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A Study Of Effective Operation and Learning Methods Of Intellectual Property Courses (Apply Core Competency Assessment)

Ju Hyun Jeon

Prof., College of General Education ,Chungang University, Korea
E-mail jhjeon@cau.ac.kr

Abstract

In the Fourth Industrial Revolution era, creative ideas are creating enormous value. This study conducted a case study on curriculum management plans aimed at protecting ideas and their results, recognizing the importance of intellectual property (IP), and cultivating basic knowledge about intellectual property. In particular, this study looked at ways to quickly learn related issues regarding new intellectual property rights related to computer software and artificial intelligence. In addition, research was conducted on ways to learn about efficient protection and utilization of inventions through actual examples. This study checked the importance and necessity of the interaction and communication between instructors and learners through the status of distance learning in domestic universities and a case study of distance learning of convergence subjects. We aim to continuously research effective class management methods and contribute to academic development through case studies of convergence subjects.

Keywords: *Da Vinci Learning, Intellectual Property, Digital Assets, Core Competency Assessment*

1. Introduction

To train talent that will live in the era of the 4th industrial revolution, universities make various efforts. In particular, they attempt to develop comprehensive designs and convergence subjects and apply the appropriate teaching-learning methods so that students can learn the topics based on social demands and promote problem-solving competence. In addition, it is expected that demands for talent with basic knowledge of mathematics and sciences will continuously increase in a future society where cutting-edge science technologies like artificial intelligence, etc. will become common, and the education infrastructure for the characteristics of future generations is still insufficient [1][2]. Especially, a problem was raised that the students taking convergence subjects that included practice had difficulty communicating with instructors. This study checked the importance and necessity of the interaction and communication between instructors and learners through

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Corresponding Author: jhjeon@cau.ac.kr
Tel: +82-2-820-6805, Fax: +82-2-826-6029
Professor, College of General Education, Chungang University, Korea

the status of distance learning in domestic universities and a case study of distance learning of convergence subjects.

Among the issues that universities of science and engineering need to consider, this study can focus on the transfer of knowledge (education), which has the following challenges. In the case of non-face-to-face education, which is one of the methods of knowledge transfer, there are inevitably gaps caused by digital resources when examined in terms of efficiency, despite its many advantages [3]. In the case of digital resources, securing specialized content in addition to content related to existing systems is also a factor that causes gaps. Thus, this study conducted a study on how convergence education can be conducted smoothly in face-to-face and non-face-to-face educational environments by targeting the convergence course "Understanding and Problem-Solving of Digital Assets," a developed course for IP education.

2. Background of the Study

Undergraduate convergence courses prioritize hands-on education, design-oriented content, and field experiences. However, unlike computer-related fields, online classes have yet to be widely adopted in Korea and overseas across other academic disciplines [3]. This has posed challenges for instructors responsible for developing online teaching materials, resulting in lower levels of student satisfaction with the courses. Specifically, students enrolled in convergence courses that involve practical exercises faced difficulties in communicating with their instructors. These communication barriers and disparities contribute to reduced learner satisfaction and a growing educational divide, particularly in the transmission of implicit knowledge. Therefore, it is imperative to explore the potential of educational tools, such as the widely-used online conferencing system (Zoom), in implementing diverse educational approaches, particularly in experimental/laboratory classes. This study conducted a case study on curriculum management strategies applicable to the course "Understanding and Problem-solving of Digital Assets." This course aims to instill an understanding of intellectual property (IP) rights, foster awareness of the significance of protecting ideas and their outputs, and establish fundamental knowledge about IP. Additionally, the study examined methods to support effective learning and evaluated their quantitative impacts.

2.1.1 Flipped Classroom

Flipped Classroom is defined as "an educational method that flips the traditional teaching model on its head, where students listen to teacher-created lectures at home and engage in discussions with teachers and students at school, solving tasks through quizzes, project activities, debates, and more."[2] This educational method shifts the role of the teacher to that of a facilitator rather than a transmitter of knowledge and is based on the philosophy that learning occurs through peer learning, where students work on projects at school and engage in discussions and debates with their peers. [4].

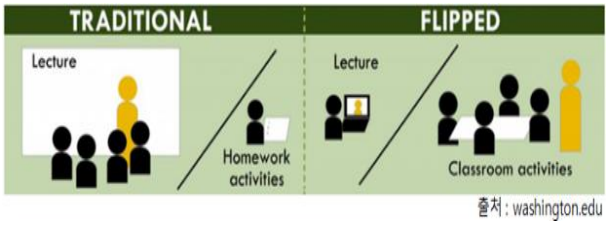


Fig. 1 Comparison between Traditional Lessons and Flipped Learning

Figure 1 illustrates the difference between traditional lessons and flipped learning. It represents a series of processes in which students acquire knowledge through content and learn by communicating with their peers, rather than through one-sided lectures by instructors. For the subject of this study, "Understanding and Problem-Solving of Digital Assets for Intellectual Property Education" at University A, the existing flipped learning methodology was expanded to promote effective convergence education through Da Vinci Learning as follows.

2.1.2 Da Vinci Learning at University A

Da Vinci Learning is a technology-based active learning model for student growth. While utilizing technology as a learning tool, theoretical learning (Pre-class) enhances students' learning initiative, and practical learning (In-class) promotes learning effectiveness through team-based cooperative learning. After-class is a methodology that aims to secure opportunities to apply class contents to the field or real life and promote engagement in all processes of the class. This study examines the application of the Da Vinci Learning model of University A to the operation of an Intellectual Property (IP) course, a convergence subject.

3. The Main Body

This study aimed to develop class contents for smooth convergence education for the developed convergence subjects, actively utilize existing well-made contents in classes, and introduce cases of applying them to student education. 1) This study conducted research on educational tools for the effective operation of non-face-to-face classes; 2) This study focused on the case of University A's operation and studied how to improve it by investigating changes in competencies before and after taking classes. 3) This study aims to provide various learning options for students and spread knowledge sharing to the community.

3.1.1 Checking the details of class implementation

Table 1 contains the Da Vinci Study Syllabus Standards. Details can be found in the standards and reflections in the following table.

In accordance with the Da Vinci Learning syllabus criteria of University A, this study implemented and operated the actual syllabus and class progression to reflect the following contents[5].

Table 1. Da Vinci Learning Syllabus Criteria

Da Vinci Learning Syllabus Criteria	Reflection
1) Does the course provide a variety of learning experiences (e.g., text and video materials, e-classes, applications, etc.) that are appropriate for the course objectives and content?	Providing a variety of learning experiences
2) Are pre-class activities (e.g., pre-class information such as videos or text materials, quizzes, and preliminary assignments) presented?	IP Academy pre-class
3) Is the course organized around teaching and learning methods that promote collaborative learning (e.g., peer teaching, team problem-solving and exercises, discussions and debates, case studies and role plays, problem and task-based learning)?	Da Vinci Classroom
4) Is there at least one post-class teaching and learning method for learning transfer (e.g., mutual feedback between instructors and learners online, inviting experts to the sites, visiting exhibitions and fairs in related fields, etc.)?	Expert teaching with Zoom
5) Does the overall lesson plan consist of activities that engage learners in the Da Vinci Learning courses?	Problem-solving tasks

This study checked whether the above contents were reflected in the syllabus and optimized the content and organization of the syllabus through consulting with three people: one educational engineer and two content experts.

3.1.2 Configuration of the Environment for Da Vinci Learning Activities

Da Vinci Learning Classroom has been organized to apply Da Vinci Learning to convergence subjects as follows. Da Vinci Classroom is a place for active learning that allows learners and instructors to freely participate in the learning process. It is a space with an environment and equipment suitable for implementing various learning activities utilized in Da Vinci Learning, such as lecture/peer teaching, practice, discussion/debate, case study, and PBL. The space can be freely changed and utilized according to the nature of the class in which Da Vinci Learning is applied, and it is characterized by providing a discussion space for collaborative learning among learners. An example of applying a space that supports various learning activities to learning can be found in the Collaborative Learning Studio at Indiana University. [6][7].

Fig. 3 The University's Collaborative Learning Studio built for effective teaching

Figure 3 shows a space that allows learners and instructors to freely participate in the learning process for effective team-based instruction for students in convergence courses. Movable desks and multiple monitors allow students and instructors to facilitate learning.

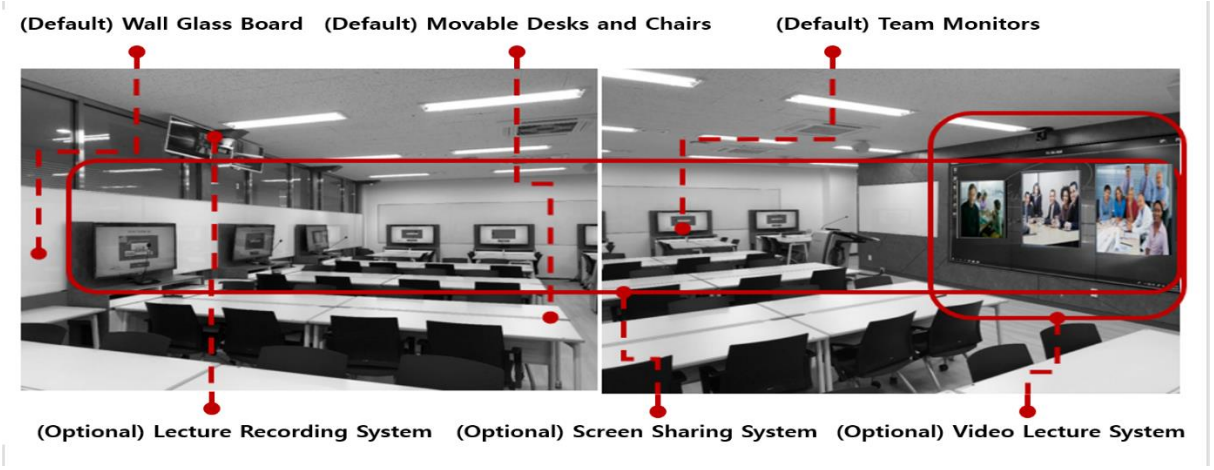


Fig. 4 Da Vinci Classroom where instructors can conduct individual instruction for each team

In the implemented space, as shown in Figure 4, team monitors and screen-sharing systems are supported so that instructors can teach both team-based and individual instruction and all students at the same time. This is a system that can effectively teach when writing research plans and implementing prototypes for each team and individual topic in convergence courses.

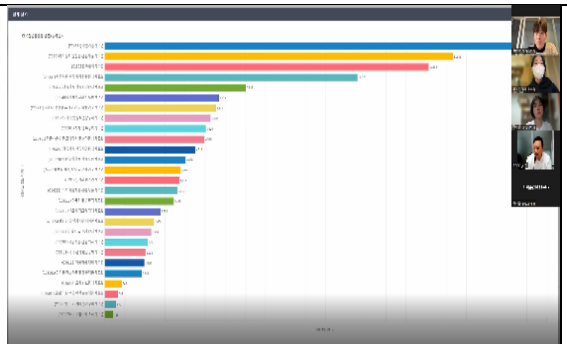
Pre-class with IP Academy	Post-class with experts through Zoom
	

Fig. 5 Progression of pre-class with IP Academy content and expert-engaged post-class

Figure 5 Pre-class with IP Academy content and expert-engaged post-class with Zoom. Students are able to 1) improve their understanding of IP through proven, quality content in the field of intellectual property; 2) refine their ideas through class with their instructors and peer learning; and 3) review their overall learning objectives through post-class meetings and assessments with experts in the industry or field.

Table 2. Achievement of core competencies of IP convergence subjects applying the Da Vinci Learning model

Competency	Definition	Pre-competency	Post-competency	Competency improvement
Creative Convergence	Competency to cross disciplinary boundaries and work across multidisciplinary fields	3.0	4.2	1.2▲
Open Mindedness & Communication	Communication and open-mindedness	3.6	4.2	0.6▲
Innovation & Entrepreneurship	Entrepreneurship to create new knowledge and value	3.1	4.1	1.0▲
Empathy	Competency to empathize and understand industrial and societal issues to uncover real problems	3.5	4.2	0.7▲
Critical Thinking	Competency to create innovative solutions through data analysis, synthesis, and integrated judgment	3.8	4.4	0.6▲
Collaboration	Competency to accept diverse perspectives and collaborate with others in teamwork activities	3.7	4.3	0.6▲

Table 2 shows the achievement level of core competencies in IP convergence subjects applying the Da Vinci Learning model. Competency was measured before and after class, and improvements and changes in competency could be confirmed.

4. Conclusion

The era of the Fourth Industrial Revolution is marked by hyper-connectivity and hyper-intelligence, evolving into a society where everything is interconnected and highly intelligent. With the integration of ICBM (IoT, Cloud, Big Data, Mobile) and AI, individuals, objects, products, and services are becoming interconnected and intelligent, ushering in a technological revolution that impacts industrial structures, employment patterns, and skillsets. It has become crucial for competitiveness to blend domain-specific expertise, data, and algorithms to intelligently generate new value with optimal outcomes. This study focused on assessing the effectiveness of educational tools for both face-to-face and online classes, using the Da Vinci Learning methodology employed by University A as a case study. The research measured the attainment of core competencies in the IP convergence course based on learning objectives and evaluated the level of competency enhancement. We aim to continue this exploration using more comprehensive quantitative and qualitative assessments using proven tools to further confirm the effectiveness of learning and improve accessibility for both instructors and learners on the Da Vinci Learning Platform.

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