digital tools. This is because, although the lectures were conducted after informing students that the tools would be actively utilized within the lectures, many students did not know how to effectively utilize the tools and appeared to be searching for ways to make effective use of the tools. This is what Zimmerman et al. mean when they say that learners are not motivated to self-regulate unless the efforts made by the digital tools provide sufficient motivation to them to facilitate the process of spontaneous learning. This suggests that students need incentives to actively use digital tools.

Next, we focus on the relationship between faculty and students in online lectures. Although there are both live and on-demand online lectures, in both formats, faculty members often speak in one direction, and the question-and-answer sessions are seldom active in the lecture. While it is true that the ability to think slowly offline and ask questions based on understanding allows for high-quality questioning, it is not easy for learners to ask questions on the spot. This can be considered as one of the causes of the open mutual dialogue distance that Moore refers to. In this regard, since Moore points out that more immediate and frequent dialogue is what affects the mutual dialogue distance, we can consider that an immediate and frequent educational environment is desirable.

In conclusion, we believe that in order for students to learn autonomously using ICT, incentives to actively use digital tools, an educational environment that allows for immediate and high-frequency interaction, and a smooth dialogue among learners are necessary elements for acquiring an awareness of learning motivation.

# 4    Proposed Learning Motivation Model

## 4.1  Typology of Lecture Types

Before discussing the learning motivation model, we will review the types of lectures. Lecture formats and their terminologies vary across schools and are not standardized. In addition, the term "e-learning" is also used for online lectures, which are not well positioned.

We use the typology of quotes [5] as a basis for discussion (Fig. 1). In the typology of quotations, the horizontal axis is defined as Internet use/non-use, and the vertical axis is classified as synchronous/asynchronous. Synchronous/asynchronous represents whether the exchange is simultaneous or not. For example, the online synchronous teaching mode is one in which lectures are given at a fixed time using a web conferencing system such as Zoom.

Moreover, lectures can be recorded and viewed at any time from a site on the Internet. The asynchronous online class is a lecture mode in which students participate in a lecture by recording the lecture content and viewing it from an Internet site at an arbitrary time. As for the offline format,

the offline and synchronous format corresponds to face-to-face classes in which lectures are given in classrooms. The offline and asynchronous class mode refers to one in which students attend lectures while using content that was conducted on the Internet in the form of paper-based or recording media that can be taken home or mailed.
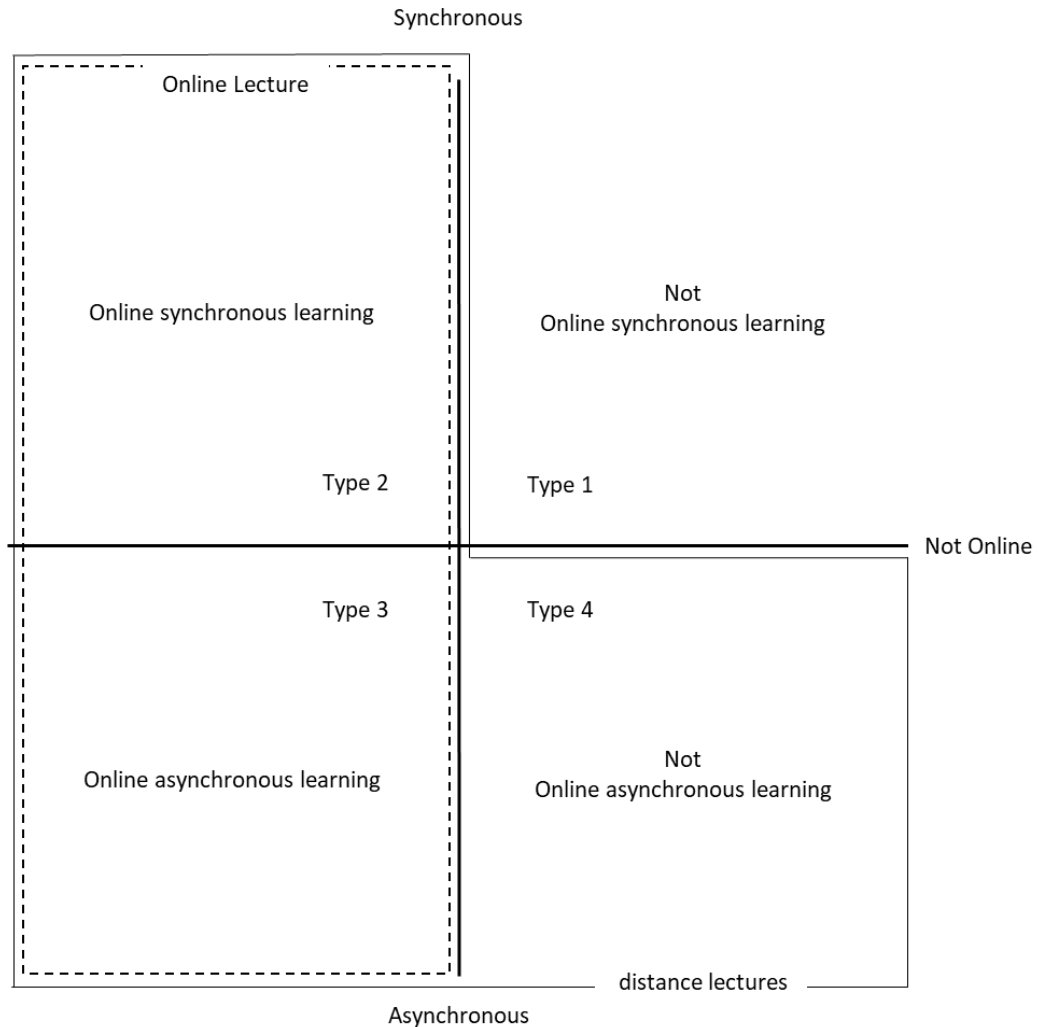


Figure 1: Learning motivation model [5]

Based on the learning motivation model depicted in Fig. 1, we will first examine the problems with the current lecture format.

## 4.2 Typology of Lecture Types

In many conventional face-to-face lectures (classroom or seminar), there is a lack of opportunities for students to actively engage in learning during the period between the lecture and the next lecture, in other words, outside the lecture. There were times when students asked and answered questions about the lecture and only a few times when students engaged in post-lecture discussions with each other. However, such opportunities could not be provided in the online lectures,

and the interactive nature between faculty and students and among students was lost.

Next, there is the problem of time constraints on presentations and discussions during lectures. Until now, presentations on issues have been made and discussed during lectures. In this case, the presentation and discussion had to be done within the limited time allotted to each person or team, and the presentation tended to be extremely short and the question-and-answer session was limited to one or two questions. This can be considered to be due in large part to the time constraint of having to respond within the lecture time.

These problems can occur in any lecture format, but they are more pronounced in online lectures. Therefore, we propose a learning motivation model for online lectures that solves the above problems and encourages students to learn autonomously.

## 4.3 Proposed Learning Motivation Model

Prior to developing the model, we addressed the aforementioned issues.

First, an online forum was introduced as a trigger for students to actively engage in learning during the period between the lecture and the next lecture (i.e., outside the lecture). However, in general, simply providing students with digital tools is not effective, as they are often left to find their own way to use the tools effectively. Therefore, we introduced a mechanism that makes students want to use the tools. Specifically, after the classroom lecture, we seek to prepare an environment in which each group can post threads for working on exercises in the online forum, and the posts in the threads induce questions and answers. Students can discuss their ideas and questions about the exercises in the threads before the exercise lecture or even a few days later. Students who have a high level of understanding of the lectures will be able to actively express their opinions and share information with other students, which in turn will raise the overall level of the participants. Students who lack understanding are expected to ask questions, deepen their understanding, and engage in self-learning by seeking a level of understanding in order to actively participate in the exercises. In this way, by providing opportunities to motivate students to learn in the period between the classroom lecture and the exercise lecture, the system can provide opportunities for students to learn spontaneously, such as preparation for the exercise lecture and review of the classroom lecture.

Next, an online video sharing platform such as YouTube was introduced to solve the problem of time constraints for presentations during lectures and their discussions. By posting the presentations of each student or team on the online video sharing platform, students can watch the presentations at their own convenience and ask questions. They can also watch the presentations repeatedly until they understand them, allowing them to ask more in-depth questions. The presenters will also be able to carefully consider and answer questions, ensuring a well-communicated question-and-answer session. Moreover, it is expected that the questions will not end with one-shot questions, but will trigger further discussions.

Fig. 2 presents a lecture plan that solves the problems discovered above [6]. This plan depicts a learning cycle that is conducted over a one-week period. Although this plan is only one example, its essence is that it aims to create an environment and mechanism for constant learning and to conduct lecture (input) → discussion → exercise (output) → presentation.

| day of week | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| Lectures | Classroom | Out of Lecture | | Exercise | Out of Lecture | | |
| Discussion | | Discussion on Internet | | Face to Face Discussion | | | |
| Presentation | | | | | Review using ICT | | |

After the lectures, students will be able to discuss online and share their presentations in group exercises, creating an environment that allows for seamless learning.Creating an environment for seamless learning
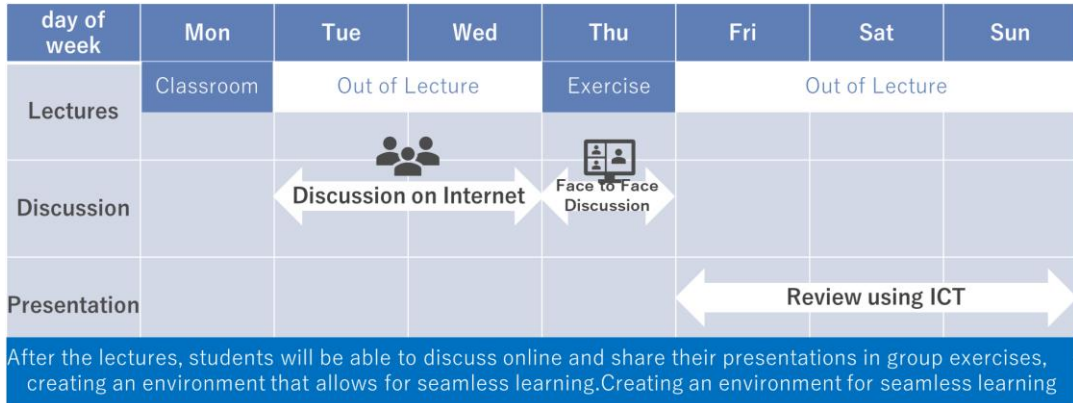
Figure 2: Example of a learning cycle using digital tools [6]

While Fig. 2 shows an example of a learning cycle using digital tools, Fig. 3 depicts a learning motivation model that was developed based on this lecture plan.

Learners collect "information" via input tasks such as lectures. The "information" is then consolidated as knowledge through discussions based on the information, using discussion forums such as online forums as an incentive. This knowledge is then transformed into understanding through output opportunities such as exercises; moreover, through "expression" such as presentations, this understanding becomes an incentive for analysis, synthesis, and evaluation, and can be considered to be sublimated into wisdom.

## 5 Discussion

This section discusses the learning cycle based on our experience and the proposed learning motivation model.

The learning process that we observed in experience is represented by the cycle of learning (input) → discussion → practice (output) → presentation. The learning and discussion in this learning cycle are not only enable meaningful participation for students, but also require thorough preparation and review before participating. The online discussion
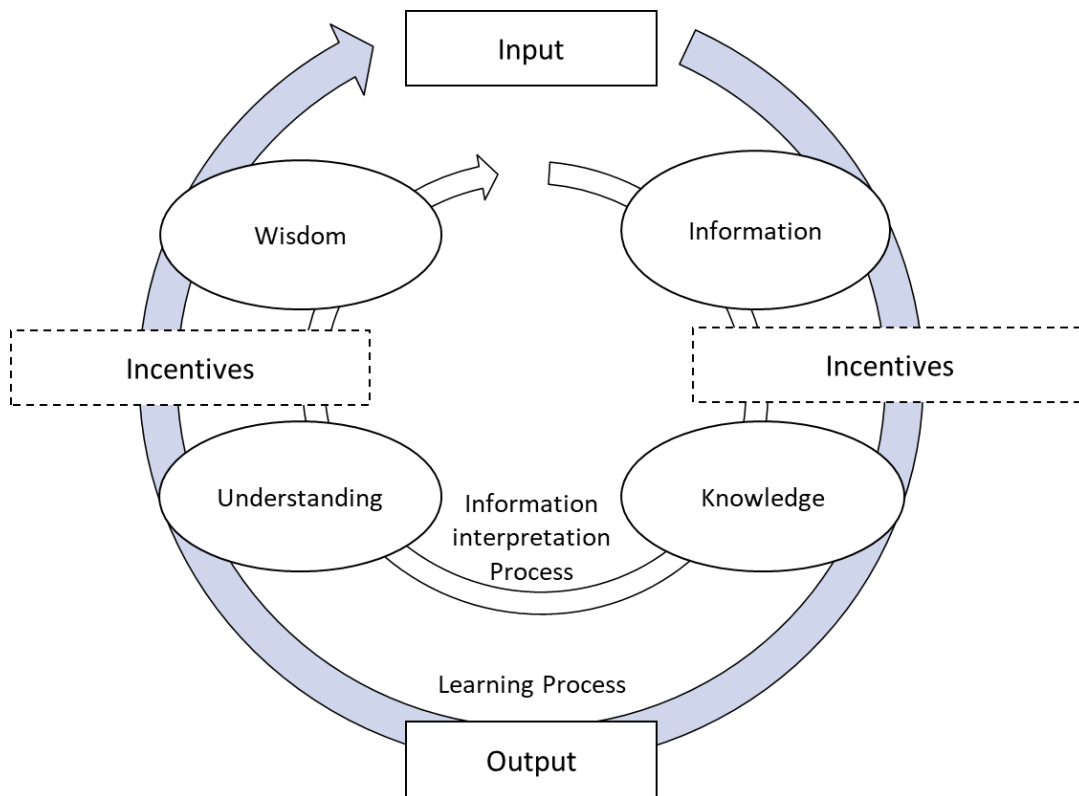
Figure 3: Example of a learning cycle using digital tools [6]

forum and online video sharing platform provide an incentive for students to engage in learning activity and can be considered as a mechanism for motivating students to learn.

As a background for this activity, there exists a utilization process regarding the information that students learn. In informatics, the process of utilizing vast amounts of information is viewed from the four perspectives of Data, Information, Knowledge, and Wisdom (DIKW model); Ackoff argues that in addition to these four perspectives, there is a process of understanding between knowledge and wisdom [7]. Our proposed model includes the understanding process described by Ackoff. In the learning model, data can be considered to be interpreted and provided as information by instructors, and the learning model is constructed based on the four perspectives of information, knowledge, understanding, and wisdom.

When students receive input from instructors in lectures, they are faced with two phases: accepting the input as mere information or storing the information as knowledge. It is reasonable to imagine that some kind of incentive is needed to store the information as knowledge. It is difficult to disseminate information unless each student digests and understands that information as knowledge on their own. For this reason, the ability to transmit one's own understanding and obtain confirmation through the establishment of an online forum is a great incentive for learning. Thus, the forum is expected to function as a window for students who have not fully digested the information to ask questions. In other words, the creation of a function that serves as an incentive for learning between the opportunity for input and output suggests that it may lead to activities for acquiring information as knowledge.

The same can be said for outputs such as exercises. Through exercises, knowledge can be utilized, and this knowledge can lead to a deeper understanding, which in turn can be thought of as leading to a way of thinking that is appropriate for the situation through question-and-answer sessions from information dissemination such as presentations. For this purpose, it is possible to sublimate understanding to wisdom by utilizing online video sharing platforms as a place and incentive.

In sum, it is clear that providing actions as incentives for students to learn at appropriate times in the process from input to output can motivate students to learn. The effectiveness of this approach has not yet been quantitatively clarified, but we are in the process of acquiring data from a questionnaire survey conducted during the implementation of the program, and we will analyze the data to clarify our hypothesis.

# 6    Consideration

In this paper, we proposed a learning motivation model in order to construct a new learning model utilizing ICT. The learning motivation model was developed based on an actual learning cycle and on an analysis of what can be done to motivate students to learn from that cycle. This learning motivation model is based on the DIKW model and shows how students can transform information into wisdom. At present, however, this model is a theoretical study and has not been experimentally proven.

In the future, we would like to clarify the validity of this model by improving the mechanism, and by analyzing the survey data on students' attitudes toward the lecture, and actually verifying the factors that motivate students.

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