



## Digital Technology in the 4IR and the Future of English Learning From the Perspective of Korean EFL University Students

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### ARTICLE INFO

Received 22 December 2018

Revised 19 January 2019

Accepted 15 February 2019

Examples in: English

Applicable Languages: English

Applicable Levels: Secondary/

Tertiary

### KEYWORD

4IR/

English learning/

EFL/

digital technology/

4차산업혁명/

영어학습/

외국어로서의 영어/

디지털 테크놀로지

### ABSTRACT

Jones, S., Richards, A., Cho, Youngsang, & Lee, Yoo-Jean. (2019). Digital technology in the 4IR and the future of English learning from the perspective of Korean EFL university students. *Modern English Education*, 20(1), 53-70.

This study is intended to explore English learners' experience of using digital technology in the Fourth Industrial Revolution (4IR) and their perceptions of learning English now and in the future. The participants were 579 Korean EFL university students enrolled in mandatory General English courses. A Google Form survey with 25 questions was provided, and the percentages of students' responses to specific questions were reported. Paired and independent *t*-tests, two-way mixed and one-way ANOVAs were also administered. Regardless of their experience of using digital technology they were positive about using it to learn English. Additionally, despite little or no statistically significant differences in factors including gender, major, GE course experience, proficiency levels, etc., students in general predicted that English teachers and in-class learning would become less important in the future. Moreover, those experienced and interested in 4IR technology were pessimistic in providing more equal opportunities to learn English and predicted a strong need for private tutoring. Interestingly, those with more experience, interest, and positive perceptions of the 4IR were more negative about how it will affect English learning and education. Based on these findings, preparations for the 4IR need to be made by both teachers and administrators. Detailed implications and limitations are provided.

## I. INTRODUCTION

This research is based upon the idea that we are now living in an era often referred to as the Fourth Industrial

Revolution (4IR). Schwab (2016) first discussed this idea in the World Economic Forum in 2016 and described it as a "fusion of technologies that is blurring the line between the physical, digital, and biological spheres" (para. 2). Lee et al. (2018) further added to this description by claim-

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ing the 4IR is “a revolutionary change characterized by the ubiquitous and mobile Internet; cheaper, smaller, and stronger sensors; and artificial and machine learning” (p. 2). Schwab continues by stating, “the possibilities of billions of people connected by mobile devices, with unprecedented processing power, storage capacity, and access to knowledge, are unlimited” (para. 4).

As a result, it is possible to conclude that currently a greater number of people have access to better and faster Internet based technology such as computers and smart devices that are changing the way people behave and interact with each other. Furthermore, the 4IR has also seen rapid innovation and revolution in technologies such as the Internet of Things (IoT), big data, artificial intelligence (AI), and block chain technology (Lee et. al., 2018). Unlike previous revolutions, the speed of this one is happening at far greater rate than we have ever experienced, and is having more of an influence in a wider area of society. Schwab (2016) states that the 4IR is “evolving at an exponential rather than linear pace” (para. 1) and is “disrupting almost every industry in every country” (para. 3).

Like many other areas of industry, education is one that will not be exempt from the effects of this current revolution. The traditional concept of the teacher/student relationship, and the way both parties find and process information could be considered slightly outdated in this era. Digital technology such as virtual classrooms, mobile communication platforms, AI, and improved Internet speeds that are now more accessible and possibly cheaper as a consequence of the 4IR might all reduce the need for classroom-based lessons. This could lead to a more student-centered approach to education with students having more control over what, when and how they study (Stone et al., 2016).

One particular area of education that will be the focus of this research is English education, specifically English as a foreign language (EFL). Commonly, Korean university students must take mandatory general English (GE) language classes to meet their graduation requirements. However, as result of the 4IR, technology is now making it possible to access English language learning materials without the need for a classroom or teachers. Mobile applications, websites, and virtual reality have removed the time and resource constraints that English learners of the past experienced. There is even an argument that recent improvements in real-time translation technology have negated all need for language lessons and learning (Rohrbach, 2018).

Clearly this innovative technology will have a significant impact on EFL classes of the future. In readiness for these new changes, it is important to clearly understand how students who are living in the early stages of the 4IR now feel about using digital technology for their EFL learning and how they perceive the influence of the 4IR on EFL teaching and learning. Answers to these questions could assist EFL teachers and administrators to plan and implement classes that will better suit the needs of students of the 4IR. In addition, they may also help English

teachers to effectively integrate 4IR digital technology into their classes. Consequently, this study will attempt to answer the following three research questions:

- 1) What experience/perceptions do Korean EFL university students have of using digital technology to learn English now?
- 2) What do these students think about learning English now and in the 4IR?
- 3) How do students perceive the effect of the 4IR on English learning?

## II. LITERATURE REVIEW

### 1. The 4IR in Education

Schwab (2016) explains that the boundaries between the physical, digital, and biological worlds are blurring into one due to the emergence and fusion of such technologies as AI, the IoT, robotics, and big data. The convergence of these physical, digital, and biological worlds is expected to end up challenging our current social and industrial systems and to drive us to change the way we act, communicate, work, learn, and produce/consume items in the future. At the center of all these new, but disruptive, changes is AI.

Wisskirchen et al. (2017) mentioned that AI is the core of the 4IR, of which advancement distinguishes the 4IR from the 3rd industrial revolution. AI is a branch of computer science whose goal is to create intelligent machines, thinking like humans with abilities to learn on their own. Through innovative learning methods like machine learning and deep learning, AI can analyze, process, and learn on its own at a faster speed than any human can (Goodfellow, Bengio, & Courville, 2016). It is expected to be able to outsmart human beings and eventually replace them in almost every sector of industry. Since AI machines are being developed at an unprecedented rate, there is a considerable amount of uncertainty about human life of the future. One of the places in which people experience this uncertainty is the job market. The World Economic Forum reported in 2016 that about 5 million human jobs could be lost by 2020 as a result of the 4IR (Gray, 2016).

The blurred line between humans and machines and the sense of uncertainty caused by rapid development of digital technologies have triggered people to start to think of a different way to provide education to the young generations so that they can survive in this new era of the 4IR. According to J. H. Park and J. Ahn (2018), the appearance of intelligent machines has alerted educators to the urgency of redirecting the focus of learning from knowledge accumulation and rote memorization to areas like creativity, problem-solving skills, interdisciplinary thinking, where humans are still believed to outsmart AI-powered machines.

In response to this need for a different approach to

more traditional education, some attempts have been made with the help of advanced digital technologies. For example, massive open online courses (MOOCs) and flipped learning create a learning environment where students can have access to online content anywhere and anytime. Portable devices like laptops, tablets, and smart devices with an Internet connection help students learn flexibly at their own pace outside of the classroom. Becker et al. (2017) adds to this idea by stating the importance of online, mobile and blended learning since this learning encourages creative thinking and independent study, enabling students to customize their own learning experiences. Many educators (Dabbagh & Kitsantas, 2012; Kop & Fournier, 2010) agree that information and communications technology makes it possible for instructors and educators to design more personalized, self-directed experiences for their students.

## 2. Perceptions on EFL Education in the Era of the 4IR

The positive view of technology-driven education that can ensure ubiquitous, personalized, student-centered, interactive, media-rich, and exciting new learning environments (Y. Bang, 2017; Fisk, 2017; Montrieux, Vanderlinde, Schellens, & De Marex, 2015) still continues in the field of EFL education. Mujtaba and Mubarak (2013) explain that the use of technology in English learning and teaching offers a wider variety of classroom content and creates alternative channels of communication between both learners and teachers. They also add that it creates more student-centered classrooms with learners having more autonomy over their learning and more control over their individual learning objectives. Mohamed (2014) continues by noting that through technology, students can experience more realistic situations and contexts in which they can use and develop their language skills.

Not only digital technology in general, but also 4IR technology is often considered beneficial. For instance, R. Kim (2018) explains that automated speech scoring application supported by AI will be able to not only automatically score language learners' spoken or written output but also provide personalized learning experience for learners by predicting what errors they might make in the future and by recommending learning materials appropriate to their level. In the case of speech recognition and synthesis technology, S. H. Ahn (2017) expects that its advancement could enable AI machines to easily detect what language errors learners make and what language input is needed and eventually to provide a human-like conversational partner.

Despite the potential of innovative technologies, not all of them are believed to benefit EFL education. One example is machine translation. As automatic translation technology based on deep neural network dramatically increases the accuracy of translation output, S. W. Kim (2017) foresees that most human interpreters and translators will be replaced by AI-based translation applications such as Google Translate and Naver Papago. Y. W. Kim

(2018) also predicts that EFL education will not be as important as it is now, and machine translation will increase the skepticism of EFL education of the future.

Amid speculation over these potential benefits and risks of 4IR technology, some empirical studies started to be conducted, focusing on teachers' and students' perceptions of 4IR technology in the field of EFL. For example, a recent study by H. S. Kim and H. Kim (2017) examined perceived readiness of elementary and secondary school English teachers for the 4IR. Y. S. Kim (2017) also explored how elementary school teachers and teacher trainers perceive how the 4IR could influence English education. E. Kim (2018) further investigated pre-service teachers' perceptions for education paradigm and teachers' teaching competency in the 4IR. Moreover, Jones, Richards, Y. Cho, and Y. J. Lee (2018) looked into the perceived effect of the 4IR on native English teachers at a Korean university.

There have been studies targeting teachers that examined their comprehensive view on EFL education in the 4IR, but there is a lack of such comprehensive studies targeting students; most of them focused on one particular type of 4IR technology such as AI teachers or AI translation. For example, J. H. Park and N. M. Shin (2017) examined how elementary and secondary school students felt about non-human AI teachers. S. Shin, M. Ha, and J. K. Lee (2017) discussed how high school students reacted to the idea of AI, but this research only involved asking two simple questions to the participants. (i.e., "Explain what you know about AI" and "What do you think of when you hear the word 'AI'?"). Further to this, H. J. Im (2017) examined university students' perceptions of AI translation in general English classes.

The research on teachers' and students' views on EFL education in the 4IR is still at an infant stage, so more studies need to be conducted on this topic. In particular, the students' perspective is worth investigating since, after all, they are consumers of education. Further to this, although it is still important to examine the perceived influence of each individual type of 4IR technology (such as AI and machine translation) from the students' perspective, more research also has to be done focusing on students' perceptions of 4IR technology as a whole so that educators can better develop a more comprehensive picture of EFL teaching and learning in the 4IR era.

## III. METHOD

### 1. Participants

In total, 579 (244 male and 355 female) students who were enrolled in compulsory English classes at a private university in Gyeonggi-do, Korea, participated in this study. Nineteen classes with a maximum enrollment of 35 students each were asked to respond to a survey. Their ages were between 19 and 23. Most of them (65.7%) were freshmen, 21.3 % soph-

omores, and the remaining were in their third or final year. All were enrolled in range of undergraduate major programs including engineering, social sciences, education, business and economics, music, etc. In order to meet university graduation requirements, all students had to pass three mandatory GE classes over three semesters and each one was worth two academic credits for a total of 6. The first semester was a speaking and listening based course, the second a reading and writing based course and the final semester presentation course. Students were divided into three proficiency level classes as perceived by themselves on the TOEIC: beginning level classes with lower than 450, intermediate classes below 750, and advanced classes higher than 750. The reason why their self-perceived English proficiency rather than actual proficiency are used in this study was that the researchers attempted to examine how students' self-perception would affect their responses to various survey questions. Their demographic information is summarized in Table 1.

**TABLE 1**  
Demographic Information of Participants

Personal information		n
Gender	Male	244
	Female	355
Age	19	218
	20	157
	21	57
	22	49
	23 or older	98
School year	1	381
	2	123
	3	21
	4	54
Major	Humanities	254
	Sciences and engineering	286
	Arts and music	39
Experience of GE course(s)	2 or less	404
	More than 2	175
Self-perceived proficiency	Beginner	138
	Low intermediate	191
	Intermediate	184
	Upper intermediate	53
	Advanced	13

## 2. Data Collection

In the middle of fall semester in 2018, a survey questionnaire which consists of 25 questions was provided through Google Docs (see Appendix) to 579 students in 19 classes. Every individual class had its own online bulletin board to which a hyperlink to the Google form survey was posted for all students to access voluntarily. The first part of the survey (i.e., six questions in total including one sub-question) asked about students' demographic information including their age, school year, gender, major, the number of general English courses taken, and self-perceived English proficiency. The

next part (seven questions in total including three sub-questions) was related to students' experiences and thoughts of learning English with digital technology. The third part (five questions) was concerned with how students perceived of the fourth industrial revolution, and the last part (16 questions in total with six sub-questions) of English education in the era of the 4IR. The survey link was provided to those who were taking one of the compulsory GE courses in the university. Students were given a brief explanation about the purpose of the survey, along with some background information about the use of digital technology in English learning in the 4IR. The survey link was available for ten days so that students were able to access and respond to it either through a smartphone or a computer.

## 3. Data Analysis

Figure 1 shows survey questions sorted by their relevance to each research question and 10 factors which may affect students' perceptions about English education in the 4IR. These 10 factors were decided from the discussions of the four researchers in this study, and they are related to only the second and third research questions.

In order to answer the first research question, students' responses to the survey question 6 through 10 (which were related to students' experiences and perceptions of English learning through digital technology) were analyzed. First, based on a summary of responses in the Google Form survey, the percentages of the number of students' responses to specific answer choices for each question were reported.

### RQ1. What experience/perceptions do Korean EFL students have regarding using digital technology for English learning?

- 6-1. Have you ever used digital technology to learn English?
- 6-2. (If you have an experience, how helpful was it for your English learning?)
- 6-3. (If you have any experience, what digital technology have you used for English learning?)
- 7. What tools do you use most when you learn English now?
- 8. How much do you use digital technology for your English learning now?
- 9. How much are you concerned/nervous when you use digital technology for English learning?
- 10. How do you perceive learning English through digital technology?

### RQ2. What do students think about English learning now and English learning in the 4IR?

- 16. How important do you think it is to learn English now?
- 17. How important do you think learning English will be as the 4IR continues?
- 18. How important do you think English education is now?
- 19. How important so you think English education is in the 4IR?

20. How much do you think English teachers are needed now?  
 21. How necessary do you think English teachers will be as the 4IR continues?  
 24. Do you think we still need to learn English in a classroom setting?  
 25. As the 4IR continues, do you think we still need to learn English in a classroom setting?

**RQ3. How do students perceive the effect of the 4IR on English learning?**

22. How do you think technology developed and used in the 4IR will influence English learning activities?  
 22-1. It will help us to get more motivated in learning English.  
 22-2. Everyone can have an equal opportunity to learn and improve English.  
 22-3. It will help us reduce our private education expenses.  
 22-4. We can try many different learning methods.  
 22-5. Technology developed and used in the 4IR will provide new and innovative ways to learn English.  
 22-6. It will help to improve my English much faster than now.  
 23. Which technology do you think will have the most positive effect on English learning?

**Ten factors which may affect students' perceptions about English education in the 4IR**

2. Gender  
 3. Major/College (1) Humanities (2) Science & Engineering (3) Arts & Music  
 4. How many mandatory general English classes have you taken so far?  
 5. What is your perceived English level?  
 6-1. Have you ever used digital technology to learn English?  
 6-2. If you have an experience, how helpful was it for your English learning?  
 10. How do you perceive learning English through digital technology?  
 11. How much do you think you know about the 4IR?  
 12. How much interest do you have in the 4IR?  
 13. How much do you know about technology that is considered important in the 4IR?

**FIGURE 1** Survey Questions Sorted by Research Questions

For the second research question, the whole students' responses were downloaded as an excel spreadsheet. Then paired *t*-tests were performed by using SPSS Statistics to see whether there were differences of the overall students' perceptions between present and future. Additionally, two-way mixed ANOVAs were carried out in order to compare students' perceptions of learning English at present with those in the future (i.e., 4IR) based on 10 factors (i.e., gender, major, experience of taking GE courses, self-perceived English proficiency, experience of using digital technology, perception of digital technology use, attitude towards using digital technology, knowledge of the 4IR, interest in the 4IR, and knowledge of the 4IR technology). Students' answers to the Questions 2, 3, 4, 5, 6-1, 6-2, 10, 11, 12, and 13 were the 10 factors which the

researchers thought that may affect students' present and future perceptions. Questions 16 and 17, 18 and 19, 20 and 21, and 24 and 25 were considered as four pairs of either students' present or future perceptions.

In the meantime, students' majors (Question 3) were categorized into three areas: Humanities (Liberal Arts, Law, Education, Business and Economics, Social Sciences, and International), Sciences and Engineering (Engineering, Natural Sciences, Architecture, and Software convergence) and Arts and Music (Art & Design and Music).

Additionally, when considering experiences of taking GE courses (Question 4), the students were divided into two groups: one who took two or less courses and others who took more than two courses. Furthermore, among five of students' self-perceived proficiency levels; 'beginning,' 'low intermediate,' 'intermediate,' 'upper intermediate,' and 'advanced'; specified in Question 5, the first two levels were classified as 'low,' intermediate as 'mid,' and the rest of the two as 'high.' For Question 6-2, excluding those who answered as 'moderately helpful' (i.e., who selected '3'), those who chose '1' and '2' were classified as a 'not helpful' group and others who chose '4' and '5' as a 'helpful' group. Similarly, for the rest of the other questions (Question 10 to 13), those who selected item '3' were not counted. Yet, the options '1' and '2' were considered negative, and '4' and '5' positive.

Finally, to answer the last research question, one-way ANOVAs and independent *t*-tests were administered in order to see if there would be statistically significant differences in students' responses to Question 22 (including several sub-questions) when considering 10 factors.

## IV. RESULTS AND DISCUSSION

### 1. What Experience/Perceptions Do Korean EFL University Students Have of Using Digital Technology for Learning English?

One of the purposes of this study was to find Korean EFL students' perceptions and their experience of using digital technology in regard to learning English. Consequently, various survey questions were asked, and around 60% of the students (350) claimed to have used digital technology to learn English (Question 6-1).

Three hundred and eighty-three (383) students responded to Question 6-2 concerning how helpful digital technology was for learning English. More than half (225) considered that digital technology helped them a lot, whereas 16 showed negative attitude. The rest of the 142 students answered they received quite a sufficient amount of help while using digital technology. The outcome of this survey question thus shows students' positive thinking in the helpfulness of digital technology to learn English.

Regarding Question 6-3 which asked about the types of digital technology the 380 students had used or had experienced with to help them learn English, the most common types of digital technology were; online dictionary (66.3%), translation website or apps (63.2%), Internet

videos such as YouTube (45%), test preparation apps or websites (34.7%), audio files (26.6%) and vocabulary apps or websites (25.8%). About 17% were using a messenger service such as Kakao Talk or Line and social media (e.g., Facebook, Instagram and Twitter), and about 9% blogs. There were only two who mentioned about the use of Internet lectures and academy websites. One of the examples specifically mentioned was the Cambridge LMS website (i.e., a learning management system website for resources used as a homework or a self-study source) which usually provides three main textbooks for mandatory GE courses.

Whereas Question 6-3 was asked to only those who had much experience of using digital technology, Question 7 concerning the types of tools that are used for individual English learning was asked to the whole 579 students. Three main tools reported were; smartphones (39.2%), books/notebooks/pencils (31.7%), and computers/laptops (26.5%). Interestingly, only seven mentioned they were using a tablet and three a TV. It was surprising that almost one third of the students preferred using books/notebooks/pencils as tools to other ones, indicating that the traditional way of studying English in a classroom setting seemed to be still valued.

With experience of using digital technology (Question 8), students were additionally asked how often they were using it. One hundred seventy-six (30.5%) said they were using it very often or quite often. Almost the same number of students (175) said they were rarely using and, interestingly, quite a large number (228) mentioned they were using it only sometimes. However, students generally did not seem to be anxious about using digital technology (Question 9). Only 54 expressed some worries or concerns. Rather, more than half of the students (379) perceived learning English through digital technology in a positive way (Question 10). This indicates that students who have little concern seem to have high perceptions on using digital technology. Similarly, around one third of the students who had some concern about digital technology (191) also perceived it in neither a positive or negative way.

Overall, regardless of students' much or less experience of using digital technology, they were more likely to be positive than negative about using it for learning English.

## 2. How Do Students Think About Learning English Now and in the 4IR?

The second research question examined students' perceptions about English learning and education at present and in the future. Table 2 shows descriptive statistics of present and future perceptions (Question 16 through 21, and Questions 24 and 25).

Questions 16 and 17 are concerned with the importance of English learning now and in the 4IR, and the majority of students (90.3%) thought that it is important at present, and 67% said it would still be important in the future. The mean score for Question 16 was 4.35 ( $SD = .71$ ), indicat-

ing that it is considered highly important. However, the mean score for Question 17 dropped significantly to 3.79 ( $SD = .97$ ) ( $t(578) = 15.02, p < .01$ ); that is, students predict that the importance of English would decrease as the 4IR fully arrives (See Table 3 for paired  $t$ -tests results).

**TABLE 2**

Descriptive Statistics of Students' Perceptions at Present and in the Future

Questions	<i>M</i>	<i>n</i>	<i>SD</i>	<i>SE</i>
Q16	4.35	579	.71	.03
Q17	3.79	579	.97	.04
Q18	3.82	579	.77	.03
Q19	3.67	579	.91	.04
Q20	3.78	579	.88	.04
Q21	3.40	579	.96	.04
Q24	3.59	579	.86	.04
Q25	2.91	579	.92	.04

Questions 18 and 19 ask about how important English education (the act of learning and teaching English in and out of school) is at present and how this might change in the 4IR; 70.6% answered that it is currently important and 63.7% believe it will still be important in the future. Although its importance in the future dropped only by 6.9% compared to the present, this was found to be a statistically significant amount ( $t(578) = 4.35, p < .01$ ). However, Cohen's effect size value was small, less than .2 ( $d = .18$ ), which indicates that the difference between students' responses to Questions 18 and 19 was somewhat trivial and probably not that important. Nevertheless, students' perceptions on the importance of English education seem to be slightly less positive in the future than present.

**TABLE 3**

Paired Samples Statistics

	<i>MD</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>	$\omega^2$
Q16 – Q17	.56	.89	15.02	578	.000**	.66
Q18 – Q19	.15	.81	4.35	578	.000**	.18
Q20 – Q21	.38	1.04	8.76	578	.000**	.41
Q24 – Q25	.68	.87	18.83	578	.000**	.76

\*\* $p < .01$

Questions 20 and 21 are about the need for teachers in learning English. A large proportion of the students (67.2%) considered that they would need English teachers at the moment to learn English ( $M = 3.78, SD = .88$ ), and more than half (51.3%) in the 4IR too, although the need of English teachers dropped to a statistically significant amount of 3.40 ( $SD = .96$ ) in the 4IR which corresponds to 15.9%.

Questions 24 and 25 ask whether English lessons of both the present day and of the future should be based in classrooms. Interestingly, more than half of the students (60.6%) responded that learning English in classroom settings would be needed now ( $M = 3.59, SD = .86$ ), but only 26.8% ( $M = 2.91, SD = .92$ ) think the same for the future; 35.3% change their views on classroom-based lesson as a

TABLE 4

Descriptive Statistics of Students' Perceptions at Present and in the Future Based on Ten Factors

Factors	n	#16		#17		#18		#19		#20		#21		#24		#25		
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	
1.Gender	M	244	4.25	.76	3.67	.97	3.78	.82	3.56	.91	3.96	.81	3.39	.94	3.59	.86	3.59	.86
	F	355	4.43	.66	3.89	.96	3.85	.73	3.76	.90	3.65	.90	3.41	.97	2.89	.91	2.92	.94
2.Major	Huma.	254	4.35	.69	3.74	.96	3.84	.79	3.63	.92	3.83	.85	3.32	.99	3.52	.89	2.85	.95
	Sci.&En.	286	4.36	.72	3.88	.96	3.79	.73	3.73	.90	3.71	.88	3.47	.91	3.63	.83	2.97	.90
	Arts& Music	39	4.31	.73	3.56	1.05	3.92	.90	3.54	.86	3.97	.96	3.41	.99	3.67	.81	2.84	.90
3.GE course exp.	1-2	404	4.31	.71	3.69	.95	3.81	.76	3.61	.89	3.88	.81	3.36	.95	3.55	.86	2.89	.89
	2+	175	4.45	.69	4.05	.96	3.85	.78	3.81	.92	3.54	.97	3.49	.96	3.66	.85	2.96	.99
4.Profici.	Low	330	4.27	.73	3.66	.95	3.79	.79	3.58	.90	3.95	.79	3.37	.95	3.57	.86	2.92	.89
	Mid	184	4.43	.65	3.91	.96	3.83	.68	3.75	.88	3.61	.87	3.63	.95	3.59	.78	2.86	.92
	High	65	4.52	.69	4.15	.94	3.92	.89	3.94	.93	3.42	1.10	3.40	.99	3.69	1.01	3.00	1.09
5.Tech. exp.	Yes	350	4.29	.72	3.68	.95	3.79	.78	3.59	.90	3.94	.82	3.38	.95	3.57	.87	2.93	.90
	No	229	4.45	.67	3.97	.96	3.86	.74	3.81	.89	3.58	.92	3.43	.96	3.61	.83	2.88	.96
6.Tech. exp. percep.	Not helpful	16	4.01	1.06	3.69	1.08	3.56	.81	3.38	.96	3.63	1.02	3.38	1.02	3.19	.91	2.38	.72
	Helpful	225	4.51	.63	3.93	.97	3.91	.77	3.71	.98	3.77	.91	3.40	1.02	3.63	.82	2.88	.94
7.Tech. exp. posi/nega	Nega.	11	4.27	.65	4.00	.89	3.82	.75	3.91	.70	3.36	1.12	3.91	.70	3.18	.75	2.82	1.08
	Posi.	379	4.34	.70	3.83	.94	3.80	.78	3.69	.86	3.74	.90	3.40	.94	3.61	.83	2.94	.87
8.4IR Knowle.	Don't know	144	4.35	.68	3.80	.94	3.74	.81	3.67	.86	3.75	.92	3.41	.93	3.60	.86	3.00	.88
	Know well	124	4.37	.68	3.80	.94	3.83	.76	3.73	.85	3.73	.84	3.34	.89	3.58	.81	2.84	.90
9.4IR Interest	Not inter.	105	4.39	.66	3.94	.89	3.87	.68	3.77	.82	3.82	.89	3.42	.93	3.62	.89	3.05	.93
	Inter.	251	4.36	.70	3.75	.99	3.78	.79	3.62	.93	3.77	.87	3.37	.96	3.57	.84	2.84	.93
10.4IR Tech. Knowle.	Don't know	146	4.36	.72	3.80	.96	3.77	.81	3.71	.89	3.90	.86	3.55	.90	3.71	.83	3.08	.91
	Know well	136	4.39	.70	3.84	.99	3.85	.81	3.71	.89	3.77	.86	3.46	.95	3.58	.91	2.86	.91

result of their views on the 4IR technology.

One key finding from the survey is that students currently view learning English in a classroom with a teacher as important. However, as the 4IR develops, their opinions on this are likely to change significantly as a result of the 4IR technology. Another noteworthy finding is that students started to perceive that English learning in general and traditional ways of English learning in particular would not automatically lead to an improvement in their English ability at present as shown in the decrease of the percentages of positive answers from 90.3% (English learning) to 70.6% (English education), to 67.2% (the need of English teachers), and to 60.6% (learning in classroom settings). This seems to become more salient in the era of the 4IR as seen in the decrease of the positive answers from 67% (English learning), to 63.7% (English education), to 51.3% (the need of English teachers), and 26.8% (learning in classroom settings). This indicates that many students think that learning English would continue to be important in the future, but not necessarily in the face-to-face classroom setting with the help of teachers. Additionally, they seem to consider that they could use digital technology to learn English by themselves. In the meantime, when specifically considering the 10 factors, it was found that several of them influenced on students' perceptions at present and in the future with statistically

significant amount (See Table 4 for descriptive statistics and Table 5 through Table 8 for two-way mixed ANOVA results).

First, in terms of gender, there were statistically significant differences between males and females in the first three sets of questions as indicated in Table 5 below (i.e., Questions 16 through 21) ( $F(1, 2) = 10.277, p < .01$  for Questions 16 and 17;  $F(1, 2) = 4.631, p < .05$  for Questions 18 and 19;  $F(1, 2) = 5.474, p < .05$  for Questions 20 and 21). Interestingly, female students considered English learning and English education (in and out of classroom) more important both at present and in the future ( $M = 4.43, SD = .66$  for Q16;  $M = 3.85, SD = .73$  for Q18) compared with male counterparts ( $M = 4.25, SD = .76$  for Q16;  $M = 3.78, SD = .82$  for Q18). However, as for the need for English teachers, more males thought it is important at present ( $M = 3.96, SD = .81$ ) than females ( $M = 3.65, SD = .90$ ). When considering their future perceptions, the result was completely opposite. The latter thought more positively ( $M = 3.41, SD = .97$ ) than the former ( $M = 3.39, SD = .94$ ). Nevertheless, both male and female students considered English teachers less important in the 4IR. Additionally, even though there were no statistically significant differences, male students thought that in-class English learning would be important both at present and future ( $M = 3.59, SD = .86$  for both); whereas female stu-

dents thought it would not be that important. The means were lower than 3.00 ( $M = 2.89$ ,  $SD = .91$  for present;  $M = 2.92$ ,  $SD = .94$  for future), indicating that female students perceived that English learning could occur without time and place restrictions.

TABLE 5

Two-Way Mixed ANOVA Table for Gender Factor

Factor	Source	Type III SS	df	MS	F	p
Gender	Between					
	Gender	10.481	1	10.481	10.277	.001**
	Error	588.426	577	1.020		
	16_17	87.904	1	87.904	221.078	.000**
	Within					
	Gender*16_17	.039	1	.039	.097	.755
	Error(16_17)	229.424	577	.398		
	Between					
	Gender	4.987	1	4.987	4.631	.032*
	Error	621.377	577	1.077		
	18_19	6.904	1	6.904	21.052	.000**
	Within					
	Gender*18_19	1.045	1	1.045	3.188	.075
	Error(18_19)	189.215	577	.328		
	Between					
	Gender	6.174	1	6.174	5.474	.020*
	Error	650.805	577	1.128		
	20_21	46.607	1	46.607	87.517	.000**
	Within					
	Gender*20_21	7.920	1	7.920	14.872	.000**
Error(20_21)	307.284	577	.533			
Between						
Gender	.068	1	.068	.056	.814	
Error	701.305	577	1.215			
24_25	130.231	1	130.231	347.482	.000**	
Within						
Gender*24_25	.051	1	.051	.137	.712	
Error(24_25)	216.251	577	.375			

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

When considering students' experience of GE courses, there was a statistically significant difference only between Questions 16 and 17 ( $F(1, 2) = 15.374$ ,  $p < .01$ ) as shown in Table 6. Regardless of how many GE courses that students had taken, they thought English learning would be less important in the future. However, those who took more than two GE courses were more negative about the future ( $M = 4.05$ ,  $SD = .96$ ). Moreover, statistically significant differences were found in the three sets of questions in terms of students' proficiency levels ( $F(1, 3) = 10.149$ ,  $p < .01$  for Questions 16 and 17;  $F(1, 3) = 3.500$ ,  $p < .05$  for Questions 18 and 19;  $F(1, 3) = 3.378$ ,  $p < .05$  for Questions 20 and 21). The more advanced they were, the more positive perceptions they had about both present and future in terms of learning English and its education. In contrast, those at a higher level considered English teachers at present as the least important among three proficiency level groups ( $M = 3.42$ ,  $SD = 1.10$ ). Additionally, they thought in a similar way for the future ( $M = 3.40$ ,  $SD = .99$ ). That is, they perceived the development of new digital technology may affect the importance of English teachers in the future. Yet, they thought its influence would not be negative, and thus their perception of English teachers (though their mean score was lower than the means of mid and lower level groups) about the future would not likely to be changed.

TABLE 6

Two-Way Mixed ANOVA Table for GE Course Experience Factor

Factor	Source	Type III SS	df	MS	F	p
GE course exp.	Between					
	GE course exp.	15.544	1	15.544	15.374	.001**
	Error	583.363	577	1.011		
	16_17	64.395	1	64.395	163.953	.000**
	Within					
	GE course exp.*16_17	2.837	1	2.837	7.224	.007**
	Error(16_17)	226.626	577	.393		
	Between					
	GE course exp.	3.577	1	3.577	3.314	.069
	Error	622.787	577	1.079		
	18_19	3.317	1	3.317	10.134	.002**
	Within					
	GE course exp.*18_19	1.430	1	1.430	4.371	.037*
	Error(18_19)	188.830	577	.327		
	Between					
	GE course exp.	2.927	1	2.927	2.582	.109
	Error	654.052	577	1.134		
	20_21	20.323	1	20.323	38.811	.000**
	Within					
	GE course exp.*20_21	13.069	1	13.069	24.958	.000**
Error(20_21)	302.135	577	.524			
Between						
GE course exp.	2.927	1	2.927	2.582	.109	
Error	654.052	577	1.134			
24_25	20.323	1	20.323	38.811	.000**	
Within						
GE course exp.*24_25	13.069	1	13.069	24.958	.000**	
Error(24_25)	302.135	577	.524			

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

Another factor that influenced on students' perceptions between the present and the future which had statistically significant amount was their experience of using digital technology ( $F(1, 2) = 14.048$ ,  $p < .01$  for Questions 16 and 17;  $F(1, 2) = 5.342$ ,  $p < .05$  for Questions 18 and 19) as shown in Table 7. Interestingly, those with no experience of using digital technology tended to think about learning English in and out of classroom more importantly and positively (both at present and in the future) than those with much experience of technology. In contrast, the latter admitted the importance of English teachers much more highly at present, but much less for the future ( $F(1, 2) = 5.258$ ,  $p < .05$ ). It can be inferred that those who were quite used to dealing with digital technology may well be more realistic at predicting about the future based on their own experience. They might have thought that English learners would possibly use digital technology anytime, and thus they could get an opportunity to learn English by themselves without much help of teachers.

In addition to the four factors mentioned above, there was one more factor; perception of digital technology use; which affected students' perceptions of the importance of in-class English learning with statistically significant amount ( $F(1, 2) = 7.878$ ,  $p < .01$ ) (see Table 8). Those who considered the use of digital technology as helpful perceived about learning English in classrooms slightly more important. However, the mean score was much lower than 3.00 ( $M = 2.88$ ,  $SD = .94$ ), indicating that they thought English learning could take place not necessarily in a face-to-

face classroom setting.

**TABLE 7**

Two-Way Mixed ANOVA Table for Technology Experience Factor

Factor	Source	Type III SS	df	MS	F	p
Tech. exp.	Between					
	Tech. exp.	14.235	1	14.235	14.048	.000**
	Error	584.672	577	1.013		
	16_17	81.187	1	81.187	205.362	.000**
	Within					
	Tech. exp.*16_17	1.353	1	1.353	3.422	.065
	Error(16_17)	228.110	577	.395		
	Between					
	Tech. exp.	5.746	1	5.746	5.342	.021
	Error	620.619	577	1.076		
	18_19	4.714	1	4.714	14.424	.000**
	Within					
	Tech. exp.*18_19	1.688	1	1.688	5.165	.023*
	Error(18_19)	188.573	577	.327		
	Between					
	Tech. exp.	5.933	1	5.933	5.258	.022*
	Error	651.046	577	1.128		
	20_21	31.995	1	31.995	60.518	.000**
Within						
Tech. exp.*20_21	10.151	1	10.151	19.200	.000**	
Error(20_21)	305.053	577	.529			
Between						
Tech. exp.	2.097	2	1.048	.865	.422	
Error	699.400	577	1.212			
24_25	5.628	1	5.628	15.019	.000**	
Within						
Tech. exp.*24_25	.957	2	.479	1.277	.280	
Error(24_25)	216.219	577	.375			

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

The rest of the five factors (i.e., major, attitude towards using digital technology, knowledge of the 4IR, interest in the 4IR, and knowledge of the 4IR technology) did not play statistically significant roles in affecting students' perceptions. However, as seen from means (Table 4), those who perceived of using digital technology more positively, those who knew more about 4IR, those who had more interest in 4IR, and those who had more knowledge of the 4IR technology tended to give lower points for the future. They particularly predicted that English teachers and in-class English learning would become much less important.

**TABLE 8**

Two-Way Mixed ANOVA Table for Technology Experience Perception Factor

Factor	Source	Type III SS	df	MS	F	p
Tech. exp.	Between					
	Tech. exp.	3.602	1	3.602	3.583	.060**
	Error	240.278	239	1.005		
	16_17	6.780	1	6.780	17.180	.000**
	Within					
	Tech. exp. percep.*16_17	.307	1	.307	.778	.379
	Error(16_17)	94.319	239	.395		
	Between					
	Tech. exp.	3.456	1	3.456	2.919	.089
	Error	283.033	239	1.184		
	18_19	1.147	1	1.147	3.133	.078
	Within					
	Tech. exp. percep.*18_19	.002	1	.002	.006	.939
	Error(18_19)	87.517	239	.366		
	Between					
	Tech. exp.	.213	1	.213	.169	.681
	Error	300.791	239	1.259		
	20_21	2.861	1	2.861	4.661	.032*
	Within					
	Tech. exp. percep.*20_21	.106	1	.106	.172	.679
	Error(20_21)	146.691	239	.614		
	Between					
	Tech. exp.	8.079	1	8.079	7.878	.005**
	Error	244.069	238	1.026		
24_25	.004	1	.004	.012	.914	
Within						
Tech. exp. percep.*24_25	.004	1	.004	.012	.914	
Error(24_25)	75.444	238	.317			

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

### 3. How Do Students Perceive the Effect of the 4IR on English Learning?

The last research question attempted to explore students' perceptions about the influence of 4IR on English learning and education. Table 9 illustrates descriptive statistics of their perceptions (Question 22 and six sub-questions).

Question 22 asked students to suggest ways how the 4IR technology (e.g., AI, big data, voice recognition, AR/VR, etc.) will influence English learning. A large majority of them felt that it will have positive effect with almost 70% (402) responding positively and only around 6% (34) negatively. The mean score was the second highest among the seven questions ( $M = 3.71$ ,  $SD = .72$ ). It seems that many of the students have seen how much influence technology has had in other areas of our society.

Further to this, the three most common types of technology associated with the 4IR that students pointed out would positively affect English learning (Question 23) were AI (75%), big data (57.3%), and voice recognition (46.9%). Other ones were AR/VR (35%), the Internet of Things (23.1%) and robotics (10.1%). The high frequency of selection of AI, big data, and voice recognition might be drawn from the following reasons: frequent use of AI-based translators, all-time check of the concentration of

fine dust or real-time traffic information through smartphone apps (which are based on big data), and occasional help from mobile virtual assistants which use voice recognition, such as Apple Siri, Samsung Bixby, and Google Assistant. Specifically, they might have thought that 1) various AI-based English learning apps are likely to be more developed, 2) big data will provide customized programs for specific English learners, and 3) voice recognition systems will satisfy English learners' curiosity about various kinds of learning contents. They thus might have thought that particularly these three types of 4IR technology will have a positive influence on English learning in the future.

TABLE 9

Descriptive Statistics of Students' Perceptions About the Effect of the 4IR on English Learning

Questions	<i>M</i>	<i>n</i>	<i>SD</i>	<i>SE</i>
Q22	3.71	579	.72	.03
Q22-1	3.39	579	.86	.04
Q22-2	3.07	579	1.01	.04
Q22-3	2.72	579	1.06	.04
Q22-4	3.89	579	.64	.03
Q22-5	3.33	579	.86	.04
Q22-6	3.60	579	.76	.032

Despite the data showing an overall positive perception of 4IR technology, views on how this technology might influence certain specific areas of English learning and education were varied. For instance, there were positive opinions on how it will provide a greater variety of learning methods with almost 80% responding positively ( $M = 3.89$ ,  $SD = .64$ ). Likewise in Question 22-5, approximately 62% felt that the technology would provide more new and innovative ways of learning English ( $M = 3.33$ ,  $SD = .86$ ).

However, when responding to questions that focused on motivation, equal learning opportunities, and speed of language learning (Question 22-1, 22-2, and 22-6, respectively) there seemed to be a little uncertainty. About half (50.08%, 290) were either unsure or answered negatively that 4IR technology would increase motivation to learn English ( $M = 3.39$ ,  $SD = .86$ ). Similarly, more than 60% of students (358) indicated they were either unsure of or gave a negative answer to its providing more equal opportunities to learn English ( $M = 3.07$ ,  $SD = 1.01$ ). Comparable figures were also found in the responses to Question 22-6 which questioned whether 4IR technology could improve the speed at which learners acquire English ( $M = 3.60$ ,  $SD = .76$ ).

To continue, question 22-3 asked students to assess if 4IR technology could reduce the cost of private English education. Interestingly, these obtained the highest number of negative responses out of all the questions on the survey ( $M = 2.72$ ,  $SD = 1.06$ ) with just under 50% of students (270) saying that costs will not be reduced under the influence of 4IR technology. Moreover, approximately 25% (145) said they were unsure, leaving only slightly over 25% (164) claiming that private education costs would be

reduced as a direct result of 4IR technology.

Among the seven questions (i.e., Question 22 and six sub-questions), particularly the means of Questions 22-2 and 22-3 were the lowest, indicating that students generally thought 4IR technology could be helpful in applying various new learning methods and improve English proficiency faster than before with more interest and motivation. However, they thought that the private expenses would never decrease. They further seemed to perceive that there would be no equal opportunity since those who can afford to spend more money would possibly get more benefits from technology which, in turn, may promote negative effect of private English education.

In the meantime, 10 more factors were considered in order to find out specifically what factors affect students' perceptions about the effect of 4IR on English learning. Means and standard deviations are presented in Table 10, and asterisks are marked where there are statistically significant differences based on the results of independent *t*-tests or one-way ANONAs.

It was found that only two factors (i.e., knowledge of the 4IR and interest in the 4IR) had statistically significant impacts on students' perception. Those who know quite well about the 4IR technology thought less positively about English learning and education compared with those who do not have much knowledge of the technology. Their mean scores for all questions were lower, and statistically significant differences were found in Question 22-6 ( $t(123) = 2.68$ ,  $p < .01$ ). By using new technology, they may already have tried learning English by themselves. They may, however, have felt that their English skills did not improve as much as they had expected during the short period of time. In contrast, those who do not know much about new technology might have assumed that their English proficiency would improve a lot if they get a help of technology.

Another factor affected students' perceptions with statistically significant amount. Specifically, those who have more interest in the 4IR were thinking less positively about the influence of new technology on English learning compared with those who had less interest (Question 22) ( $t(250) = 2.03$ ,  $p < .05$ ). In addition, they were less trustful about enhancing their English proficiency by using the technology (Question 22-6) ( $t(250) = 2.05$ ,  $p < .05$ ). They were even more negative about having equal opportunity for all learners of English (Questions 22-2 and 22-3). That is, as they have much interest and have already had the experience of using the 4IR technology, they seemed to be certain that there would not be an equal opportunity for all learners to learn English ( $t(104) = 2.14$ ,  $p < .05$ ) and there still would be a strong need for private tutoring ( $t(104) = 2.14$ ,  $p < .05$ ).

Although no statistically significant differences were found in other eight factors, the overall means for Question 22-3 were the lowest (i.e., lower than 3.00), indicating that all were anticipating a lot of expense for private education in the future anyway. Interestingly, those who perceive their experience of using technology as helpful,

TABLE 10

Students' Perceptions of the Effect of 4IR Technology on English Learning Based on Various Factors

Factors	n	#22		#22-1		#22-2		#22-3		#22-4		#22-5		#22-6		
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	
Gender	M	244	3.71	.67	3.32	.84	3.09	1.02	2.71	1.08	3.85	.66	3.32	.86	3.57	.74
	F	355	3.70	.75	3.44	.88	3.06	1.01	2.72	1.05	3.91	.63	3.33	.85	3.62	.77
Major	H	254	3.74	.71	3.39	.84	3.09	1.00	2.75	1.08	3.9	.65	3.31	.86	3.59	.76
	S&E	286	3.69	.72	3.41	.87	3.07	1.02	2.65	1.05	3.87	.63	3.54	.79	3.61	.76
	A&M	39	3.59	.75	3.26	.94	3.03	1.01	3.03	1.04	3.87	.61	3.33	.86	3.59	.75
GE course exp.	1-2	404	3.70	.70	3.36	.83	3.06	1.00	2.75	1.06	3.89	.64	3.32	.85	3.59	.76
	2+	175	3.73	.76	3.46	.95	3.11	1.04	2.66	1.07	3.89	.65	3.33	.86	3.62	.77
Profi.	L	330	3.70	.71	3.33	.84	3.04	1.01	2.73	1.06	3.90	.63	3.31	.86	3.59	.76
	M	184	3.74	.70	3.49	.89	3.08	1.01	2.72	1.04	3.86	.65	3.37	.80	3.65	.72
	H	65	3.65	.82	3.40	.90	3.23	1.03	2.66	1.14	3.92	.71	3.29	.99	3.52	.87
Tech. exp.	Yes	350	3.70	.71	3.33	.84	3.03	1.03	2.72	1.07	3.89	.63	3.31	.86	3.57	.76
	No	229	3.72	.74	3.48	.90	3.15	.99	2.71	1.06	3.89	.65	3.36	.84	3.63	.76
Tech. exp. percep.	Not Helpful	16	3.88	.34	3.44	.63	3.13	.96	2.69	1.14	3.88	.34	3.56	.63	3.13	.81
	Helpful	225	3.74	.74	3.51	.89	3.05	1.07	2.72	1.07	4.05	.60	3.69	.76	3.42	.87
Tech. exp. posi/nega	Nega.	11	3.64	.81	3.46	1.04	2.82	.98	2.36	.92	3.82	.75	3.00	1.00	3.27	.79
	Posi.	379	3.68	.72	3.40	.85	3.00	1.01	2.68	1.06	3.87	.66	3.34	.85	3.60	.75
4IR know.	Not Know well	144	3.76	.70	3.40	.94	3.11	1.09	2.79	1.16	3.93	.62	3.44	.85	3.74**	.78
	Know well	124	3.66	.69	3.36	.82	3.02	.95	2.71	1.03	3.80	.64	3.30	.84	3.49**	.70
4IR inter.	Not Inter	105	3.78*	.68	3.47	.96	3.21*	1.12	2.90*	1.21	3.97	.60	3.43	.92	3.72*	.80
	Inter	251	3.61*	.72	3.33	.86	2.96*	.97	2.63*	1.03	3.83	.67	3.25	.86	3.54*	.75
4IR tech. know.	Not Know well	146	3.71	.72	3.45	.95	3.08	1.07	2.75	1.12	3.93	.60	3.38	.88	3.67	.80
	Know well	136	3.63	.74	3.39	.85	3.01	1.00	2.77	1.05	3.81	.67	3.32	.82	3.54	.74

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

who know well about the 4IR, who have much interest in the 4IR, and who know quite well about the technology were less positive about the effect of the 4IR on English learning and education.

## V. CONCLUSION AND IMPLICATIONS

Through this research, several major findings were observed. First, regarding Korean EFL university students' perceptions and their experience of using digital technology, they were positive about using it for the purpose of learning English rather than feeling anxiety or fear. That is, whether they had much or less experience of using digital technology, they took into account it in a positive way.

Second, when comparing students' perceptions about English learning and education at present and in the future, statistically significant differences were found in five out of 10 factors (i.e., gender, experience of taking GE courses, self-perceived English proficiency, experience of using digital technology, and perception of digital technology use). Overall, they believe that learning English will be important although slightly less so than it is currently. However, there is more significant decrease in the importance of English teachers and face-to-face lessons.

Finally, in the area of students' perceptions about the effect of the 4IR on English learning and education, statistically significant differences were found only in two

factors (i.e., knowledge of the 4IR and interest in the 4IR). Yet, the majority of the students did not feel much positive about the influence of the 4IR on English learning. Besides, they predicted that an equal opportunity of English education would not be guaranteed or that the expense for private education would not be reduced in the future.

In short, although statistically significant differences were found in students' perceptions in several factors out of 10, they generally shared the same ideas. To be specific, not only were the majority of them used to applying new digital technology in learning English by themselves (though some were still depending on traditional learning tools), but also had positive perceptions about it. Additionally, they admitted the importance of learning English in the future, but not necessarily with English teachers and in a face-to-face class setting. This indicates that they were thinking they can improve their English skills to a certain extent by themselves with the help of new digital technology. In the meantime, students in this study were not positive about the use of digital technology in the future English education. They instead perceived that in order to become highly proficient in English, private tutoring would be indispensable. They thus thought those with enough money to spend of extra English education would have a better chance to become proficient as the 4IR will not provide this opportunity. Ironically, this implies that English teachers and in-class learning are necessary in order to enhance students' English skills by helping them

get enough education at school as well as reduce private tutoring expense.

There are some potential implications that these findings could have on the future of English classes at Korean universities. They are mostly concerned with how students learn, in what context they hope to learn, and what technology they are comfortable using. In addition, there are further implications regarding a variety of factors (e.g., gender, major, self-perceived English proficiency, etc.).

The first of these is related to how much digital technology should be used by both teachers and students in the classroom. Arguably, the 4IR is playing greater role than ever before in the lives of these students; thus, there could be a presumption that they would be comfortable using 4IR technology to learn English. As a result, teachers may look to incorporate an increasing amount of this technology into how they deliver classroom material and how they ask students to process this information. However, this research indicates that perhaps a more cautious and traditional approach is needed. There was a clear indication that quite a lot of students (i.e., one third of the participants) still rely on classroom tools, such as pens, pencils, and paper to help with their learning. Therefore, despite the 4IR generally moving away from these more traditional tools in other aspects of society, they should not be overlooked as still having an important role to play in the Korean university EFL classroom.

Somewhat connected to this is the type of 4IR technology that these learners believe will have the most positive effect on learning English. The students had clear ideas on what types of technology will help them. AI, big data, and voice recognition were the three most commonly identified. Consequently, if teachers are planning on introducing 4IR technology classrooms, they might want to consider these three types over others as the students have a positive perception about their benefits.

An additional implication relates to where English classes in the 4IR are based and how they should be conducted. The students indicated that learning English is extremely important to them at both the present time and as the 4IR continues to progress. Likewise, they also implied that technology could not replace teachers. While this clearly validates the need for English classes and English teachers in this context, careful consideration of the setting and format of the classes might be needed. The data show a decreasing preference for a face-to-face English classroom as the 4IR continues. As a result, university administration and program directors may need to give thought to introducing other ways to conduct and manage GE classes. Introducing MOOCs and virtual online classrooms might be a possible solution.

Finally, analysis of the data showed that there were statistically significant differences among students' perceptions about English learning now and future and their views of the effects of 4IR technology on learning English based on some of the factors among 10. Students' gender, GE course experience, self-perceived English proficiency, experience of using digital technology, etc. affected them

to give different responses to the survey questions. One implication of this is that certain types of technology could be more effective when working with students from one or more of these factors. More research might be required in this area of 4IR technology to better understand exactly how this could work in EFL classrooms of the future. The 4IR is moving at an incredibly fast pace and there appears to be an urgent need for school administrators, program directors as well as teachers to make utmost efforts to maximize students' English learning by using newly introduced digital technology.

While it has uncovered some possible implications for GE classes of the 4IR, this research does have two limitations. Firstly, it was conducted at only one university with a relatively low number of 579 participants. Even though this number included those of different ages, experience with GE classes, and area of major study, it is far from comprehensive. A much larger pool of participants would include those who have had differing experiences of GE classes from different socioeconomic backgrounds and other major subjects that are not offered at the university chosen for this study. Thus, to get a more complete understanding of Korean students' perceptions of how 4IR is going to affect English learning, the research would need to be expanded to include a much larger number of universities and greater number of participants.

Secondly, as this research is mostly quantitative, it is difficult to understand exactly how and in what specific ways 4IR technology will change English learning. A large proportion of the survey asked the students to respond to multiple choice questions which only examined the extent to which they believe the 4IR influences their learning now and how it might in the future. This data does not provide much depth in terms of exactly how it might help or hinder these students. This is an area that may have some important implications for GE classes, so further research of a more qualitative nature (e.g., interview with some of the students by considering 10 factors) might be needed.

## REFERENCES

- Ahn, Sung-Ho. (2017, April). *The 4th industrial revolution and English education*. Paper presented at the first seminar hosted by Korea Institute for Curriculum and Evaluation. Seoul, Korea.
- Bang, Youngjoo. (2017). The effect of flipped learning in an EFL classroom. *Modern English Education, 18*(2), 87-107.
- Becker, S. A., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C., & Ananthanarayanan, V. (2017). *NMC horizon report: 2017 higher education edition*. Austin, Texas: The New Media Consortium.
- Dabbagh, N., & Kitsantas, A. (2012). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher*

- Education*, 15(1), 3-8.
- Fisk, P. (2017, January 24). Education 4.0 ... the future of learning will be dramatically different, in school and throughout life. Retrieved from <https://www.thegeniusworks.com/2017/01/future-education-young-everyone-taught-together/>
- Goodfellow, I., Benjio, Y., & Courville, A. (2016). *Deep learning*. Cambridge: MIT Press.
- Gray, A. (2016, January 19). 5 million jobs to be lost by 2020. *World Economic Forum*. Retrieved from <https://www.weforum.org/agenda/2016/01/5-million-jobs-to-be-lost-by-2020/>
- Im, Hee-Joo. (2017). The university students' perceptions or attitudes on the use of English automatic translation in a general English class. *Korean Journal of General Education*, 11(6), 727-751.
- Jones, S., Richards, A., Cho, Youngsang, & Lee, Yoo-Jean. (2018). The effect of the fourth industrial revolution on general English education—A case study of native English instructors' perceptions at a Korean university. *Korean Journal of General Education*, 12(4), 35-64.
- Kim, Eunjin. (2018). An exploratory study on the pre-service teachers' perception of education paradigm in the fourth industrial revolution era. *The Journal of the Korea Contents Association*, 18(9), 248-259.
- Kim, Hyoung Soon, & Kim, Heyong. (2017). A study of Korean teachers' future readiness for the fourth industrial revolution. *Journal of Multimedia-assisted Language Learning*, 20(3), 179-205.
- Kim, Rakhun. (2018). A critical review of the impact of the fourth industrial revolution on the development of the basic communicative competence of Korean EFL learners. *Multimedia-assisted Language Learning*, 21(3), 115-148.
- Kim, Sun-Woong. (2017, April). *The 4th industrial revolution and the future of English educators*. Paper presented at the first seminar hosted by Korea Institute for Curriculum and Evaluation. Seoul, Korea.
- Kim, Yong-Suk. (2017). Elementary school teachers' and teacher educators' ideas of English education in the 4th industrial society. *The Journal of Education*, 37(3), 123-150.
- Kim, Young-Woo. (2018, May). *The 4th industrial revolution and future English textbooks*. Paper presented at the second seminar hosted by Korea Institute for Curriculum and Evaluation. Seoul, Korea.
- Kop, R., & Fournier, H. (2010). New dimensions to self-directed learning in an open networked learning environment. *International Journal of Self-directed Learning*, 7(2), 2-20.
- Lee, MinHwa, Yun, JinHyo Joseph, Pyka, A., Won, DongKyu, Kodama, F., Schiuma, G., Park, Hang-Sik, Jeon, Jeonghwan, Park, KyungBae, Jung, KwangHo, Yan, M., Lee, SamYoul, & Zhao, X. (2018). How to respond to the fourth industrial revolution, or the second information technology revolution? Dynamic new combinations between technology, market, and society through open innovation. *Journal of Open Innovation: Technology, Mark, and Complex*, 4(3), 1-24.
- Mohamed, M. (2014). Using technology in EFL/ESL classroom. *International Journal of Humanities and Cultural Studies*, 1(2), 1-18.
- Montrieux, H., Vanderlinde, R., Schellens, T., & De Marez, L. (2015). Teaching and learning with mobile technology: A qualitative explorative study about the introduction of tablet devices in secondary education. *PLOS ONE*, 10(12), 1-17.
- Mujtaba, S., & Mubarak, M. (2013). The use of computer technology in EFL classroom: Advantages and implications. *International Journal of English Language & Translation Studies*, 1(1), 61-71.
- Park, Jae-Hwan, & Ahn, Jeeyoung. (2018). Education for 4th Industrial Revolution. *Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology*, 8(5), 885-892.
- Park, Jong Hyang, & Shin, Na Min. (2017). Students' perceptions of artificial intelligence technology and artificial intelligence teachers. *The Journal of Korean Teacher Education*, 34(2), 169-192.
- Rohrbach, J. (2018, May 10). How new technologies are changing language learning, for better or for worse. *Forbes*. Retrieved from <https://forbes.com/sites/forbesnycouncil/2018/05/10/how-new-technologies-are-changing-language-learning-for-better-and-worse/#50f77942a178>
- Schwab, K. (2016, January 14). The fourth industrial revolution: What it means and how to respond. *World Economic Forum*. Retrieved from <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>
- Shin, Sein, Ha, Minsu, & Lee, Jun-Ki. (2017). High school students' perception of artificial intelligence: Focusing on conceptual understanding, emotion and risk perception. *Journal of Learner-centered Curriculum and Instruction*, 17(21), 289-312.
- Stone, P., Brooks, P., Brynjolfsson, E., Calo, R., Etzioni, O., Hager, G., Hirschberg, J., Kalyanakrishnan, S., Kamar, E., Kraus, S., Leyton-Brown, K., Parkes, D., Press, W., Saxenian, A., Shah, J., Tambe, M., & Teller, A. (2016). *Artificial intelligence and life in 2030: One hundred year study on artificial intelligence* (2016 Report). Stanford University. Retrieved from <http://ai100.stanford.edu/2016-report>
- Wisskirchen, G., Biacabe, B. T., Bormann, U., Muntz, A., Niehaus, G., Soler, G. J., & von Brauchitsch, B. (2017, April). *Artificial intelligence and robotics and their impact on the workplace*. Retrieved from <https://www.ibanet.org/Document/Default.aspx?DocumentUid=c06aa1a3-d355-4866-beda-9a3a8779ba6e>

**APPENDIX**  
Survey Questionnaire

**I. 배경정보**

1-1. Age 현재 본인의 나이를 알려주세요. (만00세)  
 ① 19    ② 20    ③ 21    ④ 22    ⑤ 23 이상

1-2. School year 현재 본인의 학년을 알려주세요.  
 ① 1학년    ② 2학년    ③ 3학년    ④ 4학년

2. Gender 성별  
 ① 남    ② 여

3. Major/College 본인의 소속대학을 알려주세요.  
 ① 문과대학    ② 법과대학    ③ 사회과학대학  
 ④ 상경대학    ⑤ 공과대학    ⑥ 자연과학대학  
 ⑦ 건축대학    ⑧ SW융합대학    ⑨ 사범대학  
 ⑩ 예술디자인대학    ⑪ 음악대학    ⑫ 국제대학  
 ⑬ Other:

4. How many mandatory general English classes have you taken so far? 현재까지 총 몇 개의 핵심교양영어를 수강하였나요? (이번 학기 포함)  
 ① 1과목    ② 2과목    ③ 3과목    ④ 4과목 이상

5. What is your perceived English level? 본인의 현재 영어 실력은 어떻다고 생각하나요?  
 ① 초급    ② 중초급    ③ 중급    ④ 중고급    ⑤ 고급

**II. 디지털 기술을 이용한 영어 학습 경험과 생각**

6-1. Have you ever used digital technology to learn English? 디지털 테크놀로지(digital technology)를 이용하여 개인적으로 영어를 학습해 본 적이 있나요?  
 ① 있다    ② 없다

6-2. (If you have an experience, how helpful was it for your English learning? (경험이 있다면) 디지털 테크놀로지(digital technology)가 본인의 영어 학습에 얼마나 도움이 되었다고 생각하나요?  
 ① 전혀 도움이 되지 않았다  
 ② 도움이 되지 않았다  
 ③ 보통이다  
 ④ 도움이 되었다  
 ⑤ 매우 도움이 되었다

6-3. (If you have an experience, what digital technology have you used for English learning?) (Check all that apply.) (경험이 있다면) 본인의 개인적인 영어 학습에 주로 이용하고 있는 디지털 테크놀로지(digital technology)는 어떤 것이 있나요? (해당하는 것에 모두 표시해 주세요)  
 ① 온라인 사전    ② 번역 웹사이트/앱    ③ 단어 학습 웹사이트/앱  
 ④ 언어교환 학습 웹사이트/앱  
 ⑤ 영어시험(TOEIC, TOEFL, IELTS 등등) 준비 웹사이트/앱  
 ⑥ 팟캐스트 웹사이트/앱  
 ⑦ 인터넷 동영상(Youtube 등등) 웹사이트/앱  
 ⑧ 인공지능 비서(구글 어시스턴트, 빅스비 등등) 앱  
 ⑨ 온라인 게임 웹사이트/앱  
 ⑩ 가상현실 / 증강현실

- ⑪ 소셜미디어(Facebook, Instagram, Twitter) 웹사이트/앱
- ⑫ 메신저 (KakaoTalk, Line) 웹사이트/앱
- ⑬ 블로그      ⑭ 음성파일(mp3, cd 등등)
- ⑮ Other:

7. What tools do you use most when you learn English now? 현재 본인의 개인적인 영어학습에 주로 이용하는 도구는 어떤 것이 있나요?

- ① TV    ② 스마트폰    ③ 컴퓨터(PC)/노트북
- ④ 태블릿    ⑤ MP3 플레이어    ⑥ CD 플레이어
- ⑦ 책 / 공책 / 연필    ⑧ Other:

8. How much do you use digital technology for your English learning now? 현재 본인의 영어 학습에 디지털 테크놀로지(digital technology)를 얼마나 이용하고 있나요?

- ① 전혀 이용하지 않는다
- ② 거의 이용하지 않는다
- ③ 가끔 이용한다
- ④ 자주 이용한다
- ⑤ 항상 이용한다

9. How much are you concerned/ scared when you use digital technology for English learning? 새로운 디지털 테크놀로지(digital technology)를 이용하여 영어 학습을 하는 것에 대한 두려움이 있나요?

- ① 두려움이 매우 많다
- ② 두려움이 있는 편이다
- ③ 보통이다
- ④ 두려움이 없는 편이다
- ⑤ 두려움이 없다

10. How do you perceive learning English through digital technology? 디지털 테크놀로지(digital technology)를 이용한 영어 학습에 대한 본인의 생각이 긍정적인가요 부정적인가요?

- ① 아주 부정적이다
- ② 부정적이다
- ③ 부정적이지도 긍정적이지도 않다
- ④ 긍정적이다
- ⑤ 매우 긍정적이다

### III. 4차산업혁명에 관한 인식

11. How much do you think you know about the 4IR? 4차산업혁명에 관해 얼마나 알고 있다고 생각하나요?

- ① 전혀 모른다
- ② 보통 이하다
- ③ 보통이다
- ④ 보통 이상이다
- ⑤ 매우 잘 안다

12. How much interest do you have in the 4IR? 4차산업혁명에 관해 얼마나 많은 관심을 갖고 있나요?

- ① 관심이 전혀 없다
- ② 관심이 없는 편이다
- ③ 관심이 있지도 없지도 않다
- ④ 관심이 있는 편이다
- ⑤ 관심이 매우 있다

13. How much do you know about technology that is considered important in the 4IR? 4차산업혁명에서 중요하게 다루어지고 있는 기술(technology)에 대해 얼마나 알고 있나요?

- ① 전혀 모른다

- ② 보통 이하다
- ③ 보통이다
- ④ 보통 이상이다
- ⑤ 매우 잘 알고 있다

14. How concerned are you about living in the 4IR? 4차산업혁명 시대에 대한 불안감이 있나요?

- ① 전혀 없다
- ② 없는 편이다
- ③ 보통이다
- ④ 있는 편이다
- ⑤ 매우 있다

15. How much has your life changed as a result of the 4IR? 4차산업혁명으로 인한 변화를 현재 피부로 직접 느끼고 있나요?

- ① 전혀 느끼지 못하고 있다
- ② 느끼지 못하고 있다
- ③ 보통이다
- ④ 느끼고 있다
- ⑤ 매우 느끼고 있다

#### IV. 4차산업시대의 영어교육에 관한 인식

16. How important do you think it is to learn English now? 현재 영어 습득이 얼마나 중요하다고 생각하나요?

- ① 전혀 중요하지 않다
- ② 중요하지 않다
- ③ 보통이다
- ④ 중요하다
- ⑤ 매우 중요하다

17. How important do you think learning English will be as the 4IR continues? 4차산업혁명이 계속 진행되어 나가면서 영어 습득의 중요성은 어떻게 될 거라 생각하나요?

- ① 전혀 중요하지 않게 될 것이다
- ② 중요하지 않게 될 것이다
- ③ 보통일 것이다
- ④ 중요하게 될 것이다
- ⑤ 매우 중요하게 될 것이다

18. How important do you think English education is now? 현재 진행되고 있는 학교 또는 학교 밖에서의 영어 교육(영어를 배우고 가르치는 행위)이 얼마만큼 중요하다고 생각하나요?

- ① 전혀 중요하지 않다
- ② 중요하지 않다
- ③ 보통이다
- ④ 중요하다
- ⑤ 매우 중요하다

19. How important so you think English education is in the 4IR? 4차산업혁명이 계속 진행되어 나가면서 학교 또는 학교 밖에서의 영어 교육(영어를 가르치고 배우는 행위)의 중요성이 어떻게 될 거라 생각하나요?

- ① 전혀 중요하지 않게 될 것이다
- ② 중요하지 않게 될 것이다
- ③ 보통일 것이다
- ④ 중요하게 될 것이다
- ⑤ 매우 중요하게 될 것이다

20. How much do you think English teachers are needed now? 현재 본인의 개인적인 영어 학습을 위해 영어 선생님이 필요하다고 생각하나요?

- ① 전혀 필요하지 않다
- ② 필요하지 않다
- ③ 잘 모르겠다
- ④ 필요하다
- ⑤ 매우 필요하다

21. How necessary do you think English teachers will be as the 4IR continues? 4차산업혁명이 계속 진행되면서 영어 선생님의 필요성이 어떻게 될거라 생각하나요?

- ① 전혀 필요 없게 될 것이다
- ② 필요 없게 될 것이다
- ③ 잘 모르겠다
- ④ 필요할 것이다
- ⑤ 매우 필요할 것이다

22. How do you think technology developed and used in the 4IR will influence English learning activities? 4차산업에서 대두되는 기술(인공지능, 빅데이터, 음성인식, 가상/증강현실, 사물인터넷, 로봇 공학, 양자 컴퓨터 등등)이 인간의 영어 학습에 어떤 영향을 미칠 것이라고 생각하나요?

- ① 아주 부정적인 영향을 미칠 것이다
- ② 부정적인 영향을 미칠 것이다
- ③ 잘 모르겠다
- ④ 긍정적인 영향을 미칠 것이다
- ⑤ 매우 긍정적인 영향을 미칠 것이다

22-1. It will help us to get more motivated in learning English. 4차산업 기술(technology)이 영어 학습에 대한 흥미를 더 높여 줄 것이라 생각하나요?

- ① 전혀 그렇지 않을 것이다
- ② 그렇지 않을 것이다
- ③ 잘 모르겠다
- ④ 그럴 것이다
- ⑤ 매우 그럴 것이다

22-2. Everyone can have an equal opportunity to learn and improve English. 4차산업에서 대두되는 기술(technology)로 인해 영어 실력을 향상시킬 수 있는 기회가 모든 사람에게 공평하게 주어질 것이라 생각하나요?

- ① 전혀 그렇지 않을 것이다
- ② 그렇지 않을 것이다
- ③ 잘 모르겠다
- ④ 그럴 것이다
- ⑤ 매우 그럴 것이다

22-3. It will help us reduce our private education expenses. 4차산업에서 대두되는 기술(technology)로 인해 영어 교육 사교육비가 줄어들 것이라 생각하나요?

- ① 전혀 그렇지 않을 것이다
- ② 그렇지 않을 것이다
- ③ 잘 모르겠다
- ④ 그럴 것이다
- ⑤ 매우 그럴 것이다

22-4. We can try many different learning methods. 4차산업에서 대두되는 기술(technology)로 인해 다양한 영어 학습 방법을 시도해 볼 수 있을 것 같나요?

- ① 전혀 그렇지 않을 것이다
- ② 그렇지 않을 것이다
- ③ 잘 모르겠다

- ④ 그럴 것이다
- ⑤ 매우 그럴 것이다

22-5. Technology developed and used in the 4IR will provide new and innovative ways to learn English? 4차산업에서 대두되는 기술(technology)은 지금과는 다른 획기적인 영어학습 기회를 제공할 것이라 생각하나요?

- ① 전혀 그렇지 않을 것이다
- ② 그렇지 않을 것이다
- ③ 잘 모르겠다
- ④ 그럴 것이다
- ⑤ 매우 그럴 것이다

22-6. It will help to improve my English much faster than now. 4차산업에서 대두되는 기술(technology)로 인해 영어 실력을 지금보다 좀더 빨리 늘릴 수 있을 것이라 생각하나요?

- ① 전혀 그렇지 않을 것이다
- ② 그렇지 않을 것이다
- ③ 잘 모르겠다
- ④ 그럴 것이다
- ⑤ 매우 그럴 것이다

23. Which technology do you think will have the most positive effect on English learning? (Choose three.) 4차산업에서 대두되는 기술(technology)중 영어학습에 긍정적으로 영향을 미칠 것 같은 3가지를 고른다면?

- ① 인공지능                      ② 빅데이터                      ③ 음성인식
- ④ 가상 또는 증강 현실        ⑤ 사물인터넷                ⑥ 음성인식 및 음성합성
- ⑦ 로봇 공학                      ⑧ 양자 컴퓨터                ⑨ Other:

24. Do you think we still need to learn English in a classroom setting? '교실영어수업'이 영어습득을 위해 현재 필요하다고 생각하나요?

- ① 교실수업은 전혀 필요하지 않다
- ② 교실수업은 필요하지 않다
- ③ 보통이다
- ④ 교실수업은 필요하다
- ⑤ 교실수업은 매우 필요하다

25. As the 4IR continues, do you think we still need to learn English in a classroom setting? 4차산업혁명이 진행될 수록 '교실영어수업'의 필요성이 어떻게 될 것이라 생각하나요?

- ① 전혀 필요하지 않게 될 것이다
- ② 필요하지 않게 될 것이다
- ③ 보통이다
- ④ 필요하게 될 것이다
- ⑤ 매우 필요하게 될 것이다