

Analyses on the Perception's Differences of Online Teaching Activity according to the Level of Self-Directed Learning in Higher Education Using the IPA Technique

Eunmo SUNG***

Jieun CHOI

Andong National University
Korea

The purpose of this study was to identify learners' perception of teaching activities in online classes that were forcibly switched due to COVID-19, and to compare and analyze differences in importance and performance of online teaching activities according to the level of self-directed learning in university students. To address these goals, 31 university students who took courses operated as online classes at university participated in this study, and the collected data were analyzed according to IPA procedures and methods. As a result, for online teaching activities, class attendance check and encouragement, clarity of class objectives, the ability to deliver the content of learning, and the ability of the instructor to deliver lectures were identified as factors to be constantly emphasized. Depending on the level of self-directed learning, there were significant differences between importance and performance in high level learners' interaction strategy with instructor, interaction strategy with learner, and timely provision of instructor's feedback. On the other hand, there was no significant difference between the importance and performance of online teaching activities for learners with a low level of self-directed learning. Based on these research results, several implications for the design of effective online teaching activities in future university education were proposed.

Keywords: Self-directed learning, Online teaching activity, Higher education, IPA, COVID-19

* Andong National University, Corresponding Author: emsung@anu.ac.kr

Introduction

COVID-19 in 2020 caused many changes in the educational field. The biggest change is that the educational field, which was centered on face-to-face classes, has been completely transformed into online classes such as real-time video conference-based learning and movie-clip based learning. COVID-19 occurred unintentionally, and accordingly, causing many problems in online classes in higher education. In the meantime, instructors who had not experienced online classes had difficulty designing and operating classes, and learners also had difficulty in continuing their own learning in a learning environment physically separated from the instructor because they also lacked experience in online classes(Sung, Choi, & Baek, 2021). However, experts say that even in the post-COVID era when the COVID-19 is over, online classes will have to accept that it is a sweeping and irreversible change in “the era of Untact”(Jeong et al., 2020; Sung, Choi, & Baek, 2021). Therefore, we need to research and apply the core theories that have been dealt with in distance education and specialized knowledge and skills for the operation of educational programs at each level so that they can be universally used in online classes(Lee et al., 2020).

Online classes according to these social changes have also changed the role required of teachers and learners. According to the study by Cho (2020), in the transition to COVID-19 response online classes, instructors must solve the challenge of providing remote guidance to individual students in non-face-to-face situations, and learners are self-directed and active learning that manages learning activities by themselves. In other words, in contrast to taking a face-to-face class in the same physical space, the learner must have the ability to actively learn in a learning environment physically separated from the instructor and peer learners as the situation changes to non-face-to-face as online learning, like distance education. In addition, in the study of Sung, Jin, and Yoo (2016), the learning success of learners in an online learning environment depends on self-directed learning ability, and it is important to provide a prescriptive teaching and learning strategy according to

learner's self-directed learning levels and to configure the learning environment Emphasized. This self-directed learning ability affects learning outcomes in an online learning environment and is supported by research results (Cho, 2020; Hong & Ryu, 2020). As such, self-directed learning ability is an important factor in online learning, and the learner's self-directed learning ability must be considered for effective online instruction.

In this regard, learners who have successfully adapted to the educational environment that has suddenly changed to online teaching and learning due to COVID-19 are often equipped with self-directed learning ability (Bae, 2020; Min, 2020; Hong & Ryu, 2020). Then, how did students with high self-directed learning ability, who have adapted well in this way, perceive online teaching activities, and how did they learn? On the contrary, how did students with low self-directed learning ability perceive the online teaching activities conducted by the instructor, and how did they learn differently from those with high self-directed learning ability? In this way, it can be inferred that their learning performance may differ depending on how they perceive online teaching activities according to their level of self-directed learning (Choi, 2009; Sung, Chae, & Lee, 2019). In other words, if it is possible to predict the recognition and actual performance of teaching activities according to the self-directed learning ability, it is easy to predict that more effective online lessons can be made because the instructor can prescribe strategies appropriate to the learner's characteristics have.

Therefore, this study attempted to compare and analyze learners' perception of online teaching activities according to the level of self-directed learning in higher education in terms of importance and performance of online teaching activities. Research questions for this are as follows.

First, is there a difference between learners' perception of importance and performance of online teaching activities?

Second, is there any difference in importance and performance according to learners' self-directed learning levels in online teaching activities?

Third, is there a difference in the importance and performance of online teaching activities according to learners' self-directed learning levels?

Theoretical background

Current status of online teaching and learning in higher education in the context of COVID-19

Education in the post-COVID-19 era is highly likely to become “new normal” from “Untact” (Jeong et al., 2020). Before COVID-19, there were not many online educations. According to the survey on the e-learning industry (2019), among all e-learning courses at regular education institutions in Korea (excluding cyber universities), the proportion of subjects that only operate online was 31.5% (average 27 subjects) at 4-year universities. In other words, there were not many teachers and learners who experienced online classes. In this situation, due to COVID-19, online classes began in almost all universities, causing a lot of confusion. Contrary to some expectations that online classes will be brief, it has been continuing since 2020. Therefore, there is a growing voice that online class is an essential element rather than an optional element, and that research for better instruction is needed. In other words, it is necessary to accept that the transformation of online classes is an all-out, irreversible change in the era of “untact new normal” (Lee et al., 2020). As the voice of criticism was high while preparing for an online class suddenly (Jeong et al., 2020), we should be able to design and operate better online classes by paying attention to the voices of such criticism.

According to the study by Lee and Kim (2020), many students mentioned as complaints from online classes that the amount of learning increased and that educational effects in online classes could not be properly obtained due to the lack of interaction with instructors or peer learners. They mentioned that in order to

improve this, it is necessary to establish a stable technical support system and improve the function of the learning management system, to prepare standardization for the method and operation of distance classes, to develop appropriate contents necessary for online classes, and to strengthen the teaching capacity of instructors. In addition, according to the study by Ju et al. (2020), learners felt that the quality of classes was low in the initial online classes due to COVID-19, but learners tended to be satisfied and want to participate in online classes as they adjust to the online classes. However, they still had complaints and anxiety about the lack of interaction between learners and learners, and between learners and instructors. In other words, learners are dissatisfied with teaching activities that are different from or lacking in face-to-face classes due to online teaching, but students who try to adapt through active efforts are increasing their participation and satisfaction in online classes. On the other hand, it can be expected that those who do not have a high probability of feeling difficult and dissatisfied with the changed online class.

This can be linked to differences in learners' perceptions of instructors' teaching activities. Learners who have tried to improve and adapt to the discomfort in online classes will have made greater efforts to lead their learning in a better direction in the online learning environment. Since the self-directed learning ability would have been demonstrated in this process, it can be considered in connection with the difference in learners' perceptions of online teaching activities according to the self-directed learning ability.

The role and function of self-directed learning in an online learning environment

Self-directed learning is the initiative of learners to diagnose their learning needs, plan learning goals, identify human and material resources for learning, select and execute appropriate learning strategies, and evaluate learning outcomes regardless of the help of others (Knowles, 1975). Self-directed learning plays an even more

important role in online learning because the learner takes the initiative in the overall process of learning. Moreover, in online learning, the learner must lead the learning entirely by himself without a teacher or peer learner, and the instructor must manage well so that the learners can lead their own learning in an online learning environment. In study of Cho (2020), the instructor must play a role in online classes such as subject learning leader, content (content) expert, content design/developer, school life leader, class (department) manager, system management/problem solver, and learner is a teaching and learning (activity) performer, self-directed learning (activity) Manager, autonomous academic management/life manager, technology problem solver, etc.

Successful online learners are said to have self-directed learning ability to encourage their own learning, manage time and behavior, and learn (Dabbagh, 2007; Hong & Jung, 2011; Moore & Kearsley, 1996; Sung, Jin, & Yoo, 2016). This self-directed learning ability cognitively promotes each learner's learning process in an online learning environment(Lee, 2013), which encourages learners to learn themselves and manages time and behavior properly. In this regard, according to the study by Hong & Ryu (2020), self-directed learning ability affects learning outcomes in an online educational environment, and is one of the important variables that differentiates upper and lower groups in learning outcomes. Learners with high self-directed learning ability can facilitate, manage, and learn their own learning process, but learners with low self-directed learning ability have difficulty promoting the learning process and managing their learning behavior and time than high students. This suggests that more effective online teaching activities can be achieved if customized teaching and learning strategies are used based on the learner's characteristics according to the level of self-directed learning ability. Therefore, in an online learning situation, rather than using the same teaching strategy for all learners, it is necessary for the instructor to use a teaching strategy that is appropriate for the learners' level of self-directed learning ability and accordingly.

Method

Participants

For this study, 31 students who participated in two online classes, which were operated with the same curriculum in the same subject, conducted by the same professor at University A during the first semester of 2020 participated in the online survey. The first semester of 2020 was a time when offline classes were forcibly switched to online classes due to COVID-19. Online classes consisted of 70% (2 hours) online asynchronous class and 30% (1 hour) online synchronous class. Online asynchronous class was centered on movie clips and assignments, and online synchronous class was centered on learners' activities, such as question-and-answer that was done in every class, discussion and debate that was conducted two times with the topic of media debate and educational use of artificial intelligence, and collaborative problem solving that was performed the project on strategies for using web technology in online learning environment for facilitating learning. Participants were 17 males (54.8%) and 14 females (45.2%), and mean of age was 22.48 years (SD=2.65) as the second year of humanities.

Measurements

Measurements tools of this study were consisted of an online learning teaching activity questionnaire, a self-directed learning questionnaire, and a participant questionnaire. The online teaching activity questionnaires comprised 14 items that were adapted and revised from Choi (2009), Park & Sung (2012), Jin, Sung, & Kim (2016), Joung, Han, & Park (2016), Jung & Rha (2004), and Rha (1999). These questionnaires are composed of online teaching activities that can be performed in an online learning environment, but these can also be used in offline teaching activities. The developed questionnaires were a 4-point Likert scales (*with 1=very little*

to 4=*very much*), and responded to importance and performance. Reliability coefficient of importance area was Cronbach $\alpha=.870$, and performance area was Cronbach was $\alpha=.852$, indicating suitable reliability. Table 1 shows items for online teaching activities.

Table 1. Items of Online Teaching Activity

1) Check and encourage class attendance
2) Clarity of class objectives (guide of table of contents and instructional information)
3) Assign appropriate amount of content in instruction and learning
4) Assign appropriate amount of assignment
5) Deliverability and understanding of learning contents (lecture materials)
6) Professor's ability to deliver lecture contents
7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)
8) Strategy for interaction with learners (Q&A, discussion, etc.)
9) Strategies for promoting learners' participation in class (quiz, free bulletin board, comments, etc.)
10) Provide collaborative learning activities with other learners in online class
11) Application of various teaching and learning methods (lecture, cooperation, discussion, PBL, etc.) according to the class goals
12) Timely provision of feedback from instructors (tutors)
13) Guidance to timely provision of peer feedback among learners
14) Timely provision of learning results (tasks and test scores)

The self-directed learning questionnaires consisted of a total of 10 items. Those items were selected based on the questionnaire for self-directed learning competency for university students developed by Sung & Choi (2016). The developed questionnaires were a 4-point Likert scales (with 1=*very little* to 4=*very much*), such as '*Clarifying the learner's own learning goals*', '*Checking notices (tasks, exams, etc.) and information frequently*', '*Learning lecture materials and submitting assignments on time*'. Reliability coefficient of the self-directed learning questionnaires was Cronbach $\alpha=.918$, indicating suitable reliability. Participants' questionnaires were composed of College, Gender, and Age. For this study, a measurement tool was developed online using Google Form.

Data Analysis

The collected data for this study was subjected to an IPA analysis method that analyzes the difference between importance and behavior. First, a paired t-test was conducted to analyze differences in importance and performance perceived by learners in online teaching activities. Second, an independent t-test was conducted to analyze the differences according to learners' self-directed learning levels, which was classified based on 3.49 as the median value, in the importance and performance perceived by learners in online teaching activities. Third, a paired t-test was conducted to analyze differences in importance and performance according to learners' self-directed learning levels in online teaching activities. In addition, the effect size was analyzed in all t-test to facilitate interpretation because the number of cases is insufficient. Cohen (1988) proposed guidelines of effect sizes for group differences research as Cohen's $d = 0.20$ 'small effect', 0.50 'medium effect', and 0.80 'large effect'. Finally, the importance and performance of online teaching activities were analyzed according to the IPA analysis method procedure according to the level of self-directed learning. IPA is a simple graphical tool to further the development of effective marketing strategies based on judgments of the importance and performance of each attribute (Martilla & James, 1977). The first quadrant is an area where items with high importance and performance are located and is a 'Keep up the good work' area that continuously produces good results. The second quadrant is an area in which items of high importance but low performance are located, and is a 'Concentrate here' area that should pay attention first. The third quadrant is an area where items with low importance and performance are located, and is a 'Low priority' area with a low priority. The fourth quadrant is an area in which items of low importance and high performance are located, and corresponds to the 'Possible overkill' area.

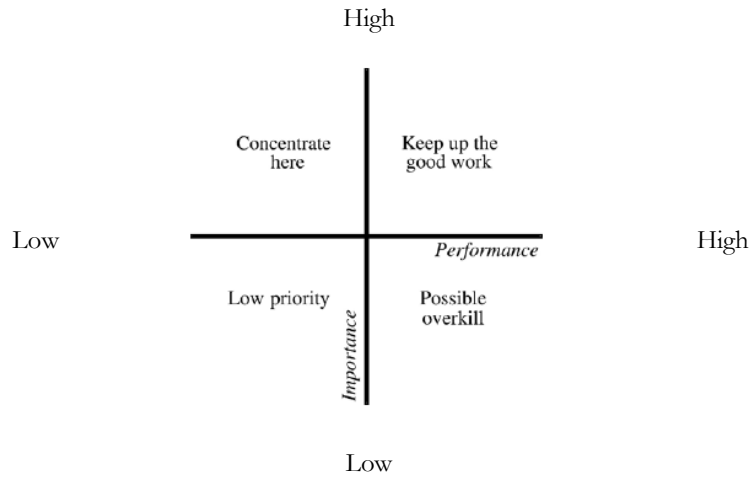


Figure. 1. Important – Performance Matrix as IPA grid (Martilla & James, 1977).

Result

Analysis of differences in importance and performance of online teaching activities

Paired t-test was conducted to analyze the difference in importance and performance perceived by learners in online teaching activities, and the results are shown in Table 2.

In the Table 2, ‘6) Professor's ability to deliver lecture contents (M=3.84, SD=.37)’ was considered the most important in the importance of online teaching activities, and ‘5) Deliverability and understanding of learning contents(M=3.81, SD=.48)’, and ‘2) Clarity of class objectives(M=3.61, SD=.56)’, and so on, and ‘13) Timely provision of peer feedback among others. learners(M=2.58, SD=1.12)’ has the lowest importance, and ‘10) Provide collaborative learning activities with other learners in online class(M=3.23, SD=.99)’ and ‘14) Timely provision of learning results (M=3.39, SD=.72)’ were low.

Table 2. Analysis of differences in importance and performance of online teaching activities

Teaching Activity	Importance (n=31)		Performance (n=31)		<i>t</i> (<i>d</i>)
	M	SD	M	SD	
Total	3.47	0.41	3.36	0.49	-1.79 (<i>d</i> =.27)
1) Check and encourage class attendance	3.58	0.67	3.55	0.72	-0.24 (<i>d</i> =.04)
2) Clarity of class objectives (guide of table of contents and instructional information)	3.61	0.56	3.68	0.60	1.00 (<i>d</i> =.13)
3) Assign appropriate amount of content in instruction and learning	3.58	0.67	3.65	0.55	0.81 (<i>d</i> =.10)
4) Assign appropriate amount of assignment	3.45	0.77	3.55	0.77	1.00 (<i>d</i> =.13)
5) Deliverability and understanding of learning contents (lecture materials)	3.81	0.48	3.65	0.66	-1.72 (<i>d</i> =.33)
6) Professor's ability to deliver lecture contents	3.84	0.37	3.71	0.59	-1.28 (<i>d</i> =.35)
7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)	3.55	0.51	3.19	0.83	-2.99** (<i>d</i> =.90)
8) Strategy for interaction with learners (Q&A, discussion, etc.)	3.48	0.68	3.16	0.82	-2.75** (<i>d</i> =.47)
9) Strategies for promoting learners' participation in class (quiz, free bulletin board, comments, etc.)	3.48	0.68	3.26	0.77	-1.75 (<i>d</i> =.32)
10) Provide collaborative learning activities with other learners in online class	3.23	0.99	3.16	1.00	0.44 (<i>d</i> =.07)
11) Application of various teaching and learning methods (lecture, cooperation, discussion, PBL, etc.) according to the class goals	3.45	0.68	3.13	0.96	1.98* (<i>d</i> =.47)
12) Timely provision of feedback from instructors (tutors)	3.55	0.68	3.19	0.83	-2.62** (<i>d</i> =.53)
13) Guidance to timely provision of peer feedback among learners	2.58	1.12	2.97	1.11	2.44* (<i>d</i> =.35)
14) Timely provision of learning results (tasks and test scores)	3.39	0.72	3.16	0.78	-1.65 (<i>d</i> =.32)

* $p < .05$, ** $p < .01$

In terms of performance, '6) Professor's ability to deliver lecture contents (M=3.71, SD=.59)' was the highest, and '2) Clarity of class objectives (M=3.68, SD=.60)', '3) Assign appropriate amount of content in instruction and learning (M=3.65, SD=.66)' and '5) Deliverability and understanding of learning contents (M=3.65, SD=.60)' were high, and '13) Guidance to timely provision of peer feedback among learners (M=2.97, SD=1.11)' was the lowest, and '11) Application of various teaching and learning methods according to the class goals (M=3.13, SD=.96)', '8) Strategy for interaction with learners (M=3.16, SD=.82)', '10) Provide collaborative learning activities with other learners in online class (M=3.16, SD=1.00)', '14) Timely provision of learning results (M=3.16, SD=.78)' were low.

As a result of analyzing whether the difference between the importance and the performance average of such online teaching activities is significant, '7) Strategy for interaction with instructors (t=-2.99, d=.90 'large effect')', '8) Strategy for interaction with learners (t=-2.75, d=.47 'medium effect')' and '12) Timely provision of feedback from instructors (t=-2.62, d=.53 'medium effect')' showed significantly higher importance than performance at $p < .05$ level. In addition, '13) Guidance to timely provision of peer feedback among learners (t=2.44, d=.35 'small effect')' showed significantly higher performance than importance with $p < .05$. As a result of the effect size analysis, it was found that learners perceived the '7) Strategy for interaction with instructors' activity as the most important online teaching activity.

Analysis of differences at the level of self-directed learning in the importance and performance of online teaching activities

An independent t-test was conducted to analyze the differences at the level of self-directed learning in the importance and performance perceived by learners in online teaching activities are shown in Table 3.

Table 3. Analysis of differences at the level of self-directed learning in the importance and performance of online teaching activities

Teaching Activity	Level of SDL	Importance (n=31)			Performance (n=31)		
		M	SD	t (d)	M	SD	t (d)
Total	High	3.71	0.59	1.15	3.82	0.53	2.54*
	Low	3.43	0.76	(d=.37)	3.21	0.80	(d=.76)
1) Check and encourage class attendance	High	3.71	0.59	1.15	3.82	0.53	2.54*
	Low	3.43	0.76	(d=.37)	3.21	0.80	(d=.76)
2) Clarity of class objectives (guide of table of contents and instructional information)	High	3.82	0.39	2.51**	3.88	0.33	2.23*
	Low	3.36	0.63	(d=.73)	3.43	0.76	(d=.59)
3) Assign appropriate amount of content in instruction and learning	High	3.82	0.53	2.38*	3.82	0.53	2.10*
	Low	3.29	0.73	(d=.73)	3.43	0.51	(d=.75)
4) Assign appropriate amount of assignment	High	3.65	0.61	1.60	3.71	0.77	1.27
	Low	3.21	0.89	(d=.49)	3.36	0.74	(d=.47)
5) Deliverability and understanding of learning contents (lecture materials)	High	4.00	0.00	2.75**	3.82	0.53	1.71
	Low	3.57	0.65	(d=.66)	3.43	0.76	(d=.63)
6) Professor's ability to deliver lecture contents	High	4.00	0.00	2.97**	3.82	0.53	1.20
	Low	3.64	0.50	(d=.86)	3.57	0.65	(d=.38)
7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)	High	3.53	0.51	-0.23	3.12	0.86	-0.55
	Low	3.57	0.51	(d=.07)	3.29	0.83	(d=.20)
8) Strategy for interaction with learners (Q&A, discussion, etc.)	High	3.53	0.62	0.41	3.06	0.90	-0.76
	Low	3.43	0.76	(d=.13)	3.29	0.73	(d=.32)
9) Strategies for promoting learners' participation in class (quiz, free bulletin board, comments, etc.)	High	3.53	0.62	0.41	3.35	0.79	0.75
	Low	3.43	0.76	(d=.13)	3.14	0.77	(d=.27)
10) Provide collaborative learning activities with other learners in online class	High	3.18	1.19	-0.30	3.18	1.13	0.09
	Low	3.29	0.73	(d=.15)	3.14	0.86	(d=.05)
11) Application of various teaching and learning methods (lecture, cooperation, discussion, PBL, etc.) according to the class goals	High	3.59	0.71	1.25	3.29	0.99	1.06
	Low	3.29	0.61	(d=.49)	2.93	0.92	(d=.39)
12) Timely provision of feedback from instructors (tutors)	High	3.76	0.56	2.07*	3.35	0.79	1.18
	Low	3.29	0.73	(d=.64)	3.00	0.88	(d=.40)
13) Guidance to timely provision of peer feedback among learners	High	2.71	1.26	0.68	3.12	1.22	0.82
	Low	2.43	0.94	(d=.30)	2.79	0.97	(d=.34)
14) Timely provision of learning results (tasks and test scores)	High	3.71	0.69	3.10**	3.41	0.80	2.08*
	Low	3.00	0.55	(d=1.29)	2.86	0.66	(d=.83)

* $p < .05$, ** $p < .01$

In the Table 3, as a result of analyzing the difference at the level of self-directed learning in the importance of online teaching activities, learners with a high level of self-directed learning were '5) Deliverability and understanding of learning contents($t=2.75$, $p<.05$, $d=.66$ 'medium effect')', '6) Professor's ability to deliver lecture contents($t=2.97$, $p<.05$, $d=.86$ 'large effect')', '3) Assign appropriate amount of content in instruction and learning($t=2.38$, $p<.05$, $d=.73$ 'large effect')', '12) Timely provision of feedback from instructors($t=2.07$, $p<.05$, $d=.64$ 'medium effect')', and '14) Timely provision of learning results ($t=3.10$, $p<.05$, $d=1.29$ 'large effect')' were significantly higher than learners with a low level of self-directed learning with $p<.05$. As a result of the effect size analysis, it was found that learners with high level of self-directed learning perceived the activities of '14) Timely provision of learning results (tasks and test scores)' and '6) Professor's ability to deliver lecture contents' most importantly.

As a result of analysis of differences according to the level of self-directed learning in the performance of online teaching activities, learners with high self-directed learning levels are '1) Check and encourage class attendance ($t=2.54$, $p<.05$, $d=.76$ 'large effect')', '2) Clarity of class objectives ($t=2.23$, $p<.05$, $d=.59$ 'medium effect')', '3) Assign appropriate amount of content in instruction and learning ($t=2.10$, $p<.05$, $d=.75$ 'large effect')', '14) Timely provision of learning results ($t=2.08$, $p<.05$, $d=.83$ 'larger effect')' was significantly higher than learners with a low level of self-directed learning with $p<.05$. As a result of the effect size analysis, it was found that learners with high level of self-directed learning performed the '14) Timely provision of learning results (tasks and test scores)' and '1) Check and encourage class attendance' activities best. As a result of the effect size analysis, learners with a high level of self-directed learning highly performed in '14) Timely provision of learning results (tasks and test scores)' and '1) Check and encourage class attendance'.

Analysis of differences in importance and performance of online teaching activities according to the level of self-directed learning

A paired t-test was conducted to analyze the difference in importance and

performance according to the learners' self-directed learning level in online teaching activities, and the results are shown in Table 4.

Table 4. Analysis of differences in importance and performance of online teaching activities according to the level of self-directed learning

Teaching Activity	Performance-Importance	High Level of SDL (n=17)			Low Level of SDL (n=14)		
		M	SD	t (d)	M	SD	t (d)
Total	Performance	3.48	0.50	-1.47	3.20	0.45	-1.01
	Importance	3.61	0.39	(d=.26)	3.30	0.39	(d=.22)
1) Check and encourage class attendance	Performance	3.82	0.53	0.62	3.21	0.80	-1.15
	Importance	3.71	0.59	(d=.21)	3.43	0.76	(d=.28)
2) Clarity of class objectives (guide of table of contents and instructional information)	Performance	3.88	0.33	1.00	3.43	0.76	0.56
	Importance	3.82	0.39	(d=.18)	3.36	0.63	(d=.09)
3) Assign appropriate amount of content in instruction and learning	Performance	3.82	0.53	0.00	3.43	0.51	1.00
	Importance	3.82	0.53	(d=.0)	3.29	0.73	(d=.27)
4) Assign appropriate amount of assignment	Performance	3.71	0.77	0.57	3.36	0.74	0.81
	Importance	3.65	0.61	(d=.08)	3.21	0.89	(d=.20)
5) Deliverability and understanding of learning contents (lecture materials)	Performance	3.82	0.53	-1.38	3.43	0.76	-1.00
	Importance	4.00	0.00	(d=.34)	3.57	0.65	(d=.18)
6) Professor's ability to deliver lecture contents	Performance	3.82	0.53	-1.38	3.57	0.65	-0.43
	Importance	4.00	0.00	(d=.34)	3.64	0.50	(d=.11)
7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)	Performance	3.12	0.86	-2.75*	3.29	0.83	-1.47
	Importance	3.53	0.51	(d=.48)	3.57	0.51	(d=.34)
8) Strategy for interaction with learners (Q&A, discussion, etc.)	Performance	3.06	0.90	-2.43*	3.29	0.73	-1.47
	Importance	3.53	0.62	(d=.52)	3.43	0.76	(d=.19)
9) Strategies for promoting learners' participation in class (quiz, free bulletin board, comments, etc.)	Performance	3.35	0.79	-1.00	3.14	0.77	-1.47
	Importance	3.53	0.62	(d=.23)	3.43	0.76	(d=.38)
10) Provide collaborative learning activities with other learners in online class	Performance	3.18	1.13	0.00	3.14	0.86	-0.81
	Importance	3.18	1.19	(d=.0)	3.29	0.73	(d=.17)

11) Application of various teaching and learning methods (lecture, cooperation, discussion, PBL, etc.) according to the class goals	Performance	3.29	0.99	-1.77 (<i>d</i> =.30)	2.93	0.92	-1.16 (<i>d</i> =.39)
	Importance	3.59	0.71		3.29	0.61	
12) Timely provision of feedback from instructors (tutors)	Performance	3.35	0.79	-2.38* (<i>d</i> =.39)	3.00	0.88	-1.30 (<i>d</i> =.33)
	Importance	3.76	0.56		3.29	0.73	
13) Guidance to timely provision of peer feedback among learners	Performance	3.12	1.22	1.95 (<i>d</i> =.34)	2.79	0.97	1.44 (<i>d</i> =.37)
	Importance	2.71	1.26		2.43	0.94	
14) Timely provision of learning results (tasks and test scores)	Performance	3.41	0.80	-1.57 (<i>d</i> =.38)	2.86	0.66	-0.69 (<i>d</i> =.21)
	Importance	3.71	0.69		3.00	0.55	

* $p < .05$, ** $p < .01$

In the Table4, there was a significant difference between importance and performance at the $p < .05$ level; ‘7) Strategy for interaction with instructors ($t = -2.75$, $p < .05$, $d = .48$ ‘medium effect’), ‘8) Strategy for interaction with learners ($t = -2.43$, $p < .05$, $d = .52$ ‘medium effect’), and ‘12) Timely provision of feedback from instructors ($t = 2.38$, $p < .05$, $d = .39$ ‘small effect’)’. On the other hand, for learners with low self-directed learning level, there was no significant difference between the importance and performance of teaching activities. As a result of the effect size analysis, learners with a high level of self-directed learning showed a higher difference in importance than performance in ‘8) Strategy for interaction with learners (Q&A, discussion, etc.)’ and ‘7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)’.

Matrix analysis of importance and performance according to self-directed learning level in online teaching activities

In online teaching activities, after IPA analysis was performed using the average value of importance and performance according to self-directed learning level, matrix

Analyses on the Perception's Differences of Online Teaching Activity according to the Level of Self-Directed Learning in Higher Education Using the IPA Technique

analysis was conducted. The result is shown in Figure 2.

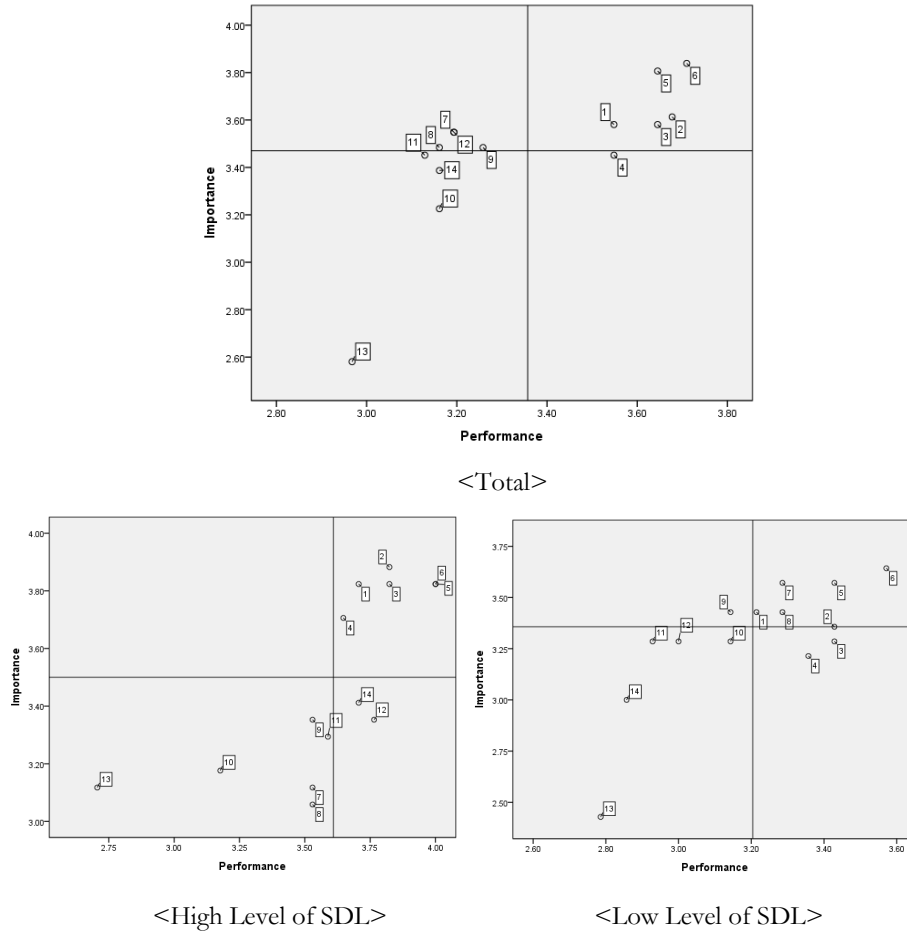


Figure 2. Matrix analysis of importance and performance in online teaching activities according to the level of self-directed learning

In the Total Matrix in Figure 1, teaching activities such as 1), 2) 3), 5), 6) belong to the 1st quadrant (Keep up good work) with high importance and high performance, with high importance and high performance. In the low 2nd quadrant (Concentrate here), teaching activities such as 7), 8), 9) 12) belong, and the 3rd quadrant (Low priority) with low importance and low performance 10), 11), 13), 14), etc., and 4) teaching activities belonged to the 4th quadrant (Possible overkill) with low

importance and high performance.

The high level of SDL on Matrix, teaching activities such as 1), 2) 3), 4), 5), 6) belong to the 1st quadrant (Keep up good work), and teaching activities that belong to the 2nd quadrant (Concentrate here) did not appear. In the 3rd quadrant (Low priority), 7), 8), 9), 10), 11), 13) belonged to the teaching activities, and the 4th quadrant (Possible overkill) included 12), 14) teaching activities.

The Low level of SDL on Matrix, teaching activities such as 1), 2) 5), 6), 7), and 8) belong to the 1st quadrant (Keep up good work), and the 2nd quadrant (Concentrate here) includes 9). Teaching activities belong, and teaching activities such as 10), 11), 12), 13), 14) belong to the 3rd quadrant (Low priority), and 3), 4) teaching activities are included in the 4th quadrant (Possible overkill). Belonged to.

The results of the matrix that analyzed the importance and performance of online teaching activities according to the level of self-directed learning are compared and summarized as shown in Table 5.

In the Table 5, when looking at the teaching activities that belong to the three areas in common, there were teaching activities such as 1), 2), 5), and 6) in the 1st quadrant (Keep up good work) with high importance and high performance. There was no common factor in the 2nd quadrant (Concentrate here) with high and low performance, and the 3rd quadrant (Low priority) with low importance and low performance includes teaching activities such as 10), 11), and 13). There was no common factor in the low and high performance in 4th quadrants (Possible overkill).

Table 5. Results of comparative analysis of the importance-performance matrix results in online teaching activities according to the level of self-directed learning

Quadrant	Total	High Level of SDL	Low Level of SDL
Quadrant I (Keep up the Good work)	1) Check and encourage class attendance	1) Check and encourage class attendance	1) Check and encourage class attendance
	2) Clarity of class objectives (guide of table of contents and instructional information)	2) Clarity of class objectives (guide of table of contents and instructional information)	2) Clarity of class objectives (guide of table of contents and instructional information)
	3) Appropriate amount of content in instruction and learning	3) Appropriate amount of content in instruction and learning	
		4) Appropriate amount of assignment	
	5) Deliverability and understanding of learning contents (lecture materials)	5) Deliverability and understanding of learning contents (lecture materials)	5) Deliverability and understanding of learning contents (lecture materials)
	6) Professor's ability to deliver lecture contents	6) Professor's ability to deliver lecture contents	6) Professor's ability to deliver lecture contents
Quadrant II (Concentrate Here)			7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)
			8) Strategy for interaction with learners (Q&A, discussion, etc.)
	7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)		
	8) Strategy for interaction with learners (Q&A, discussion, etc.)		
	9) Strategies for promoting learners' participation in class (quiz, free bulletin board, comments, etc.)		9) Strategies for promoting learners' participation in class (quiz, free bulletin board, comments, etc.)
12) Timely provision of feedback from instructors (tutors)			

		7) Strategy for interaction with instructors (Q&A, discussion, online learning counseling, etc.)	
		8) Strategy for interaction with learners (Q&A, discussion, etc.)	
		9) Strategies for promoting learners' participation in class (quiz, free bulletin board, comments, etc.)	
Quadrant III (Low Priority)	10) Collaborative learning activities regardless of time and space with other learners	10) Collaborative learning activities regardless of time and space with other learners	10) Collaborative learning activities regardless of time and space with other learners
	11) Application of various teaching and learning methods (lecture, cooperation, discussion, PBL, etc.) according to the class goals	11) Application of various teaching and learning methods (lecture, cooperation, discussion, PBL, etc.) according to the class goals	11) Application of various teaching and learning methods (lecture, cooperation, discussion, PBL, etc.) according to the class goals
			12) Timely provision of feedback from instructors (tutors)
	13) Timely provision of peer feedback among learners	13) Timely provision of peer feedback among learners	13) Timely provision of peer feedback among learners
	14) Timely provision of learning results (tasks and test scores)		14) Timely provision of learning results (tasks and test scores)
	Quadrant IV (Possible Overkill)		
4) Appropriate amount of assignment			4) Appropriate amount of assignment
		12) Timely provision of feedback from instructors (tutors)	
		14) Timely provision of learning results (tasks and test scores)	

Discussion and conclusion

The purpose of this study was to identify learners' perception of teaching activities in online classes that were forcibly switched due to COVID-19, and to compare and analyze differences in importance and performance of online teaching activities according to learners' self-directed learning levels. Based on the results of this study, it was intended to establish a basis for guidelines and directions for guiding and prescribing teaching activities in online classes that will be continuously developed in the future. To address these goals, the IPA method was employed to analyze the perceptions of learners with high and low level of self-directed learning about online teaching activities to derive implications. Based on the results of this study, the discussion is as follows.

First, '6) Professor's ability to deliver lecture contents' was considered the most important in the importance of online teaching activities, and '13) learners provided timely peer feedback' was the least important. In terms of performance, '6) Professor's ability to deliver lecture contents' was the highest, and '13) Guidance to timely provision of peer feedback among learners' was the lowest. As a result of analyzing the difference between the importance and performance of online teaching activities, '7) Strategy for interaction with instructors', '8) Strategy for interaction with learners', and '12) Timely provision of feedback from instructors' In the case of '13) Guidance to timely provision of peer feedback among learners', the importance was significantly higher than the importance. In other words, in the online teaching activities, the interactions with the instructor and the interactions with learners were not as active as they considered important. In addition, it was identified that peer feedback among learners was considered less important, but was higher in actual activities. In general, the interaction between instructors and learners, learners and learners in a distance learning environment is regarded as one of the variables that have an important influence on learning outcomes (Jung & Rha, 2004; Moore & Kearsley, 2005). However, interactions in online classes due to COVID-19 appear

small, and it is understood that the use of online learning contents for lectures and the delivery of lecture contents by instructors accordingly take up an important weight. This may be a testament to the lack and inadequate preparation of the instructor's online teaching activity design in unprepared online classes (Sung, Choi, Baek, 2021). Therefore, when designing teaching activities in online classes in the future, it seems necessary to have a strategy to further enhance the interaction between instructors and learners and learners and learners.

Second, it was analyzed whether there is a difference in the importance and performance of online teaching activities according to the learners' level of self-directed learning. This is because the learner's self-directed learning ability is regarded as the most important factor for successful learning in an online learning environment (Sung, Jin, & Yoo, 2016). As a result, in terms of importance, '5) Deliverability and understanding of learning contents', '6) Professor's ability to deliver lecture contents', '3) Assign appropriate amount of content in instruction and learning', '12) Timely provision of feedback from instructors', and '14) Timely provision of learning results', the learners with high level of self-directed learning were significantly higher than those with low level of self-directed learning. In terms of performance, self-directed learning in '1) Check and encourage class attendance', '2) Clarity of class objectives', '3) Assign appropriate amount of content in instruction and learning', '14) Timely provision of learning results' Higher level learners were found to be significantly higher than lower level of learners.

There was a difference in the importance and performance of online class activities according to the learner's self-directed learning level. In terms of importance, learning contents and instructor's lecture delivery ability were found in learners with high self-directed learning level. On the other hand, there was no difference in performance, and in actual teaching activities, the meta-cognitive strategy for behavior management and performance management, such as the appropriateness of the learner's class goals and contents, and the timely provision of class attendance and learning results. Therefore, it was confirmed that learners with a high level of self-directed learning

had high performance. In other words, it was confirmed that the content of the lecture is important for learners with high level of self-directed learning, but cognitive strategies and behavior management strategies work better in actual performance.

This is based on previous research findings that learners with a high level of self-directed learning ability in an online learning environment check their learning goals, check the learning process and achievements, and control their efforts (Jong Man Lee, 2011; Kyung Ae Choi, 2009; Zimmerman & Risemberg, 1997). However, in a situation where preparation for online classes was insufficient due to COVID-19, interactions between instructors and learners, learners and learners were insufficient, and the amount of learning increased, resulting in self-directed learning ability. The learning burden of insufficient learners' increases, and it cannot be ruled out that learners with high self-directed learning ability learned more strategically. Therefore, it is highly likely that learners with high self-directed learning ability showed their ability in online classes, but rather became a very difficult learning environment for learners with low self-directed learning ability (Sung, Choi, Baek, 2021). In this study, a more systematic online teaching activity needs to be designed in consideration of the learner's level of self-directed learning.

Finally, the difference between importance and behavioral behavior of online teaching activities according to the level of self-directed learning was analyzed. As a result, importance and performance in '7) Strategy for interaction with instructors', '8) Strategy for interaction with learners', and '12) Timely provision of feedback from instructors' for learners with a high level of self-directed learning. There was a significant difference between the learners. On the other hand, for learners with low self-directed learning level, there was no significant difference between the importance and performance of teaching activities. The result to be noted here is that learners with a high level of self-directed learning perceived that teachers and learners, interactions between learners and learners, and feedback from instructors were important, but their actual performance was low.

Despite the fact that there is a relationship that requires high performance as

important as it is, it is possible that the interaction activity in the relevant learning process acted as a variable that did not significantly affect the learning outcome, and thus learners with high self-directed learning level avoided it. In a study by Choi (2009), it was also reported that the interactions of learners with high self-direction were the lowest than those with medium or low self-direction. This is probably because the nature of the online learning environment is highly self-directed, and learners recognized that learning alone using lecture contents was a more important learning outcome. Therefore, in terms of interactivity, it is possible to confirm the implication that it is necessary to actively encourage learners with high level of self-directed learning.

Overall, for successful online teaching activities in higher education, class attendance check and encouragement, clarity of class objectives, ability to deliver learning contents, and instructor's ability to deliver lectures were identified as factors that should be continuously emphasized. In addition, the interaction between the instructor and the learner and the learner was recognized as important by the learners with low level of self-directed learning in terms of the effectiveness of education, and the performance was also high. Especially, instructors who teach in online learning environments should consider the designing strategies for teaching activities in order to increase learner's participation with the low level of self-directed learning such as strategies to increase learner's engagement (quizzes, writing free bulletin boards, posting opinions, etc.), collaborative learning activities with other learners, application of various teaching-learning methods (lecture, cooperation, cooperation, discussion and discussion, PBL, etc.), strategies for providing immediate feedback from instructors, and etc (Dixon, 2010; Gayton & McEwen, 2007; Martin & Bolliger, 2018). However, it was confirmed that it is necessary to encourage active participation of learners with high level of self-directed learning, because learners with high level of self-directed learning are more likely to appear low in importance and performance. Despite these findings, it is difficult to generalize these findings due to the limited number of cases. In addition, the results of this study may vary

depending on the context of the online class what teaching activities are designed and provided according to the characteristics of the subject. Therefore, in order to compensate for this, it is expected that research results in various aspects can be derived by collecting and analyzing more cases in the future, or by collecting and analyzing qualitative data from instructors and learners.

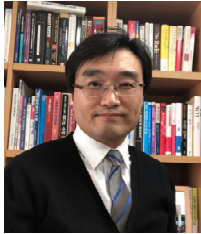
Even if the COVID-19 outbreak stabilizes in the future, online education is not an option, but is likely to become an essential education method, or as an education method that must be conducted in parallel with face-to-face education. In this situation, however, the results of this study are expected to be of little help to teachers and learners who plan to design and operate online teaching activities in the future.

References

- Bae, S. H. (2020). *Corona 19's impact on Korean universities and futureTasks*. Proceedings 2020 conference of Korean Educational Research Association.
- Cho, E. S. (2020). Untact classes in post COVID-19: The roles and challenges of educational technology. *Journal of Educational Technology*, 36(3), 693-713.
- Choi, K. A. (2009). Relationship between the use of learning strategies and adult learners' self-directedness in e-Learning. *The Journal of Korean Education*, 36(2), 137-163.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillside, NJ: Lawrence Erlbaum Associates.
- Dabbagh, N. (2007). The online learner : Characteristics and pedagogical implications. *Contemporary Issues in Technology and Teacher Education*, 7(3), 217-226.
- Dixon, M. D. (2010). Creating effective student engagement in online courses: What do students find engaging? *Journal of the Scholarship of Teaching and Learning*, 10(2), 1-13.
- Gayton, J., & McEwen, B. C. (2007). Effective online instructional and assessment strategies. *American Journal of Distance Education*, 21(3), 117-132.
- Hong, S. Y., & Ryu, Y. J. (2020). Factors affecting college students' learning outcomes in non face-to-face environment during COVID-19 pandemic. *Journal of Educational Technology*, 36(3), 957-989.
- Hong, S., & Jung, I. (2011). The distance learner competencies: A three-phased empirical approach. *Educational Technology Research and Development*, 59(1), 21-42.
- Jin, S. H., Sung, E. M., & Kim, Y. Y. (2016). Learning activities and learning behaviors for learning analytics in e-Learning environments. *Educational Technology International*, 17(2). 175-202.
- Jeong, H. H., Roh, S. Z., Jung, J. W., & Cho, Y. H. (2020). The challenge of the spread of COVID-19 to education: High quality remote learning for everyone. *Journal of Educational Technology*, 36(3), 645-669.

- Joung, Y., Han, S., & Park, J. (2016). A study of awareness on success factors in e-Learning course of participants of Korea-ASEAN cyber university. *Journal of Educational Technology*, 32(4), 955-986.
- Ju, Y. G., Park, D. S., Jung, K. H., Son, S. R., & Jing, Q. (2020). One semester on online: The lesson of digital face to face classes' experience. *Journal of Educational Technology*, 36(3), 805-838.
- Jung, I. S, & Rha, I. J. (2004). *Understanding of distance education*. Seoul: Kyoyookbook.
- Knowles, M. S. (1975). *Self-directed learning*. New York: Association Press.
- Lee, D. J. & Kim, Misook. (2020). University students' perceptions on the practices of online learning in the COVID-19 situation and future directions. *Multimedia-Assisted Language Learning*, 23(3), 359-377.
- Lee, E. K. (2013). Effects of self-directed learning and social presence of online adult learners to learning outcomes. *Journal of Lifelong Education*, 19(4), 27-50.
- Lee, J. M (2011). What drives a successful e-Learning: Focusing on the critical factors influencing e-Learning satisfaction. *Korean Journal of Business Administration*, 24(4), 2245-2257.
- Lee, J. Y., Sung, E. M., Lee, J. E., Lim, K, Y., & Han, S. Y. (2020). Challenges and tasks facing online classes during the COVID-19 pandemic. *Journal of Educational Technology*, 36(3), 671-692.
- Martilla, J. A., & James, J. C. (1977). Importance-performance analysis. *Journal of Marketing*, 41(1), 77-79.
- Martin, F. & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning* 22(1), 205-222.
- Min, H. (2020). *Status and Analysis of Non face-to-face Education at Seoul National University*. The issues of higher education due to Covid 19. 7th Gwanak Education Forum(2020. July 1).
- Ministry of Trade, Industry & Energy (2020). *2019 Survey of Korean e-Learning industry*.
- Moore, M. & Kersely, G. (2005). *Distance education*. CA: Thomson Learning, Inc.

- Moore, M. G., & Kearsley, G. (1996). *Distance education: A system view*. Belmont, CA: Thomson/Wadsworth.
- Park, K. S., & Sung, E. M. (2012). The Influence of students' perception of instructional performances on learning motivation, learning attitude, and learning satisfaction in a higher education Context. *Journal of Educational Technology, 28*(2), 231-257.
- Rha, I. J. (1999). *Web-based instruction*. Seoul: Kyoyookbook.
- Sung, E. M., Chae, Y. J., & Lee, S. H. (2019). Analysis of types and characteristics of self-directed learning of learners in online software education. *The Journal of Korean Association of Computer Education, 22*(1), 31-46.
- Sung, E. M., & Choi, H. S. (2016). Exploring the factors of self-directed learning competency of the highest academic-achievement learners in higher education. *Journal of Educational Technology, 32*(2), 427-452.
- Sung, E. M., Choi, J. E., & Baek, M. J. (2021). A study on development for teaching and learning model of online project-based learning in untact Context. *Korean Journal of Educational Methodology Studies, 33*(1), 227-270.
- Sung, E. M., Jin, S. J., & Yoo, M. N. (2016). Exploring learning data for supporting self-directed learning in the perspective of learning analytics. *Journal of Educational Technology, 32*(3), 453-499.
- Zimmerman, B. J., & Risemberg, R. (1997) Becoming a self-regulated writer: A social cognitive perspective. *Contemporary Educational Psychology, 22*, 73-101.



Eunmo SUNG

Assistant Professor, Dept. of Educational Technology, Andong National University.

Interests: Instructional Design, Self-directed Learning, Learning Analytics, Competency Modeling, EduTech.

E-mail: emsung@anu.ac.kr



Jieun CHOI

Master's Student, Dept. of Educational Technology, Andong National University.

Interests: Instructional Design, Learning Analytics, EduTech.

E-mail: wleun073@naver.com