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Perception of University Instructors for Designing Online Interactions: Findings from Importance-Performance Analysis*

Ji Young LIM
Ewha Womans University, South Korea

Seyoung KIM
Sogang University, South Korea

Mi Kyung CHO
Ewha Womans University, South Korea

Eugene LIM**
Sungkyunkwan University, South Korea

The aim of the current study was to suggest priorities needed to be considered by university instructors when designing online learning. Based on three types of interactions (learner-content, learner-instructor, and learner-learner interactions) for effective online learning (Moore, 1989), draft questionnaires representing each type of interaction were written. After examining content validity by two Ph.D. experts, the survey was constructed with an Importance-Performance Analysis (IPA) form. Data of 133 university instructors were collected online. Results showed that support for designing learner-learner interaction was the priority for improving online learning. In terms of learner-instructor interaction, instructors needed to provide social-emotional support to learners so that learners could have a sense of belonging. For learner-instructor interaction, supporting instructors to monitor the level of understanding was the most highly demanding strategy for online learning. Limitations and suggestions for further studies were discussed.

Keywords : Online learning, Distance education, Interaction design, Importance-Performance Analysis, Higher education, COVID-19

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** Corresponding author (elim@skku.edu; Visiting Professor)

Introduction

The spread of COVID-19 in 2020 has brought unprecedented changes to the world. The education community faced an unexpected situation where offline classes from K-12 to university were suspended. With increasing seriousness of the disease, universities had decided to extend online classes indefinitely or to conduct full online classes for a semester, starting with delays and two weeks of online classes (Park, 2020).

As the space of classes moved from face-to-face classroom to online, both instructors and learners experienced trial and error, having new experiences unlike before. Since the classroom and online spaces are completely different environments, instructors are required to have the ability to organize and redesign contents in order to provide a better learning experience based on understanding of online teaching and learning process (Rapanta, Botturi, Goodyear, Guàrdia, & Koole, 2020). In other words, instructors were given the role of comprehensive designers structuring differently between online and offline learning (Oh, 2020). Previous studies targeting university instructors in South Korea who had to operate online classes suddenly due to COVID-19 found that they had difficulties to redesign learning activities to be applicable to an online environment previously conducted in offline classes. They also felt difficulties in developing online learning materials such as a lecture video and communicating with learners in the online space (Do, 2020; Kim & Cheon, 2020).

Students were also confused as they took all courses in the form of online learning. Previous studies about university students' experiences of non-face-to-face classes due to COVID-19 have reported that satisfaction with online classes by learners is different depending on the type of online classes and the quality of lecture videos (Lee, 2020; Lee, Park, & Yun, 2020). In particular, it was reported that learners felt isolation and loneliness due to taking all classes online, which made it difficult for them to adapt to their studies, social activities, and relationships at the campus.

The sense of isolation that learners felt in online classes has long been an interest of researchers in e-learning. As learners need to participate in learning proactively with instructors or peers in an online environment without direct encounters, it is necessary for the instructor to think about how the learner can interact with the instructor or peers when designing and operating a class (Joo, Chung, Yoo, & Yi, 2012). On the other hand, in face-to-face classes, instructors can continuously interact with learners in the same space at the same time to promote learners' motivation and participation, whereas in online classes, instructors and learners interact in a completely new form in different spaces, sometimes at different time (Choi & Choi, 2016). If it is not a synchronous video class, non-verbal elements such as facial expressions and gestures are limited. Therefore, the sense of presence perceived by the learner can easily deteriorate, which might negatively affect learning patterns and outcomes (Lee, 2010; Lim, Kim, & Park, 2014).

As such, interaction can be said to be a key element in online classes in that learners' motivation and achievement are affected by how interactions are promoted and expressed in online classes. Choi and Choi (2016) have conducted a meta-analysis about the effect of interaction on achievement in online classes and found that the overall effect of interaction is large. Previous studies (Chei & Lee, 2017; Jeon & Cho, 2017) have also reported that interaction affects not only cognitive learning outcomes such as satisfaction and academic achievement, but also emotions, including positive such as learning interest and pleasure and negative emotions such as anxiety. Therefore, the success of learning can be determined by how the instructor designs interactions in online classes.

According to Moore (1989, 1993), learners generally interact with contents, instructors, and peer learners in online classes. Learner-content interaction is an activity in which learners obtain information from learning materials and contents provided in various forms such as text, audio, and video. Learner-instructor interaction is an instructor's activity that guides learners' learning process by delivering information, encouraging learners, and providing feedback to achieve

learning goals. Learner-learner interaction is an activity in which information and ideas are exchanged between learners. As these three types of interaction can greatly affect online learning outcomes (Chei & Lee, 2017; Jean & Cho, 2017), the ability of instructors to design and promote these interactions in the online teaching and learning process is very important.

Previously, online classes were operated only in some subjects of universities. Thus, instructors have low interest in designing online classes. In addition, education for instructors is insufficient (Kim & Byun, 2015). In the current situation of COVID-19, instructors who have no education or experience in designing and operating online classes are thrown into a situation where they have to execute online classes immediately. For this reason, current university students have criticized the low quality of online classes compared to offline classes (Park, 2020). With the emphasis on preparing for the era of untact (Cho & Lee, 2020), it is time to help instructors to be equipped with designing and managing capabilities for online classes.

Since interaction plays an important role in non-face-to-face learning situations, this study aims to analyze how current instructors design interactions based on three interactions suggested by Moore (1989) and to suggest specific strategies for online class improvement. Many existing studies (Dennen, Aubteen Darabi, Smith, 2007; Kim et al., 2020; York & Richardson, 2012) have focused on only one or two interactions of the three interactions suggested. However, all three interactions are fundamental for successful online learning. Thus, this study attempted to comprehensively analyze these three interactions. First, a survey was conducted to understand an instructor's perception of interaction design as a key element of online classes to derive priorities for improving online class design capabilities. Through this, we intend to prepare empirical evidence for improving the quality of online classes by analyzing the importance and performance level of three interactions.

Research questions to address the research purpose are as follows:

Research question 1: Which of the three types of online interactions are perceived

as priorities for improvement by university instructors?

Research question 2: Which online interaction strategies are perceived as priorities for improvement by university instructors?

Theoretical background

In online classes, interaction is known as a factor that determines or promotes the quality of learning (Nandi, Hmilton, & Harland, 2012). In results of meta-analysis on interactions in online classes and learning effect, various forms of interactions have significant positive effects on learning (Choi & Choi, 2016). Since interactions do not just happen, online classes should be designed in consideration of interactions (Northup, 2001). Educational institutions and instructors need to create a learning environment that provides learners with various opportunities to experience interactions.

Moore (1989) has proposed three forms of interactions that should be considered in distance education: learner-learner interaction, learner-instructor interaction, and learner-content interaction. First, learner-content interaction is the interaction between the learner and contents. It involves changing the learner's cognitive structure (Moore, 1989). From this point of view, learning means that learners can construct their own knowledge by integrating newly presented knowledge into an existing cognitive structure. However, even if learners can construct knowledge by interacting with contents in the learning process, the instructor needs to play a role of helping individual learners convert these contents into individual knowledge in the learning process (Moore & Kearsley, 2011). To promote learner-content interactions, contents can be presented in a variety of ways such as didactic text, print, broadcast on radio and television programs, electronic recordings on audiotape, videotape, and computer software, interactive videodisc, and so on (Moore, 1989). While traditional school classrooms used text-oriented contents, online classes not only use text-

oriented contents, but also use various forms of electronic resources. In particular, the development of technology has made it possible to present contents using various media. In the past, teaching and learning based on learner-instructor interactions were performed in the school classroom. However, in online learning, learner-content interactions have replaced some of learner-instructor interactions' functions (Anderson, 2003). Therefore, what is important in terms of learner-content interaction is that contents should be developed by considering the degree of elaboration of contents and the degree of helping meet individual needs of learners at various levels.

Second, learner-instructor interaction is the interaction between the learner and the instructor. This perceives educators as the most basic element for teaching. Since the interaction between the learner and the instructor presupposes that the instructor is tailored to the learner's needs, this is regarded as a factor that can induce learner's interest and motivation for learning (Moore, 1989). Lu, Liu, and Zhang (2020) found that in MOOCs (Massive Open Online Courses) classes, when instructors participated in helping learners understand the questions presented by instructors, encouraged them to ask questions, or provided hints, learners felt more connected with instructors during classes. In general, learner-instructor interaction is considered when instructors provide motivation and feedback to learners (Lim, Park, & Song, 2006). In the past, it was only an interaction in which learners asked questions about learning content and teachers responded to them. However, as strategies of learner-instructor interaction gradually diversifies, Lee et al. (2020) have stated that specific strategies for activating learner-instructor interaction need to be distinguished.

Third, learner-learner interaction is the interaction between learners. This interaction is attracting attention in distance education because synchronous and asynchronous interactions can occur by using computers. It can be used to overcome limitations of large-scale face-to-face lectures. It allows learners to interact with other learners as well as instructors, thus contributing to learning positively. Because interactions with peer learners can increase learning motivation, it can be regarded as

an important factor in online classes, especially for learner-centered education (Kuo et al., 2014; Moore & Kearsley, 2011). Learner-learner interaction started to appear in earnest as computer-mediated communication became possible in online classes (Harasim, 1987). Online classes could be designed to participate in learning activities based on group activities to promote learner-learner interactions (Lim, 1999). Also, supporting tools and environments must be provided to help communication and collaboration for group-based learning activities (Lee et al., 2020). For example, the most commonly used strategy to promote learner-learner interactions is to use a discussion board to share opinions. In this case, the process and results of interaction and communication between learners need to be refluxed and actively used as educational resources (Lee et al., 2020).

Forms of interactions are considered when designing online classes. They can function independently or complement each other. In the past, when distance education was started, online classes were designed mainly considering learner-content interaction. However, in order to maximize the learning effect, learner-instructor interaction and learner-learner interaction are considered. These three types of interaction are approached in various ways. In practice, learner-instructor interaction and learner-learner interaction are not well considered when designing online classes (Lee, 2021; Lee et al., 2020). Moore (1989) has emphasized that each type of interaction should be considered so that the effectiveness of each interaction can be maximized to design online classes. Also, the forms of interaction appropriate to different learner levels and characteristics of the task should be reflected.

Interaction in online classes is known to have a great influence on learning satisfaction (Choi & Choi, 2016; Jean & Cho, 2017). However, according to each study, one or two of these three interactions were suggested as factors affecting learning satisfaction (Choi & Choi, 2016; Dannen et al., 2007; Jung & Lim, 2000; Lim et al., 2000; York & Richardson, 2012). In other words, studies on interactions in online classes have investigated the effect of one or two types of interaction depending on the researcher.

The design of online classes that apply interaction types needs to go beyond learner-content interaction so that communities that help learners learn can be created (Moller, 1998). Saba and Shearer (1994) have remarked the importance of the learning community as a factor that can positively influence learning outcomes as well as asynchronous online teaching methods that focus only on interaction. Recently, interest in learner-learner interaction and learner-instructor interaction in online classes has been linked to a community for online learning. The community for online learning serves to provide a place for learners to share experiences and help each other (Lim, 2016). It is also important to properly combine the three forms of interactions presented above for online classes to be successful. Anderson (2003) has found that forms of interactions required or preferred might differ according to characteristics of individual learners. Even if all forms of interactions do not occur sufficiently, meaningful learning is possible when only interactions required by the learner occur sufficiently.

Research methods

Participants and contexts

To analyze the importance and performance perceived by university instructors on the interaction design of online classes, a survey was conducted for about 11 weeks (from April 6 to June 20, 2020) among instructors currently running classes in South Korea universities. The survey was made with the Importance-Performance Analysis (IPA) and conducted online. Participants were recruited by convenience sampling and snowball sampling. Of 162 survey data collected, 133 were used for data analysis after excluding 29 responses with more than 80% of unanswered questions. Background information about these participants is shown in Table 1.

Table 1. Background information of participants

Class subject area	Freq. (%)	Teaching career (years)	Freq. (%)
Humanities	17 (12.8%)	Less than a year	6 (4.5%)
Social science	23 (30.0%)	1-2 years	6 (4.5%)
Education	22 (46.6%)	3-4 years	18 (13.5%)
Natural science	25 (18.8%)	5-9 years	26 (19.5%)
Engineering	27 (20.3%)	10-14 years	31 (23.3%)
Arts	15 (11.3%)	15-10 years	10 (7.5%)
Other (e.g., Medical)	4 (3.0%)	More than 20 years	36 (27.1%)
Total	133 (100.0%)	Total	133 (100.0%)
Major/Elective	Freq. (%)	Class characteristics	Freq. (%)
Undergraduate major	97 (72.9%)	Theory	69 (51.9%)
Undergraduate elective	26 (19.5%)	Practice	8 (6.0%)
Graduate major	10 (7.5%)	Theory/practice	42.1%
Total	133 (100.0%)	Total	133 (100.0%)

Measurements

Since validated instruments measuring three types of interaction for online classes were hard to find, draft questionnaires were written based on existing studies on interactions in online classes. Content validity was then examined by two experts. Specifically, Moore's (1989, 1993) studies on the three types of interactions in online classes and a learner-professor interaction measurement tool in an online class environment developed by Kang (2009) were reviewed for the draft. Two Ph.D.s majored in Educational Technologies were invited to review the content validity of draft questions. Based on the review, survey questionnaires were revised and six questions for learner-content interaction (LC), 14 questions for learner-instructor interaction (LI), and five questions for learner-learner interaction (LL) were selected.

The internal-consistency reliability of each interaction type was acceptable.

Importance scores for the three types of interaction ranged from .88 to .92 and performance scores for the three types of interaction ranged from .80 to .92. To check the construct validity, Exploratory Factor Analysis (EFA) was conducted. Results revealed that LL and LC showed acceptable fit indices except for LI. CFI exceeded .90 for both importance and performance of LL and LC (Bentler & Bonett, 1980; Tucker & Lewis, 1973). CFI of LI were lower than .80. However, since the research interest in this study was on detailed contents of the interaction design, all questions were included for analysis.

Table 2. Validation of measurement instruments

Interaction type (Number of items)	Importance -performance	Goodness of items		Sample item
		CFA	Cronbach's alpha	
Learner-Content (six items)	Importance	.966	.88	To organize materials in various forms, including video contents and reading materials.
	Performance	.807	.80	
Learner-Instructor (fourteen items)	Importance	.777	.93	To provide feedback on the results of learners' learning activities (such as assignments, discussions, tests, etc.) as soon as possible.
	Performance	.700	.90	
Learner-Learner (five items)	Importance	.974	.92	To provide learners with the opportunities to share information and opinions with other learners.
	Performance	.985	.92	

Analysis

To identify which interaction types and strategies were perceived as less performed than perceived level of importance, Importance-Performance Analysis (IPA) was

carried out in this study. The analysis was conducted with four steps as suggested by Cho (2009). For the first step, paired t-test was conducted to examine the difference between perceived importance and performance. For the second step, items with high priority for improvement were derived using Borich's formula as follows: $Cal\ \ En = (In - Co)(Ig)$, where *Cal En* was the calculated educational needs, *Co* was the degree of performance of the item, *In* was the degree of importance of the item, and Ig was the importance mean of items included in the interaction type. Since it was hard to find studies suggesting exact cut-off score separating priorities for refinements (Cho, 2009), items with top 45% of the Borich value were considered as priority for improvement in this study. For the third step, the Locus for Focus model was drawn to visually examine the priority for improvement. Locus for Focus model displays items on a quadrant with difference between importance and performance on the X-axis and importance on the Y axis (Mink, Shultz, & Mink, 1991). Mink and colleagues (1991) have suggested ways to interpret priorities using the model as follows. Items placed on the first quadrant are considered as the priority for improvement because they show large differences in importance and perception. In addition, their importance is higher than the average. Conversely, the third quadrant is an area with the lowest priority because the difference between importance and performance (x-axis) and importance (y-axis) are all lower than the average. Although priorities for improvement of items on the second and fourth quadrants are relatively lower than those on the first quadrant, priorities between the second quadrant and the fourth quadrant are unclear. For the last step, the top priorities for improving online class interactions were determined considering results found from the first to third steps. In this step, items with high Borich values as well as those located in the first quadrant were selected. All analysis procedures were conducted on interaction areas first and then on interaction strategies.

Results

Priorities for improving online classes: Interaction types

An analysis was first conducted to derive the priority for improvement by interaction types. Results showed that university instructors perceived learner-instructor interaction as the most important type of interaction (importance mean score = 4.20), while learner-learner interaction was performed as the least important type of interaction (importance mean score = 3.80). However, learner-instructor interaction was perceived as the most performed interaction type (performance mean more = 3.76), while learner-learner interaction was perceived as the least performed interaction (performance mean score = 2.96). Such importance-performance differences of all three types of interaction were significant at $p < .001$. Regarding the rank order of Borich value of the three interaction types, learner-learner interaction had the highest rank (rank = 1), followed by learner-content interaction (rank = 2) and learner-instructor interaction (rank = 3).

Table 3. Results of importance-performance analysis by interaction type

Interaction type	Importance mean	Performance mean	Importance-performance	*t*	Borich needs assessment	
					Value	Rank
Learner-content interaction	4.15	3.69	0.46	8.37***	1.88	2
Learner-instructor interaction	4.20	3.76	0.43	7.83***	1.75	3
Learner-learner interaction	3.80	2.96	0.84	9.55***	3.39	1

*** $p < .001$

The Locus for Focus model as shown in Figure 1 was then examined. None of the three interaction types was placed in the first quadrant denoting the highest priority

for improvement or the third quadrant denoting the lowest priority for improvement.

Considering these results altogether, none of the interaction types was found to be the priority for improvement. However, the gap between importance and performance was the largest for learner-learner interaction, indicating that it might need relatively more improvement than other types of interaction.

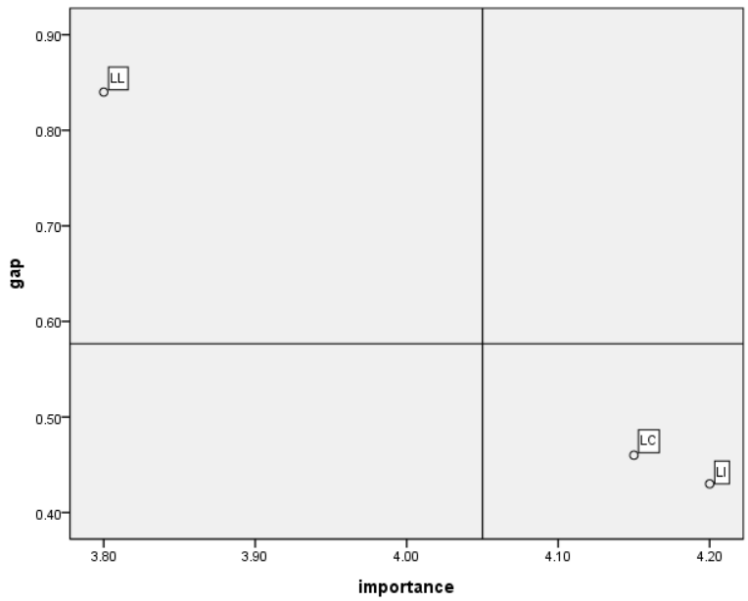

Figure 1. The Locus for Focus model of interaction types.
LC: Learner-content interaction, LI: Learner-instructor interaction,
LL: Learner-learner interaction

Priorities for improving online classes: Interaction strategies

To examine research question 2, interactional strategies were analyzed. Every strategy examined in this study was found to have a significant difference between perceived importance and performance by university instructors at $p < .01$. Among 25 strategies, one learner-content interaction (LC4), five learner-instructor interaction (LI 1, 4, 5, 11, 13), and all learner-learner interaction (LL 1, 2, 3, 4, 5)

strategies were ranked as top 45% based on Borich values. However, only one strategy of learner-instructor interaction (LI11) was placed in the first quadrant of the Locus for Focus model. Other strategies except three (LC6, LI6, LI14) were placed in the second and fourth quadrants.

Therefore, LI11 was selected as the most required strategy to be improved. Ten strategies (LC4, LI1, LI4, LI5, LI13, LL1-5) with high Borich values but not placed in the second or fourth quadrant were also selected to be improved, although they needed less improvement than LI11.

Table 4. Results of IPA analysis by interaction strategies

	Item	Importance Mean (I)	Performance Mean (P)	I-P	*t*	Borich needs assessment		Prio -rity
						Value	Rank	
LC1	Organizing contents	4.44	4.06	.38	5.40**	1.54	18	
LC2	Using various media contents	4.26	3.74	.52	6.35**	2.13	12	
LC3	Providing detailed guidance about using learning materials	4.20	3.90	.29	4.66**	1.20	19	
LC4	Providing activities to check the level of understandings	3.92	3.36	.56	7.45**	2.31	11	++
LC5	Providing activities for problem-solving	4.16	3.65	.51	7.09**	2.10	14	
LC6	Providing materials for supplement or advanced study	3.92	3.41	.52	7.45**	2.13	13	
LI1	Spending time to enhance the sense of closeness in the beginning of the semester	3.78	3.21	.57	5.78**	2.35	10	++
LI2	Providing information about the educational methods and schedule in the beginning of the semester	4.38	4.11	.28	3.41*	1.14	20	
LI3	Providing help as soon as learners ask	4.48	4.23	.26	3.96**	1.05	21	
LI4	To display attention to an individual learner	3.89	3.24	.65	6.85**	2.69	8	++

Table 4. Results of IPA analysis by interaction strategies (continued)

	Item	Importance Mean (I)	Performance Mean (P)	I-P	*t*	Borich needs assessment		Prio-rity
						Value	Rank	
LI5	Providing sense of belonging with instructor in online learning environments	4.00	3.38	.62	6.31**	2.53	9	++
LI6	To make friendly atmosphere to make conversation freely about the learners' understandings	4.10	3.69	.41	4.95**	1.67	17	
LI7	To make friendly atmosphere which encourages asking	4.47	4.23	.24	3.32*	0.99	22	
LI8	To answer immediately to the questions	4.47	4.30	.17	2.89*	0.71	24	
LI9	Providing enriched answer to the questions	4.58	4.42	.16	2.80*	0.65	25	
LI10	To check class participations regularly	4.16	3.92	.23	3.00*	0.96	23	
LI11	To check the level of understandings continuously	4.16	3.33	.83	7.93**	3.40	4	
LI12	To give immediate feedback to the learning activities	4.31	3.90	.41	5.22**	1.67	16	
LI13	To encourage participation of the passive learners	3.89	3.14	.76	8.26**	3.12	6	++
LI14	To give positive feedback to active learners	4.05	3.56	.49	5.65**	2.01	15	
LL1	To give opportunities to get closed with classmates	3.72	2.88	.84	8.32**	3.46	3	++
LL2	To give opportunities to share information and opinions	3.95	3.20	.74	7.77**	3.06	7	++
LL3	To provide opportunities to learn by peer-teaching	3.60	2.68	.92	9.10**	3.80	1	++
LL4	Providing opportunities for peer-feedback about learning activities	3.94	3.15	.79	7.88**	3.24	5	++
LL5	Providing opportunities to collaborate and make shared goals	3.78	2.89	.89	8.24**	3.64	2	++

Note 1. LC: Learner-content interaction; LI: Learner-instructor interaction; LL: Learner-learner interaction.
Note 2. ** $p < .001$, * $p < .01$.
Note 3. +: an item with priority for improvement, ++: an item with second priority for improvement.

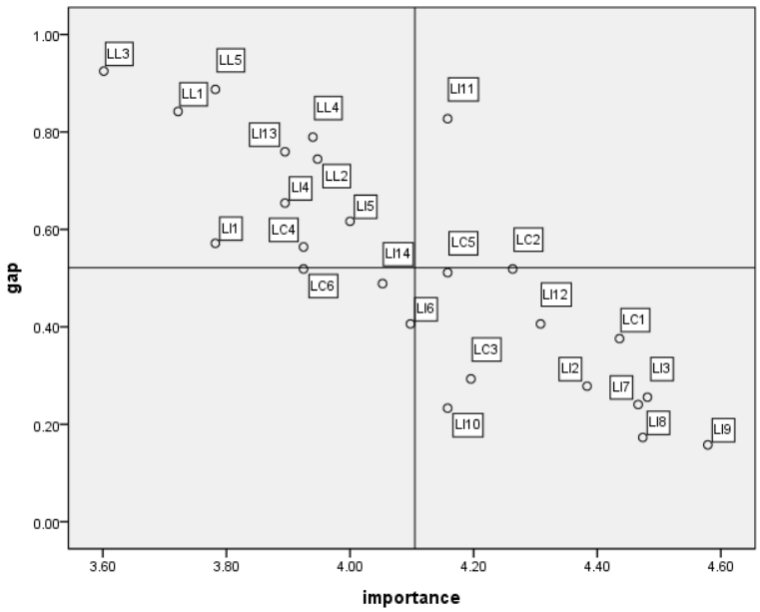

Figure 2. Locus for Focus model of interaction strategies

LC: Learner-content interaction, LI: Learner-instructor interaction, LL: Learner-learner interaction

Discussion

In this study, an IPA analysis of an instructor's interaction design in an online learning environment was conducted to suggest a method to improve the quality of online classes. To this end, an in-depth analysis of the interaction was conducted based on three types of interactions proposed by Moore (1989, 1993). Results of this study are as follows.

In terms of research question 1 (Which of the three types of online interactions have the highest demands of university instructors for improvement?), learner-learner interaction was relatively more needed to be improved than learner-content interaction and learner-instructor interaction. What was noteworthy is that instructors perceived the importance of learner-learner interaction lower than other

types of interaction. Nevertheless, Borich's value of learner-learner interaction was the highest among the three types of interaction because its perceived performance level was much lower than those of the other two types, leading to a large gap between importance and performance level.

For research question 2 (Which interaction strategies in online learning have the highest demands of university instructors for improvement?), the most required strategy for improvement was the teacher-learner interaction to check understandings throughout classes (LI11). It means that, despite an instructor perceives the importance to monitor learners' understanding, they are having considerable difficulties in doing so online. This was consistent with results showing that among learner-content interaction strategies, professors had difficulties in providing activities online to monitor learners' levels of understanding (LC4). In order to monitor learners' understanding, a careful and detailed strategy is needed considering the class type. In the case of synchronous classes, learners' understanding can be checked using synchronous interaction tools such as quiz platforms immediately after explaining the learning content (Lim, Kim, Park, Bae, & Yeom, 2021). In the case of asynchronous classes using contents such as lecture videos, learning tasks can be presented through Learning Management System (LMS) and learners' understanding can be checked while monitoring their process (Leem, Kim, & Lee, 2021). Existing research has suggested that teacher dashboards are necessary for online learning environments because it is hard to monitor the learning progress of learners (e.g., Grover et al., 2014). For example, Minerva School has embedded a dashboard on its online learning platform that visualizes the level of participation per learner in traffic light colors and provides this information to instructors (Minerva project, n.d.). Instructors can see this signal and encourage learners with lower levels of participation. Recently, studies on a dashboard for instructors designed based on online learning data have been reported steadily (e.g., Diana et al., 2017; Xhakai et al., 2017). However, results of this study suggest that more active efforts are needed to extend the research to the actual educational field.

It was also found that instructors had difficulty in performing their roles as learning facilitators with socio-emotional interaction online. Looking at the learner-instructor interaction shown as the second priority, providing a sense of belonging or closeness (LI1, 5), expressing interest to individual learners (LI4), and encouraging passive learners (LI13) were needed. In contrast, cognitive interactions such as providing feedback (LI 3, 8, 12) were not highly ranked based on Borich's values. These results suggest that instructors should play a role in actively supporting students' learning by considering emotional aspects of individual learners beyond developing and delivering online learning contents. According to previous studies (e.g., Kwon, 2011), instructor's socio-emotional support to learners (so that learners do not feel isolated online) can have a positive effect on learners' learning processes and outcomes. The absence of sense of community among learners makes it hard for learners to collaborate online (Han, 2008). Instructors can create a comfortable atmosphere by starting classes with possible ice-breaking activities or games online, rather than immediately entering task-oriented activities at the start of classes (Kim, Ryu, Byun, & Seo, 2020). This role will be more important in future education. Jeong (2020) has emphasized that instructors in the age of artificial intelligence should work with AI for personalized learning in a broader sense, including not only delivering content and knowledge, but also providing emotional support for individual students. Such result of this study suggests that more specific guidance is needed for university instructors about how they can form socio-emotional relationships with learners online.

All strategies for learner-learner interaction (LL1-5) were ranked as highly demanding strategies for online learning, consistent with findings of research question 1. Although there have been enormous technologies designed to support collaborative learning online, simply providing tools does not guarantee effective collaborative learning (Lim et al., 2020). How learner collaborate, including not only which tools to use, but also the process of collaboration, need to be elaborately designed in advance (Lim, 2020). Results of this study reflect those instructors are

less likely to have enough skills to design collaborative learning. Therefore, specific guidance on how to design online-based collaborative learning in a variety of ways, from simple discussions in class or information sharing to peer-teaching or project-based learning, needs to be provided to university instructors.

Analysis results of this study can be summarized as follows. First, it is necessary to consider methods that can confirm learner's levels of understanding in an online learning situation. Instructors need to be informed about how to check learners' levels of understanding based on LMS or data. Universities should consider developing dashboards or platforms that can immediately check learners' learning progress and levels of understanding based on data.

Second, in non-face-to-face situations, instructors need to use strategies that allow learners to feel more emotional intimacy with instructors such as asking how they are doing or exchanging messages with individual learners. In an online learning situation, more emotional aspects should be taken care of so that learners can continue to participate in classes without dropout or feeling isolated.

Finally, it is necessary to apply a teaching method in which interactions between learners can be active. Rather than instructor-centered lecture-type classes, it is necessary to design a project-based class that allows learners to solve problems and collaborate. In order to enable various types of teaching methods to be achieved in online learning situations, instructors need efforts to improve teaching methods. Universities need to support and encourage these new attempts.

In this study, implications for the design of online classes were suggested based on empirical findings collected from university instructors. Since not enough studies have examined how instructors perceive the importance and performance about online learning design, results of this study are expected to help university headquarters decide what are prior considerations to improve the quality of online learning.

However, this study has some limitations. The focus of this study was on the perspective of instructors only. So far, some studies (e.g., Kim et al., 2021) have been

conducted on what learners actually experience in online classes. It would be meaningful to investigate and reflect the view of learners since distance education previously considered a part of future education has become increasingly routine due to COVID-19. Next, by including various majors as research context, it has the advantage of dealing with phenomena that generally occur in university education. However, there is a limitation in that it cannot deal with differences that occur according to characteristics of majors. In addition, the number of research participants was insufficient to analyze according to major or class types in this study. Thus, it is necessary to focus on differences according to characteristics of the class in subsequent studies.

This study is meaningful in that it presents specific strategies for each of the three types of interaction based on an understanding of the current status of online interaction design of university instructors during the early period of COVID-19 outbreak.

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Ji Young LIM
Research professor, Department of Educational Technology, Ewha Womans University
Interests: Technology-enhanced Learning Design, CSCL, Personalized learning
E-mail: lim.edu@ewha.ac.kr

Seyoung KIM
Research Professor, Center for Teaching & Learning, Sogang University
Interests: Instructional Design, Higher Education, Distance Education
E-mail: dreamer302@gmail.com

Mi Kyung CHO
Instructor, Department of Elementary Education, Ewha Womans University
Interests: Instructional Design, Teacher Education, Elementary Education
E-mail: cmk0530@daum.net

Eugene LIM
Visiting Professor, Graduate School of Education, Sungkyunkwan University
Interests: Instructional Design, Teacher Education, Distance Education
E-mail: elim@skku.edu

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