Immersive Learning Technologies in English Language Teaching: A Systematic Review

Hamide Kobra ALTUN                      Jeongmin LEE**
Ewha Womans University
Korea

The aim of this study was to examine the trends (e.g., the distribution of the studies by year, country, research methods, and participants’ education level) and fundamental findings [e.g., interaction in Virtual Reality (VR) environments, educational content through VR and Augmented Reality (AR) technologies, learning environment in AR, etc.] regarding immersive learning technologies such as VR and AR in English Language Teaching (ELT) between 2010 and 2019. Employing a systematic review research methodology, data was gathered from 59 academic articles published in the following databases: EBSCOhost, ERIC, Web of Science, and Taylor & Francis. The studies were analyzed using a content analysis approach, and findings demonstrated that immersive learning technologies in ELT came to prominence in 2017. Mixed methods research was the most widely employed research method. The most studied language skill was vocabulary for AR and speaking for VR. The results also revealed advantages and challenges with regards to the use of immersive learning technologies in ELT. Further analysis illustrated the findings related to characteristics of immersive learning technologies in ELT. Based on this review, research and design implications for researchers and practitioners are presented.

Keywords: Immersive learning technologies, Virtual reality, Augmented reality, English language teaching, Systematic review

* This paper is a revision of some of the thesis of the first author
** Corresponding author, jeongmin@ewha.ac.kr
Introduction

With the rapidly increasing development of emerging technologies, dramatic transformations are occurring in every part of our lives, including aspects of society such as culture, the economy, and education. Technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) draw the interest of many educators as they offer numerous learning opportunities and experiences for learners. These technologies promote 21st century skills (collaboration, communication, critical thinking, and creativity) (Lambert & Cuper, 2008) and immerse learners into meaningful contexts, which can enhance the positive transfer of new information into realistic situations. Thus, all fields of education seek to keep up with these innovations. English Language Teaching (ELT) is one such field that needs to consistently offer new opportunities for learners’ self-improvement.

Despite the availability of various information and communication technology (ICT) instruments and programs, teachers in ELT still continue to employ conventional teaching methods that use abstract forms of delivering information (Safar, Al-Jafar, & Al-Yousefi, 2017). Using limited resources and similar (often repetitive) activities can result in boredom and a loss of passion (Tsai, 2018), curiosity, and motivation (Taskiran, 2019) for learning among learners. The implementation of decontextualized activities in ELT means that learners are deprived of opportunities to interact in authentic environments (Lee & Park, 2019). Furthermore, they are not provided with situated learning, and interactions are restricted to lecture formats with instructors, resulting in a lack of social engagement (Shea, 2014).

Immersive learning technologies including VR, AR, and MR can solve these problems as they provide learners with engaging experiences through integrated audio and visual content (Blyth, 2018). Moreover, these technologies might reduce the distinction between formal and informal learning, thereby allowing language learners to explore challenges, and to gain unexpected enjoyment and intrinsic
motivation (Taskiran, 2019). The aim of this study was to examine the trends (e.g., the distribution of the studies by year, country, research methods, and participants’ education level) and fundamental findings (e.g., interaction in VR environments, educational content through VR and AR technologies, learning environment in AR, etc.) regarding immersive learning technologies such as VR and AR in ELT between 2010 and 2019.

The implementation of VR supports English language learners in several ways. First, opportunities for learners to practice English are provided in environments where communication and interaction with other learners or avatars occur (Liaw, 2019). Second, learners are provided with engaging activities that address other senses than sight and hearing, such as tactile stimuli (Chen, 2016) and kinaesthetic activities (Urun, Aksoy, & Comez, 2017). Lastly, certain conditions (such as peer pressure or new subject content) may put learners under stress. Accordingly, VR can provide a stress-free environment (especially by means of virtual characters), which helps to relieve stress and provide encouragement to use the language (Hong, Chen, & Lan, 2014). A further factor that can contribute to a stress-free learning environment is that learners can embody virtual characters (Urun et al., 2017) when they are assigned roles.

The use of AR in ELT plays an essential role by facilitating contextualized learning (Taskiran, 2019) whereby learners can experience authentic input and potential opportunities to interact. Hsu (2017) report three main features of AR in situated learning for English learners: learner-centered learning rather than teacher-centered learning, learners becoming active observers controlling their learning to attain knowledge-internalization, and learners being allowed to implement the knowledge they manage in addition to producing appropriate English in realistic circumstances. Hence, AR supports situated learning, which provides learners with surroundings close to reality, all of which enhances learning effectiveness (Hsu, 2017). By providing realistic surroundings, AR has a constructive influence on being able to transfer skills obtained in a learning context to real life (Chen, 2016).
MR implementation is quite unusual, and this may be attributed to its technical restrictions. According to Vazquez et al. (2017), contextual awareness is still constrained to “machine learning and sensor technologies, hindering the capacity for contextual affinity under certain circumstances” (p. 2177). The application they used to discover MR was WordSense, in which items may be labelled improperly or classified imprecisely. To illustrate, it is possible for cats to be categorized as mammals. Because irrelevant embeddings may be displayed on the system as actively linked content, learners may become confused. Furthermore, latency can lead to problems when there are difficulties on the network (Vazquez et al., 2017). Taking these points into consideration, this systematic review focused specifically on immersive learning technologies that utilize VR and AR.

To date, research has demonstrated that immersive learning technologies contribute to academic achievement (Chen & Chan, 2019; Urun et al., 2017), enhance learning motivation (Taskiran, 2019), and engagement (Hao & Lee, 2019). Further, they capture learners’ attention (Jee, 2014), promote social skills (Wu, 2019), reduce anxiety (Hsu, 2017), promote experiential learning (Knutzen & Kennedy, 2012), and learner-centered learning environments (Hong et al., 2014; Hsu, 2019).

As several studies revealed, immersive learning technologies have produced positive outcomes in ELT, suggesting that teachers and researchers need to integrate these technologies for effective learning outcomes. Hence, this paper can guide practitioners on how to implement them for better results. Systematic reviews are significant in that unmanageable amounts of information is transferred into a competent set of information so that practitioners and scholars can reach rational decisions through given data (Mulrow, 1994), which paves the way for future studies (Turan & Akdag-Cimen, 2019). Furthermore, systematic reviews illustrate whether findings are confirmative and can be generalized over other contexts and samples or based on particular subcategories (Mulrow, 1994).
Immersive Learning Technologies in English Language Teaching: A Systematic Review

**Literature Review**

There is an increase in the integration of immersive learning technologies (Akçayır & Akçayır, 2017), which results from recent mobile technologies and increasing number of mobile device owners (Statista, 2020). These technologies have come into prominence in education as well and they are investigated to reveal their learning outcomes, especially with university students as in other fields of studies (Bacca et al., 2014; Kavanagh et al., 2017; Turan & Akdağ-Cimen, 2019). They might be preferred since it is easier to access them (Turan & Akdağ-Cimen, 2019).

Immersive learning technologies can be employed when the aim is to provide EFL learners an authentic learning environment to practice their speaking (Taskiran, 2019) as they are stress-free (Küçük, Yılmaz, & Göktaş 2014) and support contextualized (Lee & Park, 2019) and situated learning (Hsu, 2017).

AR might be more convenient to access and implement in the sense of devices (Martin et al., 2011) because smartphones can simply enable AR technology. Additionally, mobile devices can be easily used and carried (Johnson et al., 2010) compared to heavy headsets or computers.

Immersive learning technologies in ELT have several benefits such as motivation (Bacca et al., 2014; Kavanagh et al., 2017; Quintero et al., 2019), catching attention (Chen & Chan, 2019), giving enjoyment and entertainment (Lantavou & Fesakis, 2018), reducing anxiety and increasing confidence (Taskiran, 2019), improving learning achievement (Akçayır & Akçayır, 2017; Bacca et al., 2014), facilitating individualized learning (Bacca et al., 2014; Kavanagh et al., 2017), and so on. However, there are also some challenges regarding these technologies such as technical/Internet-related problems (Akçayır & Akçayır, 2017; Quintero et al., 2019; Yung & Khoo-Lattimore, 2019).

No systematic review has been conducted on immersive learning technologies in the field of ELT to date, although such a review has been completed in a broader
educational context. Akçayır and Akçayır (2017) investigated AR in educational settings by reviewing 68 studies published up to 2016. The focus of the research questions was as follows: distribution of the studies across years, learner type, device type, and benefits and challenges of AR in education. According to their findings, the number of the papers increased over the past four years. With regard to learner type, the mostly preferred sample group was K-12 students. As for device type, mobile devices were largely chosen. The most commonly identified advantage was enhancing learning achievement. Lastly, usability was the most commonly reported challenge in that learners had difficulty utilizing AR.

Kavanagh et al. (2017) performed a systematic review on VR integration in education by analyzing 379 papers published between 2010 and 2017. They investigated how VR was applied, the motivations for use, and what challenges were faced. They found that the foremost areas of application were constructivist pedagogy, collaboration, and gamification. In terms of motivations, the most documented benefit was boosting intrinsic motivation. Finally, the most commonly identified challenges were cost, user experience, and interactivity. While these findings have some implications, it is not possible to generalize them to specific disciplines such as ELT. Therefore, the motivation to carry out this systematic review with an emphasis on ELT was based on possible difficulties experienced by researchers and practitioners when designing learning materials, which could result in planning similar materials with previous studies. Thus, providing trends, directions, effective methods, and widespread applications can assist them in their future studies by offering practical methods. Finally, there is a need for a specific analysis regarding characteristics of VR and AR in an ELT context. To this end, the following research questions were composed based on existing systematic review studies considering application plans of immersive learning technologies in ELT context and examined for the purpose of this study:

1. What are the trends in immersive learning technologies related to ELT
research?

2. What were the key findings identified from the existing body of literature?

2.1 What were the key findings regarding the implementation of immersive learning technologies in ELT overall?

2.2 What were the key results particular to VR technology in ELT?

2.3 What were the key results particular to AR technology in ELT?

**Method**

Borenstein et al. (2009) defined a systematic review as specifying explicit rules that guide the search for studies (including inclusion and exclusion criteria) for analysis. Although setting these criteria can be considered subjective to an extent, mechanisms are clear as all decisions are identified distinctly (Borenstein et al., 2009). In this study, a systematic review was used, as this enables incontrollable volumes of information to be converted into an efficient set of information for practitioners and scholars. This provides data from which reasonable decisions can be made (Mulrow, 1994) and may offer grounds for future studies (Turan & Akdag-Cimen, 2019). Besides, systematic reviews reveal whether findings obtained are corroborative and might be generalized in other contexts, or whether they depend on particular subcategories (Mulrow, 1994). Moreover, systematic reviews confine bias and increase reliability as well as accuracy of conclusions via obvious methods (Mulrow, 1994). Hence, the current status of immersive learning technologies in ELT was investigated to illustrate propensities, advantages, and challenges on this subject to offer an inclusive insight for future research.

**Data collection**

Scientific papers from 2010 to 2019 were selected for investigation. A systematic search was conducted using the following databases: Web of Science, EBSCOhost,
ERIC, and Taylor & Francis, all of which consist of the highest number of articles regarding education (Turan & Akdag-Cimen, 2019). The following keywords were utilized: augmented reality, virtual reality linked with English, English learning, EFL, ESL, language learning, and foreign language teaching.

**Data analysis**

A coding list was developed, adapted from the study by Cho (2018), to perform data coding. For consistency and reliability, the coding list was confirmed by a Ph.D. student studying Educational Technology with experiences of systematic review and meta-analysis studies for 2 years, a Ph.D. student mastering ELT with an experience of systematic review for 1 year, and two experts in Educational Technology. Content analysis was applied as this approach is extensively preferred for textual analyses, providing scope to compare, contrast, and categorize the data (Fraenkel & Wallen, 2000). To perform qualitative systematic reviews, content analysis can be considered since it offers a flexible data analysis method if the purpose is to construct knowledge and form theory to accommodate data which are well-structured and contextualized (Finfgeld-Connett, 2014).

First, the coding list was generated using Microsoft Excel to take notes on studies based on the research questions (as demonstrated in Table 1). The coding list included related information as the studies were meticulously read. Microsoft Excel was also employed for the analysis, which was specified as a systematic and iterative method to condense significant volumes of data into smaller categories according to precise coding rules (Berelson, 1952). The first research question referred to descriptive information, which is mentioned clearly in the papers. As for the second research question, detailed information about the studies was also searched. Notably, the analysis was performed in a way that one article is considered as two different studies for the article (Bonner & Reinders, 2018) which focused on both VR and AR. For instance, the article provided some practical ideas for practitioners, thus suggesting a variety of lesson activities some of which require
Immersive Learning Technologies in English Language Teaching: A Systematic Review

smartphones while others requiring computers. In this case, both smartphones and computers were counted separately.

### Table 1. Subcategories of research questions

<table>
<thead>
<tr>
<th>Research questions</th>
<th>Subcategories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>- Distribution of the studies by year: publication years from 2010 to 2019</td>
</tr>
<tr>
<td></td>
<td>- Distribution of the studies by country</td>
</tr>
<tr>
<td></td>
<td>- Research methods: qualitative, quantitative, mixed, literature review, or system design</td>
</tr>
<tr>
<td></td>
<td>- Education level of samples: pre-school, primary school, secondary school, high school, university, and other EFL/ESL students from diverse backgrounds</td>
</tr>
<tr>
<td>2.1</td>
<td>- Technology type: VR or AR</td>
</tr>
<tr>
<td></td>
<td>- Studied basic language skill by technology type: speaking, listening, reading, vocabulary, etc. trends in VR and AR</td>
</tr>
<tr>
<td></td>
<td>- Device type: smartphones, tablets, computers, head mounted display (HMD), google cardboard, and so on</td>
</tr>
<tr>
<td></td>
<td>- Program type: existing programs or programs that are designed and developed by researchers</td>
</tr>
<tr>
<td></td>
<td>- Advantages and challenges of immersive learning technologies in ELT</td>
</tr>
<tr>
<td>2.2</td>
<td>- Interaction: whether learners interacted with real people, avatars, game characters, or virtual objects</td>
</tr>
<tr>
<td></td>
<td>- Interaction methods: how learners interact with the VR content (e.g. visual, audio-visual, voice, text, haptic, and body movements)</td>
</tr>
<tr>
<td></td>
<td>- Educational content: the main purpose of VR implementation (simulation, training, access limited sources, and distance learning)</td>
</tr>
<tr>
<td>2.3</td>
<td>- Learning environment: whether AR had an influence on the learning environment and led to learner-centered environment</td>
</tr>
<tr>
<td></td>
<td>- Learning by doing: if AR facilitated learning by doing in ELT or not</td>
</tr>
<tr>
<td></td>
<td>- AR addressing five senses: sight, hearing, touch, smell, and taste</td>
</tr>
<tr>
<td></td>
<td>- AR type: marker-based AR, marker-less AR, or location-based AR</td>
</tr>
<tr>
<td></td>
<td>- Educational content: the fundamental aim of the articles (communicative, collaborative, experiential, and practical) in using AR in ELT</td>
</tr>
</tbody>
</table>

Keywords were searched to detect articles implementing VR or AR in ELT based on the selection criteria, which resulted in 1,294 articles as illustrated in
Figure 1. After omitting duplicates, 1,224 studies remained to be screened. The extracted articles were reviewed based on their titles and abstracts, which resulted in removing a further 328 articles as they were not related to VR or AR. Another 825 of the remaining articles were not relevant to ELT. For eligibility, the final 71 articles were then scanned. Subsequently, three studies were excluded as they were not written in English, and another three studies were removed because full text was not available. A further six articles were omitted since they give only descriptive information about VR or AR technologies and were not scientific research studies. Following this process of elimination, 59 studies remained for inclusion in this study.

To establish inter-rater reliability, 30 out of 59 studies were randomly selected and independently coded by two researchers, one of whom was a Ph.D. student majoring in ELT. Microsoft Excel was utilized to examine two code sets to reveal the Cohen’s Kappa coefficient value, which was determined to be 0.78, indicating agreement between researchers (Viera & Garrett, 2005). Furthermore, two researchers discussed the remaining studies and reached a compromise.
Results

Trends in Immersive Learning Technologies and ELT literature

The distribution of the studies by year, country, research methods, and participants’ education level were examined to respond to research question 1. Each category is described in the following sub-sections. Also, brief information regarding each article is given in Appendix.

Distribution of the articles by year

Figure 2 presents the distribution of the papers by year with regards to immersive learning technologies in ELT. A slow increase in the number of papers between 2010 and 2017 was observed followed by a significant increase after 2017. Notably, no study was published in 2011.

![Figure 2. The number of the studies by year](chart)

Distribution of the studies by country

Most studies examining immersive learning technologies in ELT were carried out in Taiwan (n = 17), followed by Turkey (n = 8), with a couple of studies performed in United States (n = 5), China (n = 4), Germany (n = 3), Australia (n = 3), and Korea (n = 2). The following countries only produced one article: Greece,
Colombia, Poland, Spain, Italy, Vietnam, India, The State of Kuwait, Iran, Netherlands, Thailand, Romania, Hong Kong, Japan, and United Kingdom. However, no information was provided regarding country in two studies. These results show that a wide range of countries conducted studies on immersive learning technologies in ELT.

Research methods used

A mixed methods approach (n = 22) was the most commonly used research method, followed by quantitative (n = 16) and qualitative methods (n = 15). Design study (n = 2) and literature review (n = 4) were the least commonly employed research methods.

Education level of the sample

It was revealed that university students (n = 26) were preferred as the sample in most studies, followed by primary school students (n = 10) and EFL/ESL learners with diverse backgrounds (n = 9). Among the remaining articles, pre-school students (n = 5) and high school students (n = 3) were chosen as the sample. The least commonly selected group was secondary school students (n = 1). Five articles did not provide information regarding the sample group.

Findings of Immersive Learning Technologies and ELT Literature

Immersive Learning Technologies in ELT

The subcategories examined were as follows: technology type, studied basic language skill studied by technology type, device type, utilized program, advantages, and challenges of immersive learning technologies in ELT.

Technology type implemented

The number of the studies applying AR (n = 31) was the majority, closely followed by VR (n = 27). One literature review study focused on both AR and VR.
Basic language skills studies by technology type

The language skill most commonly focused on in AR studies was vocabulary (n = 16), followed by writing (n = 7), speaking (n = 6), listening (n = 4), reading (n = 4), alphabet (n = 2), culture learning (n = 1) and grammar (n = 1). Next, the most commonly studied language skill in VR papers was speaking (n = 13), followed by listening (n = 7), vocabulary (n = 6), reading (n = 2), writing (n = 2), English language arts (n = 1), aviation English (n = 1), presence (n = 1), culture learning (n = 1), collaboration (n = 1), language play (n = 1), and grammar (n = 1).

Device type utilized

It was found that smartphones (n = 14) were used in most studies, closely followed by computers (n = 13). Next, HMD (n = 8), tablets (n = 6), projector accompanied with computers (n = 5), smartphones and tablets (n = 5), Google cardboards with smartphones (n = 2), and smartphones and computers (n = 1) were employed in the studies. Moreover, other devices (n = 2) were also utilized: one study employed The Microsoft Xbox Kinect console for Kinect-based gaming, and the other implemented Leap Motion Controller. However, no information was provided regarding devices in three of the studies.

Program type utilized

It was found that most articles deployed an existing program (n = 41) and the remainder (n = 18) designed and developed a program for their research purposes.

Advantages of Immersive Learning Technologies in ELT

Numerous benefits of immersive learning technologies in ELT were reported. The most observed benefit was the increase in the affective domains of learners (n = 135), which comprised increasing motivation (n = 35), enjoyment (n = 25), engagement (n = 24), capturing learners’ attention (n = 21), promoting an anxiety-free environment (n = 13), improving confidence (n = 10), and increasing positive attitudes toward the learning experience (n = 6). Next, enriching the
cognitive domain of learners was a commonly reported benefit, which primarily consisted of enhancing learning achievement \((n = 25)\), developing cultural knowledge \((n = 8)\), boosting self-regulation skills \((n = 5)\), and fostering long term memory \((n = 4)\).

Another commonly discovered benefit was the progression of language skills \((n = 40)\), which included advancing vocabulary \((n = 11)\), speaking skills \((n = 7)\), general proficiency \((n = 5)\), listening \((n = 4)\), grammar \((n = 4)\), pronunciation \((n = 4)\), reading \((n = 3)\), and writing skills \((n = 1)\). Subsequently, augmenting the interpersonal domain of learners was a commonly identified benefit, which consisted of increasing collaboration \((n = 12)\), communication \((n = 6)\), and social skills \((n = 3)\). Regarding features of immersive technologies \((n = 19)\), this addressed advantages such as enabling situational learning \((n = 5)\), contextual learning \((n = 4)\), enhancing a sense of presence \((n = 4)\), advancing spatial/motor abilities \((n = 4)\), and promoting embodiment of virtual characters \((n = 2)\).

**Challenges of Immersive Learning Technologies in ELT**

Despite the range of diverse benefits, some challenges also emerge while implementing immersive learning technologies in ELT. It was indicated that technical or Internet-related problems \((n = 21)\) were the most frequently mentioned challenge. Next, technology-related problems \((n = 15)\) were commonly mentioned, comprising distraction by technology, technology accessibility, heavy wearable sets, limited editing/creation opportunities, technology sickness, expenses, and privacy and security issues. Next, human-related problems \((n = 13)\) included limited information/skills on technology, different learning style/personality, requiring extra time for adaption, and personal fears.

In relation to learning domain-related problems \((n = 4)\), cognitive load and anxiety were documented. Regarding activity related problems \((n = 4)\), activity design problems, tiring outside activities, and activities causing boredom were included. Extra workload for teachers, being time consuming, and classroom management were noted as challenges for teachers. Moreover, some challenges
peculiar to VR and AR components such as different time zones (for global activities) and high expenses were identified for VR. In terms of AR, heavy headsets and physical fatigue in case of outside activities through location-based AR might be challenging.

**Findings regarding VR technology**

*Interaction in VR*

The results showed that learners interacted with real people in most studies \( (n = 10) \), followed by avatars \( (n = 7) \). Next, there were studies in which learners interacted with virtual objects \( (n = 5) \) and game characters \( (n = 3) \). No information was provided in two studies regarding this matter.

*Interaction methods*

It is worth noting that some articles reviewed enabled learners with more than one interaction method. Consequently, audio-visual \( (n = 13) \) was the most documented interaction method. In addition, some studies allowed learners to interact with others through voice \( (n = 11) \), namely, by talking to each other. Besides, learners were provided with only visual aids \( (n = 10) \) in some VR environments. Furthermore, learners also used texting features \( (n = 8) \) to interact with others. Moreover, in two studies, learners were allowed to control VR content with their body movements, one implementing Microsoft Xbox Kinect console for Kinect-based gaming while the other using HTC Vive VR system, together with two handheld motion controllers and two wall-mounted infrared sensors. Lastly, interacting through haptic touch was provided to learners in one study. However, three studies did not provide any information.

*Educational content*

According to the findings, the mostly implemented VR content was training \( (n = 13) \). Subsequently, simulation \( (n = 6) \) and distance learning \( (n = 6) \) were commonly
explored VR content. Notably, using VR for limited sources to access (n = 1) was the least applied VR content. No information was detected in one article regarding this analysis.

**Main results regarding AR technology**

*Learning environment*

Many articles (n = 22) revealed that the integration of AR in ELT provided learners with a learner-centered environment. Only some studies (n = 5) demonstrated a more teacher-centered environment. Nevertheless, four articles did not identify any information regarding learning environment.

*Learning by doing*

A large number of studies (n = 19) presented opportunities for learning by doing, whereby learners were no longer just receivers of information but also participated into hands-on activities. Nevertheless, some studies (n = 8) conducted activities where hands-on activities were not provided. No information was specified in four studies on this issue.

*Senses addressed*

Audio-visual content corresponded to the most displayed content (n = 20). There were some articles (n = 10) addressing only visual content. One article did not identify any related information. Notably, no study addressed other senses such as touch, smell, or taste.

*AR type implemented*

The most frequently utilized AR type was marker-based AR (n = 15). Next, location-based AR (n = 8), followed by marker-less AR (n = 7) were explored in the reviewed studies. In addition, one study (Hockly, 2019) did not report any information on AR type.
Educational content

The most mentioned AR content in ELT was communicative AR content ($n = 18$), followed by collaborative AR content ($n = 9$). A few studies implemented experiential AR content ($n = 2$). However, no article employed practical AR content. Two studies did not provide any information on educational content. Communicative AR content comprised activities where learners mostly interacted with virtual objects through their device screens in marker-based AR or marker-less AR. In terms of collaborative AR content, learners were put into groups or pairs to complete missions or solve problems, which mainly occurred in location-based AR. As for experiential AR content, learners discovered fields to detect a variety of plants on campus or scenic spots in London for culture learning.

Discussion

In this study, 59 articles were selected through EBSCOhost, ERIC, Web of Science, and Taylor & Francis and examined with regard to their trends and findings on immersive learning technologies in ELT. According to the investigation, a slow increase in the number of articles published was revealed between 2010 and 2017. However, a significant increase was observed from 2017 onwards. The relatively recent increase in the number of articles can be attributed to the development of technology as well as the growing accessibility of these technologies. In a systematic review of AR in the context of education conducted by Akçayır and Akçayır (2017), this increase was attributed to innovations in mobile technologies along with an increase in the number of mobile device owners (Statista, 2020).

Among the analyzed articles, an encouraging range of countries were reported to have conducted studies on immersive learning technologies in ELT. It is worth noting that Taiwan revealed the highest number of studies, which might be
attributed to the fact that Taiwan has come into prominence for its Information Technology industry and integrating technology into education owing to numerous startups as well as respected technology firms focusing on Technology Enabled Learning (Ferry, 2016). Many insights were gained on the topic of immersive learning technologies in ELT by means of various countries and cultures, which suggests more studies on the implementation of these immersive technologies should be conducted to keep up with the trends. This systematic review revealed that mixed methods research was the mostly employed research method, which corroborates the study of Bacca et al. (2014). This finding accords with the necessity in ascertaining the impact of immersive learning technologies implementation in ELT. The next mostly utilized research methods were quantitative and qualitative methods, indicating that there has been an effort to explore the effect of immersive learning technologies in ELT from multiple perspectives. However, more effort is required in the future considering this systematic review consists of two separate immersive technologies, VR and AR. There would have been fewer studies if these technologies were considered exclusively, suggesting that there is a lack of research for each of these subjects individually.

In the investigated articles, university students were the most studied sample group, which is in line with other review studies in the literature (Bacca et al., 2014; Kavanagh et al., 2017; Turan & Akdag-Cimen, 2019). A common tendency has been observed in educational technology research to target university students as the sample group (Kucuk et al., 2013). This could be because it is more convenient to access university students (Turan & Akdag-Cimen, 2019). Furthermore, Garzón and Acevedo (2019) conducted a meta-analysis on the effectiveness of AR systems on student learning outcomes and revealed that AR had a large effect on university level of students, but a lesser effect on primary and secondary school students. This finding is not consistent with the study conducted by Ozdemir et al. (2018), who concluded that education level showed no statistically significant difference.
In the examined articles, the most studied language skill was vocabulary. This was found to play a significant role in language learning, particularly in relation to language learning through games (Urun et al., 2017). The second common language skill studied in the articles was speaking, which is a well-chosen skill considering EFL learners do not have opportunities to practice their speaking skills and it is usually practiced via uncontextualized activities. Immersive learning technologies offer EFL learners the opportunity to practice speaking in an authentic way (Taskiran, 2019) in a stress-free environment (Küçük, Yılmaz, & Göktaş 2014) with contextualized (Lee & Park, 2019) and situated learning materials (Hsu, 2017). Thus, more effort should be made to integrate these technologies into EFL lessons. While listening was studied in several articles, there is still a need for more studies in different language skills to offer clear insights into the effective application of immersive learning technologies.

This systematic review demonstrated that AR is the more commonly implemented technology, which may be because it is easier to access and apply in terms of devices (Martin et al., 2011). A smartphone would be enough to explore AR technology. In addition, it is more convenient as mobile devices are becoming easier to use and portable (Johnson et al., 2010). Conversely, heavy headsets or computers were utilized to employ VR technology. Hence, this might have challenged the users. However, VR technology is becoming more accessible as technology improves. For instance, Google cardboard (which is very economical) works with a smartphone is a convenient way for VR experience. Therefore, future studies should focus on exploring the effectiveness of VR technology in ELT as well as its challenges and advantages.

This systematic review revealed the most studied language skills by the type of technology. Accordingly, speaking was the most explored language skill in VR studies. Learning a language, especially speaking skill, demands regular practice, which may not be addressed in every classroom or context. Since some kind of interaction is provided by VR through avatars, other users, or content in a virtual
environment, English learners are offered an advantageous platform to practice their speaking in a stress-free environment. Hence, teachers are encouraged to take advantage of VR to improve speaking skills of their learners in a practical and effective way. As for AR studies, the most reported language skill was vocabulary, with researchers employing AR as flashcards (Chen & Chan, 2019; Lantavou & Fesakis, 2018; Tsai, 2018) presenting 3D pictures of the vocabulary, and sometimes pronunciation as well as usage in a sentence. Furthermore, some studies designed AR games to teach vocabulary (Hsu, 2017; Hsu, 2019). Because AR integrates virtual objects into real environments, more situated and contextualized learning can be provided for learners of English. Therefore, teachers are recommended to further explore AR technology in vocabulary teaching.

In the analyzed articles, smartphones were the most utilized devices to integrate these immersive technologies. It is estimated that use of smartphones will increase substantially as they become more convenient (Johnson et al., 2010). Few studies employed tablets, which might be because they are heavier to hold and carry. The findings of this study are inconsistent with earlier studies on AR technology by Akçayır and Akçayır (2017) and Quintero et al. (2019), who found that mobile devices were the most commonly utilized devices. In addition, it is worth noting that previous research on AR applications by Ozdemir et al. (2018) showed that mobile devices produced better learning outcomes regarding academic achievement compared with webcam-based devices. Mobile devices are suggested because they are economical and easy to utilize, particularly for younger students (Furió et al., 2013).

This review highlighted that most studies employed an existing program. However, many studies also designed and developed their own program and evaluated how well they work for their purposes. Using an existing program might produce more reliable results. In addition, there are numerous programs that facilitate the preparation of learning content for users’ aims. However, researchers are encouraged to design their own programs as this serves their research objectives.
A wide range of advantages of immersive learning technologies in ELT context were reported. The most mentioned advantage was learner motivation, which also substantiates other studies conducted on AR in educational settings (Bacca et al., 2014; Kavanagh et al., 2017; Quintero et al., 2019). This finding might be connected to attention, relevance, confidence, and satisfaction (ARSC) as a feature of the model of motivation theory proposed by Keller (2008). Accordingly, learners’ attention is drawn by dynamic features of these immersive technologies (Chen & Chan, 2019), by generating a sense of enjoyment and entertainment for users (Lantavou & Fesakis, 2018). Such immersive materials can be perceived as games that reduce anxiety and increase confidence by offering challenges, intrinsically motivating experiences, and surprising pleasure (Taskiran, 2019).

Another commonly mentioned benefit was that immersive learning technologies improve learning achievement, which bears similarities with previous studies (Akçayır & Akçayır, 2017; Bacca et al., 2014). This finding can be attributed to other benefits of immersive technologies such as enhancing learner motivation (Hao & Lee, 2019), learner enjoyment (Tsai, 2018), learner engagement (Hsu, 2019), interaction (Urun et al., 2017), drawing attention (Wu, 2019), and reducing anxiety (Lantavou & Fesakis, 2018). All these benefits contribute to learner achievement in that their perception towards English also improves. However, benefits such as promoting individualized learning (Bacca et al., 2014; Kavanagh et al., 2017), knowledge transfer into the real world, and social learning skills need to be explored further.

Even though immersive learning technologies offer various benefits for ELT, they also pose some challenges. This review showed that the most reported challenge was technical/Internet-related problems, which is in accordance with the findings of the earlier studies by Akçayır and Akçayır (2017), Quintero et al. (2019), and Yung and Khoo-Lattimore (2019). Other main challenges and difficulties identified included distraction by technology, limited information/skills on
technology, and limited editing/creation options.

This systematic review demonstrated that interaction with real people constitutes a majority in most of the articles on VR. In other words, the learners interacted with real people through text chat and/or voice chat (Knutzen & Kennedy, 2012) during their journey through VR. These interactions occurred among classmates, with native speakers, or internationally with learners of English around the world. Considering EFL learners have few opportunities to practice their English (Shea, 2014), VR technology enables them to use language to interact with others with the help of authentic oral and written inputs (Yang, Chen, & Jeng, 2010). Furthermore, several studies mentioned learners interacting with avatars, indicating a reduction of anxiety. Thus, interaction with avatars can be suggested for shy or low proficiency learners who comprise a large proportion of learners, who might feel overwhelmed if they are required to interact with real people. Therefore, teachers are encouraged to conduct an analysis of their learners’ characteristics and implement the type of interactions that apply best to their particular condition.

A variety of interaction methods were detected, ranging from audio-visual to kinesthetic methods. The most evident interaction method was audio-visual, which provides sufficient immersive experiences for learners. Nevertheless, learners may involve themselves in the virtual environment better if they interact with the content kinesthetically or control contents through their voice (Urun et al., 2017). However, devices that provide such immersive experiences might be very expensive or have limited access. This is why policy makers are encouraged to initiate programs that offer engaging immersive experiences for learners, especially those who study at underprivileged schools.

This systematic review indicated that VR content was used for training purposes in most articles, referring to the application with the intention of facilitating practical transferrable skills. The main aim was to enable learners to practice their English skills so that they can apply those skills in real life. For instance, Hong et al. (2014) designed animated pedagogical agents through which learners could practice
their communication skills using a question and answer method integrated into a storytelling activity. Nevertheless, VR is suggested for use for other purposes such as simulation or to access limited sources. This enables users to discover things that they may not experience easily because of high expense, limited access, or infeasibility. Therefore, teachers might utilize VR more: for example, by taking their learners on a virtual travel abroad to practice situational conversations.

The investigated studies showed that AR turned conventional teacher-centered learning environments into more learner-centered learning environments, which was indicated in previous studies (Kerawalla et al., 2006; Küçük et al., 2014). In learner-centered environments, learners are longer be dependent on their teachers for information; instead, they become active participants in the learning process by controlling their pace or collaborating with others to achieve learning objectives (Lantavou & Fesakis, 2018; Lee & Park, 2019). Teachers should take this significant characteristic of AR into account and design their AR lessons to allow active participation.

Next, this review revealed that AR technology allows students to learn by doing and gain experience with the help of hands-on activities, which echoed earlier studies (Tekedere & Göke, 2016). Learners were given problems to solve, missions to achieve, and/or roles to behave in a certain way. Accordingly, they were engaged in experiential learning. Thus, AR technology should be used not only to motivate or entertain learners for learning, but also to provide them with as many ways as possible to increase their engagement with contents, which is in line with Fauth (1988), who claimed 90% of what people listen, see, say, and do is learnt.

This systematic review examined which senses were addressed by AR in the reviewed articles. Consequently, it was found that AR addresses sight and hearing in most of the articles. None of the studies provided experiences to address touch, smell, or taste, since these would require a higher quality of technology making it expensive and limited to implement. However, Tekedere and Göke (2016) pointed out that the more senses addressed, the more powerful the learning experience.
Besides, Rodrigues et al. (2019) indicated that more studies focus on more sensory AR systems to provide better immersive experiences for users. Hence, teachers are encouraged to implement AR applications that trigger learners’ senses as much as possible.

In the investigated papers, marker-based AR was the mostly utilized AR type, which may be because they are easier to design, especially compared to location-based AR. Location-based AR requires activities to be held outside, which might not always be possible because of lack of Internet connection, adverse weather conditions, or finding a proper place to conduct activities. Furthermore, teachers might face challenges in monitoring learners, especially young learners. Considering that marker-based AR provides convenience for indoor activities with its less challenging design process, teachers and researchers tend to utilize it more often. Leaving classrooms for a change can motivate learners (even if they know the sites) as they can even design their own tours with compatible applications (Lakarnchua & Reinders, 2014). In addition, location-based AR applications were reported to foster creativity, facilitate collaboration, increase engagement along with opportunities for just-in-time learning and situational vocabulary learning (Wu, 2019), and foster active learning and improve environmental awareness (Mei & Yang, 2019). Thus, more teachers are encouraged to design lessons integrating location-based AR once their conditions are met.

Finally, this systematic review reported that most articles conducted their studies utilizing a communicative type in terms of educational AR content. Communicative type content refers to the interaction between learners and augmented content, usually in marker-based AR activities. Moreover, several studies employed collaborative-type content where learners were put into pairs or groups to work together on a problem or mission, which contributed to learners’ interpersonal skills. However, there is a lack of studies on integrating experiential type of content considering that AR technology can offer more immersive experiences in museums or historical places to enhance learners’ cultural learning about the target language.
Notably, practical content was not observed in any of the studies, calling for researchers and teachers to design lessons where learners can experience things that they may not experience due to high risk or cost.

**Conclusion**

The current study is essential as it is the first review study regarding the practice of immersive learning technologies in ELT. The findings of this study are as follows: This study revealed an abrupt increase in the number of the studies starting from 2017. Taiwan revealed the highest number of the studies. The mostly employed research method was mixed methods research, and the most studied sample group was university students. The most focused language skill was vocabulary, speaking, and listening respectively. The most implemented technology was AR, and the most utilized tools to integrate these immersive technologies were smartphones. Most studies employed an existing program. The most mentioned advantage was learning motivation, improving learning achievement, learning enjoyment, learner engagement, interaction, drawing attention, reducing anxiety, and so forth. The review illustrated that the most reported challenge was technical/internet related problems.

Interaction in VR environments occurred with real people in most of the studies, and audiovisual was the most preferred interaction method. The most implemented educational content through VR was training. In most of the AR articles, AR changed the learning environment towards learner-centered environment and promoted learning by doing. The most common senses that AR addressed were sight and hearing. Moreover, the most implemented educational content via AR was communication. Lastly, marker-based AR was the most utilized AR type.

It is aimed to present following research implications for researchers who plan to perform studies on this matter. Finally, design principles are presented for
practitioners according to the results of this study.

Research implications

- Future research should focus on participants from other education levels.
- There needs to be more studies on grammar knowledge, reading, and writing skills.
- In future research, benefits such as promoting individualized learning, knowledge transfer into the real world, and social learning skills need to be investigated.
- Future studies should offer ways to explore VR or AR for access limited resources.
- More sensory AR that addresses senses (e.g. touching, smell) should be examined.
- There is a need to conduct further studies through location-based AR.
- More studies are required with practical and experiential type of educational content in AR implementation.

Design implications

- Instructors should actively implement immersive learning technologies with university students considering intervention duration, arranging programs meticulously, and offering sources of motivation for learning.
- Instructors can employ AR mainly for vocabulary teaching and VR for speaking skills.
- Instructors are advised to select adjustable programs that offer addition, removal, and change without difficulty based on their needs and objectives (Kerawalla et al., 2006).
Learners who are to practice interpersonal skills should be allowed to interact with real people in VR environments, especially native speakers. Instructors may benefit avatars for younger or lower proficiency learners.

Instructors are suggested to design more dynamic AR contents that include videos and animations to increase immersion, thereby contributing to enhanced learning.

Regarding VR content, they are recommended to employ supplementary devices to computers such as HMD. Google cardboards might be considered in that they are economical, accessible, and provide high immersion.
References

References marked with an asterisk indicate studies included in systematic review.


Liaw, M. L. (2019). EFL learners’ intercultural communication in an open social


Immersive Learning Technologies in English Language Teaching: A Systematic Review


---

**Hamide Kubra ALTUN**

Master of Arts in Educational Technology, Ewha Womans University.

Interests: Virtual Reality, Augmented Reality, Flipped Learning

E-mail: altun.kubra2@gmail.com

---

**Jeongmin LEE**

Associate Professor, Ewha Womans University.

Interests: Technology-facilitated Learning Design

E-mail: jeongmin@ewha.ac.kr

---

Received: September 05, 2020 / Peer review completed: September 21, 2020 / Accepted: September 28, 2020
## Immersive Learning Technologies in English Language Teaching: A Systematic Review

### Appendix

<table>
<thead>
<tr>
<th>No</th>
<th>Author (year)</th>
<th>Country</th>
<th>Research method</th>
<th>Education level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alexe (2013)</td>
<td>Romania</td>
<td>Qualitative</td>
<td>University</td>
</tr>
<tr>
<td>2</td>
<td>Aroltay and Totel (2018)</td>
<td>Turkey</td>
<td>Qualitative</td>
<td>University</td>
</tr>
<tr>
<td></td>
<td>Bonner and Reinders (2016)</td>
<td>Literature review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Castañeda et al. (2018)</td>
<td>Colombia</td>
<td>Quantitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>4</td>
<td>Chen J. C. (2016a)</td>
<td>Australia</td>
<td>Qualitative</td>
<td>Other ESL learners</td>
</tr>
<tr>
<td>5</td>
<td>Chen J. C. (2016b)</td>
<td>Australia</td>
<td>Qualitative</td>
<td>Other ESL learners</td>
</tr>
<tr>
<td>6</td>
<td>Chen (2018)</td>
<td>Australia</td>
<td>Qualitative</td>
<td>Other ESL learners</td>
</tr>
<tr>
<td>7</td>
<td>Chen and Chan (2019)</td>
<td>China</td>
<td>Mixed methods</td>
<td>Pre-school</td>
</tr>
<tr>
<td>8</td>
<td>Chen Y. L (2016)</td>
<td>Taiwan</td>
<td>Quantitative</td>
<td>University</td>
</tr>
<tr>
<td>9</td>
<td>Dash et al. (2018)</td>
<td>India</td>
<td>App development</td>
<td>Pre-school</td>
</tr>
<tr>
<td>10</td>
<td>Dolguelve et al. (2018)</td>
<td>Turkey</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>12</td>
<td>Hao and Lee (2019)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>Primary school</td>
</tr>
<tr>
<td>13</td>
<td>Harvey et al. (2019)</td>
<td>The U.S.</td>
<td>Qualitative</td>
<td>High school</td>
</tr>
<tr>
<td>14</td>
<td>Hassani et al. (2016)</td>
<td>Iran</td>
<td>Quantitative</td>
<td>University</td>
</tr>
<tr>
<td>15</td>
<td>Hellermann et al. (2017)</td>
<td>The U.S.</td>
<td>Qualitative</td>
<td>University</td>
</tr>
<tr>
<td>16</td>
<td>Himanouchi (2012)</td>
<td>Turkey</td>
<td>Literature review</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Ho et al. (2017)</td>
<td>Taiwan</td>
<td>Quantitative</td>
<td>Other EFL learners</td>
</tr>
<tr>
<td>18</td>
<td>Hoang and Nguyen (2019)</td>
<td>Vietnam</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>19</td>
<td>Hookly (2019)</td>
<td>Literature review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Hong et al. (2014)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>Primary school</td>
</tr>
<tr>
<td>21</td>
<td>Hsu (2017)</td>
<td>Taiwan</td>
<td>Quantitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>22</td>
<td>Hsu (2019)</td>
<td>Taiwan</td>
<td>Quantitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>23</td>
<td>Huang (2010)</td>
<td>The U.K.</td>
<td>Qualitative</td>
<td>Other</td>
</tr>
<tr>
<td>24</td>
<td>Ioc (2014)</td>
<td>The U.S.</td>
<td>Qualitative</td>
<td>Other ESL learners</td>
</tr>
<tr>
<td>25</td>
<td>Kim and Kerr (2018)</td>
<td>South Korea</td>
<td>System design</td>
<td>Pre-school</td>
</tr>
<tr>
<td>26</td>
<td>Knutten and Kennedy (2012)</td>
<td>Hong Kong</td>
<td>Qualitative</td>
<td>University</td>
</tr>
<tr>
<td>27</td>
<td>Krak (2014)</td>
<td>Poland</td>
<td>Quantitative</td>
<td>High school</td>
</tr>
<tr>
<td>28</td>
<td>Kurtz (2016)</td>
<td>Germany</td>
<td>Literature review</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Kučik et al. (2014)</td>
<td>Turkey</td>
<td>Quantitative</td>
<td>Secondary school</td>
</tr>
<tr>
<td>30</td>
<td>Lakarnchua and Reinders (2014)</td>
<td>Thailand</td>
<td>Qualitative</td>
<td>University</td>
</tr>
<tr>
<td>31</td>
<td>Lantavou and Freakis (2018)</td>
<td>Greece</td>
<td>Quantitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>32</td>
<td>Lee and Park (2019)</td>
<td>South Korea</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>33</td>
<td>Li et al. (2016)</td>
<td>Taiwan</td>
<td>Qualitative</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Liang (2012)</td>
<td>Taiwan</td>
<td>Mixed Methods</td>
<td>University</td>
</tr>
<tr>
<td>35</td>
<td>Law (2019)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>36</td>
<td>Law (2012)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>37</td>
<td>Liu and Tsai (2013)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>38</td>
<td>Lochmann et al. (2015)</td>
<td>Germany</td>
<td>Mixed methods</td>
<td>Other ESL learners</td>
</tr>
<tr>
<td>40</td>
<td>Park (2018)</td>
<td>China</td>
<td>Mixed methods</td>
<td>Other ESL learners</td>
</tr>
<tr>
<td>41</td>
<td>Peterson (2012)</td>
<td>Japan</td>
<td>Mixed Methods</td>
<td>University</td>
</tr>
<tr>
<td>42</td>
<td>Qi et al. (2013)</td>
<td>Netherlands</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>43</td>
<td>Redondo et al. (2019)</td>
<td>Spain</td>
<td>Quantitative</td>
<td>Pre-school</td>
</tr>
<tr>
<td>44</td>
<td>Richardson (2016)</td>
<td>Germany</td>
<td>Qualitative</td>
<td>University</td>
</tr>
<tr>
<td>45</td>
<td>Sofiak et al. (2017)</td>
<td>Kuwait</td>
<td>Mixed methods</td>
<td>Pre-school</td>
</tr>
<tr>
<td>46</td>
<td>Shih (2015)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>47</td>
<td>Solak and Cakir (2015)</td>
<td>Turkey</td>
<td>Quantitative</td>
<td>University</td>
</tr>
<tr>
<td>48</td>
<td>Solak and Cakir (2016)</td>
<td>Turkey</td>
<td>Quantitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>49</td>
<td>Sorrentino and Spino (2019)</td>
<td>Italy</td>
<td>Qualitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>50</td>
<td>Sydorenko et al. (2019)</td>
<td>The U.S.</td>
<td>Qualitative</td>
<td>University</td>
</tr>
<tr>
<td>51</td>
<td>Taskiran (2019)</td>
<td>Turkey</td>
<td>Quantitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>52</td>
<td>Tsai (2018)</td>
<td>Taiwan</td>
<td>Quantitative</td>
<td>Primary school</td>
</tr>
<tr>
<td>53</td>
<td>Urun et al. (2017)</td>
<td>Turkey</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>54</td>
<td>Wang et al. (2017)</td>
<td>China</td>
<td>Quantitative</td>
<td>Other ESL learners</td>
</tr>
<tr>
<td>55</td>
<td>Wang et al. (2019)</td>
<td>Taiwan</td>
<td>Quantitative</td>
<td>High school</td>
</tr>
<tr>
<td>56</td>
<td>Wu (2019)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>57</td>
<td>Yang et al. (2019)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>Primary school</td>
</tr>
<tr>
<td>58</td>
<td>Yang and Luo (2014)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
<tr>
<td>59</td>
<td>Yang et al. (2020)</td>
<td>Taiwan</td>
<td>Mixed methods</td>
<td>University</td>
</tr>
</tbody>
</table>

191