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Examining Relationships between Technology and Critical Thinking: A Study of South Korean EFL Learners

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Abstract: Little research has been conducted to examine how technology shapes values concerning critical thinking (CT) in English as a Foreign Language (EFL) contexts. Due to the need for further research, this study was designed to examine the relationships between perceptions of technology and attitudes about CT. A total of 80 EFL students were given two Likert surveys and two optional qualitative questions concerning CT and technology. Likert surveys were compared using Spearman's rank correlation, whereas qualitative data were evaluated using reflexive thematic analysis. Quantitative results revealed that support for engagement with tech and laptops, along with support for using technology for career goals or IT skills development, positively correlated to a learner's understanding and value for CT. In contrast, learners who favored using technology did not tend to value CT and were more likely to skip class if materials were provided online. Qualitative results also suggest that prosocial behaviors for engagement and clear goals promote positive attitudes toward CT, whereas overreliance on technology hampers the cultivation of CT in EFL classrooms. Implications for pedagogy have been proposed.

Keywords: critical thinking; technology; EFL; AI; internet addiction

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1. Introduction

Early in my career as an ESL teacher, my supervisor observed a class I had been teaching on English composition. I was given very positive reviews, with a single caveat: "You need more technology!" Although I was by no means averse to the idea of using technology, I wondered exactly why it was necessary and how it should be implemented. Despite extensive research having been conducted since this time [1–3], answers concerning how technology should be adapted to foreign language classrooms remain elusive.

One reason for the difficulty of adapting theory to practice is a constantly changing social, economic, and political environment, which impacts how technology can be effectively utilized. In 2020, for example, COVID-19 forced teachers to move almost exclusively online, impacting how technology was used both inside and outside of the classroom [4–6]. Other difficulties in adapting technology to foreign language learning classrooms have involved the type of technology used, the infrastructure used to implement technological interventions, and the type of learning task emphasized via technology (e.g., writing genre) [4,7]. A final complexity involves the attitudes of the teachers and learners themselves, which may impact whether or not a technology is effective [3]. Because technology may be affected by several factors, aspects of diversity related to students, educators, and educational institutions should be examined before new technological solutions are implemented. Currently, the corpus of research concerning diversified technological solutions is limited, which compels educators to adopt a more simplistic one-size-fits-all approach to EFL enhancement with technology. More research is needed to identify unique learning contexts and conditions that require different technologies or pedagogical techniques.

Despite the complexities of implementation, technology has the potential to transform foreign language learning, promoting student development. Early studies of ESL writing have suggested that learners who use computers to write are more engaged and motivated,

producing works that are of greater length and higher quality [8,9]. Today, online resources provide additional practice with the target language, while AI chatbots like ChatGPT provide input, output, and feedback. Concerning the impact of new technologies, Renandya et al. (2024) point out the multitude of ways in which they can be adapted to foreign language learning contexts, serving to reduce a teacher's workload, increase a teacher's quality, increase student motivation, increase student participation, provide personalized instruction or feedback, and foster learner autonomy [10].

Although the potential of technology is clear, Renandya et al. (2024) also point out that the realization of potential has been limited in language learning contexts [10]. He uses a meta-analysis of over 350 studies of classroom-based technologies, mobile devices, and social networking tools to assert this claim. While the meta-analysis reveals a strong influence over pronunciation and output in foreign language learning, only a weak impact is revealed concerning grammatical accuracy, comprehension, and vocabulary learning [11]. Of particular concern is the relatively weak impact of technology on thinking processes. For example, there was only moderate support for the cultivation of meta-linguistic knowledge through technology [11]. At very basic levels, English may be taught without careful thought, as students learn to use simple vocabulary through rote memorization, listening, and repeating. However, as students gain proficiency, they must personalize discourse and engage in problem-solving as they read and write in real-life communicative contexts [12]. Careful consideration of both language and content becomes more essential as a foreign language learner develops, making skills for critical evaluation essential.

Problems using technology to enhance critical evaluation of language or content reveal a need for additional study. Currently, the link between technology and critical thinking is not well known. To accommodate a need for further research, the present study was designed to closely examine the relationship between technology and critical evaluation of language and content by EFL learners. Such a study may help assist educators, who must use technology to cultivate cognitive development and reflection in diverse classroom contexts.

2. Literature Review

The use of technology in ESL and EFL classrooms has been extensively studied [10,13], yet little research exists concerning technology's role in enhancing critical thinking (CT) in a foreign language. Monash University (2022) defines CT as "a kind of thinking in which you question, analyze, interpret, evaluate and make a judgment about what you read, hear, say, or write" [14] (para. 1). As implied by the definition, CT is an essential element of EFL classrooms, where students need skills to examine discourse, construct novel arguments, and provide evidence that is both credible and convincing. In addition to skills, CT may also include dispositions toward inquisitiveness, open-mindedness, and understanding [15].

Although a worthy topic of research, CT has not been extensively explored in past studies of foreign language learning. This limitation appears to be the byproduct of past philosophical traditions like behaviorism, which promoted language learning through rote memorization and drill. Via such techniques, language learning was conceptualized as a systematic process, whereby creativity in language and expression is largely unnecessary. As in the case of behaviorism, generative cognitivists approached language learning in an organized way, seeing acquisition as a systematic and inflexible process of cognitive development [16]. Due to the legacy of past philosophical traditions, language learning programs have remained highly systematic and regimented, treating thinking as a peripheral process in pedagogical designs. Concerning this issue, Liaw (2007) writes that "Language as a way of thinking and learning has been more of a pedagogical catchphrase than instructional practice" [17] (p. 45).

Despite philosophical impediments to research of CT in ESL and EFL contexts, more modern research has begun to investigate the issue. A research study of 62 Turkish 7th-grade students revealed that instruction emphasizing six skills (analysis, evaluation, infer-

ence, interpretation, explanation, and self-regulation) could have a significantly positive impact on CT. Activities such as reflective learning diaries, self-evaluative discussions, and critical writing activities were shown to have a positive impact on both CT performance and motivation [18]. Although largely positive, the study also revealed that negative outcomes could result if learners were adversely influenced by individual attitudes or background characteristics. As a case in point, some low-proficiency learners expressed anxiety and confusion when working on justifying procedures or conjecturing alternatives, which limited the efficacy of a treatment. For these learners, lack of language proficiency appears to have had a demotivating effect [18] (p. 8). Variability within research findings reveals a need to better understand how individual differences impact the efficacy of CT skills instruction.

The Impact of Technology on CT

Individual differences and their impact on CT in English language learning contexts are further complicated by modern technological innovations. The widespread popularity of internet and AI technologies may influence the results of CT research, leading to disparate or even contradictory determinations of efficacy. It is important to understand such variability, as well as current gaps in research which require further investigation.

Concerning the internet, research suggests that online resources can sometimes promote critical inquiry and creative thought in carefully designed EFL tasks [19–22]. WebQuests, for example, a method of inquiry whereby learners obtain answers through research of online sources, has revealed success in cultivating critical thinking and creative discovery [23,24]. In a study of Iranian EFL learners, WebQuest-based tasks were more effective than traditional face-to-face tasks for the development of CT and academic writing skills [24]. At the same time, access to online resources may reduce a student's ability to critically think [25]. Learners may access online information through rudimentary searches of one or two web pages without careful consideration of content, leading to a lack of concentration, a tendency toward skimming, or avoidance of in-depth reading and analysis [26]. Other factors like proficiency may impact the efficacy of technological strategies designed to cultivate CT. In a study of WebQuests, for example, the treatment was only effective with learners at a lower skill level [23]. As suggested by the inconsistency of experimental results, aspects of learner variability have an impact on the success or failure of technological treatments designed to enhance CT. More research is needed to better understand the relationship between an individual, technology, and successful implementation of EFL strategies for CT. It is essential that student attitudes and tech habits be understood before pedagogical treatments for CT are implemented.

Research suggests that learners also use social media technologies in different ways, affecting the degree to which CT may be possible. Some learners appear to be well-equipped to utilize social media for critical evaluation. This view is exemplified by a recent study of 424 millennials, which revealed that 50% could adequately discern fake news [27]. At the same time, other learners may not be able to utilize social media for critical thinking [25,26,28]. In the same study of 424 millennials, 50% could not adequately identify true or false assertions to discern fake news [27]. This mirrors recent findings from the Programme for International Student Assessment (PISA), a test of 15-year-old learners from 79 OECD countries, which revealed that many students who have grown up in a digital world are unable to distinguish fact from fiction. Fewer than "1 in 10 students in OECD countries was able to distinguish between fact and opinion, based on implicit cues pertaining to the content or source of the information" [29] (p. 14). Differences in habits concerning technology may have a significant impact on technological interventions designed to cultivate critical thinking in EFL contexts. Therefore, more research is needed to clearly discern the relationship between tech habits and the use of technology.

Finally, learners may utilize AI technologies in different ways, thereby impacting the results of interventions designed to promote CT. A great deal of research about AI language generators like ChatGPT has been conducted, suggesting a potential positive impact on

CT [30–32]. At the same time, little research has examined habitual behaviors with these technologies and their impact on the efficacy of an educational task. Individual student differences in technological beliefs or behaviors may impact whether a specific form of technology is effective. This view is exemplified by a recent study of 626 student activities obtained from ten doctoral students. The study revealed that generative AI tools resulted in higher performance for grad students who used the technology in a repeated, highly interactive way; in contrast, it resulted in lower performance when grad students used AI as a supplementary resource and maintained a linear approach to writing [33]. Findings suggest that individual differences significantly impact the efficacy of a new technological approach. A more thorough examination of the relationships between individual variability, technology, and CT are clearly needed.

Because individual habits regarding technology may impact the efficacy of an educational task, a learner's technological behaviors must be further examined in accordance with educational learning objectives. Although habits can be investigated via direct observation in experimental settings, they may also be examined through student surveys, yielding additional insights. In a recent study, learners with lower performance and higher inaccuracy in a problem-solving task had overinflated perceptions of the usefulness of ChatGPT. Consequently, the self-evaluations of these learners regarding AI technologies did not correlate with performance [34]. Results reveal that the relationship between technology and the cultivation of CT is not always a positive one. Such findings also provide further support for the need to investigate both CT and technology in foreign language contexts. Additional research may yield key insights, helping educators understand how different forms of technology can be effectually used to promote CT in diverse EFL contexts.

The efficacy of technological innovations for CT may vary considerably based on individual learner characteristics, behaviors, or beliefs. Consequently, it is important that differences in technology use among EFL students be further studied in conjunction with beliefs about CT. More research may provide a clear understanding of how technology influences cognition. If the relationship between technology and CT is clearly understood, more effective educational strategies may be designed to promote critical evaluation of language or content in EFL contexts.

3. Research Questions

The purpose of this study was to further examine how different attitudes and perceived habits concerning the use of technology are related to perceptions of CT. To guide this inquiry, the following questions were posed:

1. How are attitudes about technology and perceived tech behaviors related to attitudes about critical thinking? What implications may these relationships have for pedagogy in foreign language learning contexts?
2. What insights do students have concerning the influence of technology on critical thinking? What applications may these insights have for pedagogy in foreign language learning contexts?

It was hoped that research on these questions could lead to insights that help promote more effective pedagogical techniques for diverse learners.

4. Materials and Methods

Although technology and critical thinking appear to be closely related, little research has been conducted to examine the relationship. In order to provide a more holistic understanding of how technology and CT are connected, a concurrent mixed methods design was utilized [35]. In the study, both quantitative and qualitative data were obtained from 80 EFL learners for statistical comparison. This design was used so that data could be triangulated to provide both empirical significance and narrative insight concerning the relationship between technology and CT.

4.1. Instruments

To examine perceptions of CT, which are needed to answer research question one, a seven-question survey was used (see Appendix A). Each survey question employed a five-item Likert scale with the following potential answers: strongly disagree (value of 1), disagree (value of 2), neutral (value of 3), agree (value of 4), and strongly agree (value of 5). This survey was specifically designed for English learners in foreign language contexts, making it a valid measure. It also examined learners' attitudes about CT, revealing insights about the participants' perceptions of the meaning of CT, CT's position in their foreign language learning process, and the perceived need for training to enhance CT. In addition to a valid evaluation of learner attitudes in an EFL context, a Cronbach's alpha value of 0.721 suggests that the instrument is reliable [36].

To examine perceptions of technology, a survey entitled "Perceptions of Use of Technology-Enabled Learning" was used from the Technology-Enabled Learning Implementation Handbook [37]. This survey was adapted to the present study by selecting 8 of the survey questions from Part C, which could yield perceptions about both performance and engagement with technology. The first four questions ask for opinions about how technology will help the learner in performance (concerning class and future endeavors). The next four questions ask about how technology affects class engagement (see adapted version of the survey in Appendix B). Each survey question employed a five-item Likert scale with the following potential answers: strongly disagree, disagree, neutral, agree, and strongly agree. Each of the questions was coded with values from 1 to 5 based on respective responses for analysis.

4.2. Participants

A total of 80 undergraduate learners from a U.S. university located in South Korea were surveyed for analysis. The respondents were all EFL learners who ranged in age from 20 to 27. A larger number of respondents were female, comprising 52 of the total 80 respondents, 65% of the sample. Included in the sample were two students from Myanmar, two students from China, one student from Iran, and one from Malaysia. The remainder of the participants were South Korean nationals. No pressure was given to participate in the study and learners were informed that they could opt out of the study at any time. All learners needed to consent to participate in the study before they were given the surveys.

4.3. Procedure

Before any data were collected, Internal Review Board (IRB) approval was obtained for the delivery of surveys. Next, three EFL classes studying English literature were selected for examination. After learners from these classes were informed about the study and signed the consent form, they were given both surveys for technology [37] and critical thinking [36] via one Google survey. The following demographic information was also included in the survey:

- Age;
- Gender;
- Nationality.

To address research question one, technology preferences were correlated to responses on the Critical Thinking Survey using Spearman's rank correlation coefficient. Because data used to calculate each category came from ordinal Likert scales, the non-parametric Spearman formula was used. This formula does not assume that differences between two variables are linear, making it ideal for identifying monotonic (non-linear) relationships within ordinal data.

To address research question two, learners were asked to answer two questions. Individual emails were sent a month after the collection of the quantitative data to request written information about the learner's tech habits and perceptions of CT. As in the prior

surveys, participation was optional. Only 26 of the 80 participants surveyed decided to add additional written insights. The questions were the following:

1. How does technology help with critical thinking and/or English learning at your school?
2. How does technology make your critical thinking and/or English learning more difficult at your school?

After collecting the qualitative data, it was analyzed by using reflexive thematic analysis, a technique developed by Braun and Clarke [38,39]. Via this process, the researcher systematically moves through the data identifying common items, which are referred to as codes. These codes are then compared and collated to identify connected meanings or themes, which may also be broken up into sub-themes. Following the identification of themes, the themes were then clearly defined [40]. Via this systematic approach, it was hoped that the results could be triangulated with the quantitative data, thereby yielding new insights.

5. Results and Discussion

5.1. RQ1: The Relationship of Technology and Critical Thinking

Results of the Spearman rank correlation revealed a significant connection between critical thinking and engagement (See Table 1). The value *I have a clear idea of critical thinking* was positively correlated to the ideas that tech promotes personal engagement ($r^s = 0.232$; $p = 0.04$; $n = 80$) and tablets/laptops promote engagement ($r^s = 0.236$; $p = 0.04$; $n = 80$). Learners who felt that critical thinking is especially important in foreign language learning recognized the importance of technology in promoting connectivity with other students ($r^s = 0.240$; $p = 0.03$; $n = 80$). These results suggest that an appreciation for engagement and interaction is associated with an understanding and appreciation of CT. Positive correlations with technology as a means to promote engagement may reveal prosocial behaviors that promote critical thinking. Learners who are engaged and active are aware of the importance of creativity and involvement.

Table 1. Spearman rank correlations for attitudes toward CT and engagement with technology.

	Engagement with Tech	Skip Class with Tech	Tech for Connection to Other Students	Tablets/Laptops in Class Improve Engagement
I have a clear idea of critical thinking.	$r_s = 0.232$ * $p = 0.039$	−0.069 0.543	0.191 0.089	0.236 * 0.035
Learning critical thinking is important.	r_s =0.090 $p = 0.429$	−0.184 0.102	0.156 0.168	0.039 0.730
Teachers give us critical thinking training.	r_s =0.069 $p = 0.543$	0.127 0.260	0.156 0.167	0.042 0.710
It is not necessary to increase critical thinking.	r_s =0.104 $p = 0.359$	0.257 * 0.021	−0.005 0.968	0.140 0.215
It is not the job of the teacher to teach critical thinking.	$r_s = -0.128$ $p = 0.257$	0.037 0.745	−0.147 0.193	0.110 0.332
Critical thinking is especially important in foreign language learning.	r_s =0.067 $p = 0.554$	−0.075 0.506	0.240 * 0.032	−0.015 0.897
I need more instruction from teachers about critical thinking.	$r_s = -0.102$ $p = 0.368$	−0.002 0.985	−0.074 0.512	−0.088 0.435

* Correlations with an asterisk denote significance at a 0.05 alpha level.

Learners with a clear understanding of how technology could be used for future success also showed a positive view of critical thinking (see Table 2). The value *I have a clear idea of critical thinking* was positively correlated to the ideas that tech could improve both IT

skills (r^s = 0.235; p = 0.04; n = 80) and career prospects (r^s = 0.321; p = 0.004; n = 80). Learners who thought critical thinking was important also tended to feel that using technology increased career prospects (r^s = 0.287; p = 0.01; n = 80). The connection between tech as a means to improve IT skills/career prospects and CT may reflect the importance of establishing a clear vision for learning and future development. Learners who have a clear understanding of career goals and the importance of learning may be more likely to realize the importance of critical thinking. Such results suggest that learners who lack such an understanding could benefit from additional instruction that gives learners a clear understanding of goals and positive CT strategies for goal achievement.

Table 2. Spearman rank correlations for attitudes toward CT and performance with technology.

	Tech for Better Results in Subjects	Tech for Deep Understanding	Tech for IT Skills	Tech for Career
I have a clear idea of critical thinking.	r_s = 0.141 p = 0.212	0.147 0.194	0.235 * 0.036	0.321 * 0.004
Learning critical thinking is important.	r_s = 0.047 p = 0.676	0.142 0.209	0.160 0.158	0.287 * 0.010
Teachers give us critical thinking training.	r_s = 0.029 p = 0.798	−0.046 0.683	0.133 0.239	0.044 0.701
It is not necessary to increase critical thinking.	r_s = 0.182 p = 0.106	0.225 * 0.044	0.164 0.146	−0.010 0.933
It is not the job of the teacher to teach critical thinking.	r_s = 0.025 p = 0.825	0.112 0.322	0.143 0.205	−0.127 0.260
Critical thinking is especially important in foreign language learning.	r_s = 0.045 p = 0.691	0.123 0.277	0.022 0.849	0.186 0.099
I need more instruction from teachers about critical thinking.	r_s = −0.149 p = 0.186	−0.021 0.855	−0.034 0.764	−0.058 0.610

* Correlations with an asterisk denote significance at a 0.05 alpha level.

In contrast to learners who favored engagement and achievement with technology, learners who believed that technology helped to promote a deeper understanding of the subject matter did not tend to value critical thinking (r^s = 0.225; p = 0.04; n = 80). Likewise, learners who were more likely to skip class if materials were provided online did not value critical thinking (r^s = 0.257; p = 0.02; n = 80). The relative lack of importance placed on CT may suggest that these learners are relying on technology to serve as a replacement for executive cognitive functions. As the use of technology to accomplish cognitively demanding tasks increases, the perceived importance of CT decreases. Learners with a heavy reliance on technology may need training, which outlines the potential negative consequences of overutilizing technology for executive cognitive functions.

It is important to note that several significant correlations were revealed, yet they were weak (below a value of 0.3). Although there are clear relationships, attitudes about technology and CT may be concurrently impacted by other factors.

5.2. RQ2: The Influence of Technology on Critical Thinking

The resulting data revealed several different codes that were aggregated into larger themes. Initially, the following six codes were discovered: tech to promote understanding, tech to find resources, tech for different perspectives, tech to change the way we critically think, tech reduced critical thinking, and too much reliance on tech.

After analyzing the semantic links between codes, some themes and subthemes emerged. These themes could be categorized as positive, neutral, or negative. The positive theme was the use of technology to obtain information, which included the following sub-themes: tech to promote understanding, tech to find resources, and tech for different perspectives. There was one neutral view that technology has merely changed the way that

we critically think. Finally, there was one negative theme of decreased critical thinking, which could be subdivided into three sub-themes: bad online habits leading to less critical thinking, cognitive changes, and AI taking away the ability to think critically. Results are further explained in the next five sections.

5.2.1. Technology for Understanding, Resources, and Different Perspectives

Students' views tended to differ widely based on whether technology had a positive or negative influence on language education. Some learners felt that technology had a mostly positive impact. These learners described using technology to access various resources and perspectives. Some learners described the use of technologies like Grammarly and English–Korean translators to heighten the accuracy and understanding of English. Other learners wrote about using technology to gain new perspectives. For example, one student used the internet to find "recent issues related to the topic on the internet". Another learner used the internet to gain new perspectives, writing the following passage:

> Technology helps us to access other's opinions or thinking process so that we could know that there are various ways to think of a specific topic. As an example, political opinions could be seen everywhere, which helps not make individuals biased.

While the learner identifies an ability to access a great deal of information through the internet, they may also lack an awareness of potential biases introduced by algorithms or other forms of content creation. Another learner cited that "mass media gives an out for everyone to have a voice, therefore enhancing people to group together with their peers". Similarly, another learner refers to the efficacy of online programs, citing the following:

> For example, social media sites and online platforms offer forums for discussion, brainstorming, and idea exchange. These online forums allow users to have fruitful discussions, test presumptions, and consider many viewpoints, which can help people develop their critical thinking skills.

This learner viewed critical thinking as a means to see things differently and come up "with different ways to approach a solution". The importance of communication and interaction with others is also emphasized. They cited accessibility to photos, videos, and VR technology to support their conclusions.

These positive responses may explain quantitative trends in the data. Learners who are engaged and active in finding new solutions and varied perspectives are aware of the importance of creativity and involvement. This may explain the significance of correlations between tech for engagement and the importance of CT. Learners who value engagement, as well as the cultivation of multiple viewpoints, may utilize technology in a more positive way. If learners do not have these values, they may need special instruction to cultivate a clear understanding of the importance of engagement as a means of goal attainment.

Some students have an awareness of technology's potential to promote group discussions and multiple interactions that bolster CT. These students may be allowed to share their impressions of technology, yielding rich insights that may impact their peers. Learners who have a better awareness of how to utilize technology for constructive purposes may be utilized to promote CT, as well as the development of IT skills and career prospects.

5.2.2. Tech Has Merely Changed the Way We Critically Think

Other students seemed to suggest that the impact of technology was merely a change that would require adjustment. These learners did not mention potential shortcomings, which may represent a relative lack of awareness concerning technology's impact on CT. This perspective is reflected in the response of one learner, who wrote: "Think about how people have some data. That is 'Internet'. Then, what do we need when brainstorming or researching? Technology. That's it". This statement seems to reveal a wholehearted acceptance of the internet, without a recognition that overreliance on information from the

internet may lead to less critical thinking, as is exemplified by the "Wikipedia Problem". Another learner expressed similar opinions, stating the following:

> Because of covid, most of English courses turned out to be online classes. Critical thinking was challenged and opened out during this transformation. Students have to get used to new teaching methods and interact with online tools. In order to navigate online resources, assess the reliability of digital sources, and take part in online debates and collaborative activities, critical thinking skills are a necessity. I don't think it affected that much but just changed the way of doing critical thinking.

This learner recognizes the importance of assessing the reliability of sources and collaboration, believing that CT techniques have simply been ported to the internet. This learner appears to accept that technology is an equivalent means to use CT, without an understanding of precisely how CT may differ from traditional methods. There may be no awareness of the potential negative effects of technology on the thinking process.

Insights presented here may explain quantitative findings, which revealed a significant relationship between using technology for deeper understanding and the belief that CT was unnecessary. Learners who only recognize technology as a positive step forward may rely on technology to do their critical thinking, thereby lessening the importance placed on personal cognitive effort. The views may reveal a general lack of awareness that some students have regarding the potential negative influences of technology on the process of CT.

Learners who believe CT has changed through the use of technology certainly have a valid point. Research of Technological, Pedagogical, And Content Knowledge (TPACK) among teachers [41] suggests that conceptions of technology and content are now inextricably linked, forming one "unique and distinct body of knowledge" [42] (p. 5). Because conceptualizations of technology and content knowledge are closely linked, CT in language learning may not be effective without a combined understanding of both technology and English. How the integration of technology impacts cognition in educational activities such as brainstorming or the organization of texts must be carefully examined.

Other forms of CT used in language learning, such as metacognition, may also need to be re-examined in accordance with tech habits. Metacognition is an "executive" function involved in "planning for learning, thinking about the learning process as it is taking place, monitoring of one's production or comprehension, and evaluating learning after an activity is completed" (p. 134) [43,44]. Metacognition may be limited by internet search algorithms and AI text generators, which can autonomously locate research and produce texts, thereby bypassing a learner's need to consciously examine the process of brainstorming, the organization of ideas, or the construction of texts. Overreliance on technology may provide perspectives that are either limited by algorithms or erroneously constructed via AI-generated LLMs. Finally, massive amounts of information may limit the time that learners can spend evaluating and utilizing English input. More research is needed to understand how different technologies have impacted metacognition and other forms of CT. Additional research would allow for the development of new pedagogical techniques, which facilitate CT skills while technology is seamlessly integrated into EFL activities.

5.2.3. Bad Online Habits Leading to Less Critical Thinking

Although some learners focused mainly on the positive, other learners recognized potential problems associated with the overuse of technology. One student described choosing technology over CT as a means of convenience, writing the following statement:

> I personally believe technology prevents students from critical thinking. Whenever I am stuck with a question, I prefer to search online rather than think about a single question for half an hour.

As the learner suggests, a student may rely on what they find online rather than critically evaluating multiple sources. Such an issue can have significant implications for

how ideas and language input are obtained. If only one online search is conducted (as in the "Wikipedia Problem"), the quality and variety of results may be limited by algorithms. Due to the importance of finding multiple sources and perspectives for critical evaluation or research synthesis, time constraints affecting CT should be carefully considered. Learners may be given additional time to search for and evaluate multiple sources. Such an intervention may reduce temptation, thereby ensuring that CT skills are more consistently utilized.

In addition to using technology for convenience, other bad habits were identified. One student wrote the following:

> I believe technology is making our critical thinking more difficult. The invention of the smartphone is leading people to digital addiction, the social media in it is making people biased, and the ChatGPT that came along recently is causing people to think less when utilizing the information they searched.

This learner has identified some key issues with the use of technology, which include digital addition, bias in social media, and ChatGPT's negative impact on CT. Learners with such issues may benefit from journals that compel students to document how technology is being used to complete class assignments. Through journaling, learners may become aware of bad habits related to social media and digital addiction. Teachers may also need to provide additional training to promote responsible use of cell phones and reduce bias caused by social media posts.

5.2.4. Cognitive Changes

Many learners had an awareness of how technology was impacting the cognitive processes necessary for CT. Concerning this issue, one student wrote the following:

> It is much easier to find the information that you want since it gives the answer right away. So the time you spend searching for information is reduced by a lot. However, as I'm thinking less time evaluating information, I feel that I am forgetting the information I found very quickly.

This student perceived memory issues due to frequent access to online resources. Another student even realized changes in the understanding of information based upon interaction with online resources. He wrote the following:

> Technology such as the internet may certainly help with critical thinking, but I think it interferes with critical thinking in most cases. For example, let's say you read a novel. We can get information on what this novel means on the Internet and what the author thinks. However, when we look at the information, we can no longer see the novel from our subjective perspective. I think that the human brain, which has adapted to a particular perspective, no longer tries to think critically from various perspectives.

This student explains that retrieval of information from online sources precludes cognitive processing of reading. To counteract potentially negative effects on CT, teachers may need to compel their learners to "unplug" from the internet. This will allow time for cognitive development that could have been hampered by the internet or other technologies, which provide information at the touch of a button.

Perceived cognitive changes have implications for EFL pedagogy. A tendency to simply access and forget information may pose significant problems that should be addressed. Such activity may impact a learner's ability to utilize cognitive functions like transfer (linking prior knowledge to new knowledge) or inferencing (the guessing of meaning, prediction of outcomes, and filling in gaps) [43]. Little time spent processing information received on the internet may severely limit the time spent interpreting and incorporating new information, thereby limiting critical thinking. Special training may be needed to help learners understand the importance of taking the time to process information and incorporate new knowledge. Another solution may be to temporarily "unplug" learners

from technology, giving them time to process information or link existing knowledge with new knowledge.

5.2.5. AI Is a "Robber" of CT Skills

Some students identified the influence of AI on the learning process. One learner stated that "some students are abusing AI to write their papers" and further concluded that it is not effective as a means to improve either critical thinking skills or English skills. Another learner wrote extensively about the influence of AI, writing the following:

> AI does not help with critical thinking because it gives us the answer and does not give us the chance to think critically by ourselves.
>
> As I mentioned above, AI makes it more difficult for students to think critically because it provides all the information and ideas they need to think independently. For example, when ChatGPT was first introduced, I searched for the script for the presentation with my friend, and it gave a whole script. Creating a script requires a lot of time because you must write it considering the time, length, topic, and readers' reactions. However, thanks to(? Due to) GPT, we did not need to spend much time. It robs the opportunity to think about the whole structure of the presentation and write it ourselves. Therefore, the tech does not help our critical thinking.
>
> It disrupts our critical thinking. Many students use it when organizing their essay outline, and I think the most critical process of an essay is outlining because it requires you critical thinking and organizing skill.

This passage provides a clear view of the negative influences of AI. By providing answers and constructing outlines for speeches or writings, learners are not able to create meaningful links between different forms of information or ideas.

Some learners realized adverse effects due to AI programs such as ChatGPT. One student explained that ChatGPT "robs" us of the opportunity to draft and structure a presentation, which negatively impacts critical thinking. Initially, these students may need to be given sufficient time and motivation to organize ideas into a writing outline without the help of ChatGPT or other AI chatbots. To do this, educators may compel learners to "unplug" from technology when designing outlines and synthesizing research for English compositions. The ease with which AI can be utilized already appears to have a significant impact on learners. Student perspectives reveal a need for careful training and regulation of AI generative language programs like ChatGPT. While they may be useful, there is clear evidence that they may have a negative impact. Educators will need a heightened awareness of how each learner is utilizing AI.

6. Conclusions

Research into student attitudes about technology and its relationship to CT has yielded some valuable insights. Rather than using a one-size-fits-all approach to technological strategies, a more nuanced approach may be needed. Individual learners can first be assessed for their awareness of technology and its impact on classroom learning. Learners who lack an awareness of the potential positive or negative effects of technology may then need special instruction. Teachers might need to utilize think-aloud protocols during class activities to help learners examine the impact of technology on language learning. After reflection, students can then learn about (or create) new metacognitive strategies that integrate CT with technology. Teachers may also need to carefully control how technology is used to prevent overutilization. When reading, for example, learners may first be compelled to examine a text in English with no technological assistance. Following the first reading, learners may then be allowed to use a dictionary. Next, they may be allowed to use translation devices to heighten understanding. Finally, students may be compelled to reread the passage in English. In this way, all technological resources are carefully

controlled to scaffold instruction and encourage the processing of language, as well as a deep understanding of content.

Learners who think positively about the impact of technology may not always be aware of its potential shortcomings. This perspective can explain statistical correlations, in which learners who believed that they could learn deeply with technology also thought that CT was less important. Students may posit that CT has simply changed and has not been negatively impacted. Such learners may need more stringent regulations and additional training to use technology effectively. They may also be encouraged to document how they are using technology with language learning, helping them gain an understanding of digital addiction. Finally, these learners may be given examples and explanations of bias in social media, online media, and AI-generated texts to illustrate the importance of CT.

Due to cognitive and behavioral changes resulting from technology, mixed strategies may be required to address learners at different levels of technological awareness. Learners with little awareness may require more direct, top-down control of technological resources in the classroom. Learners with heightened awareness can be allowed more autonomy as they become cognizant of their own technology use, as well as how to regulate it. Ultimately, all learners will need a concrete understanding of how technology is related to the content they learn in EFL classrooms. Currently, there is a great deal of research concerning the interdependence of Technological, Pedagogical, and Content Knowledge (TPCK) for teachers [41,42]. However, there is little research examining how students can cultivate an understanding of these components, which will be needed for new pedagogical reforms.

Although the present study presented key insights, the data obtained were limited to the perspectives of 80 university learners from South Korea, only 26 of whom completed the qualitative questions. Surveys were also limited in scope. There were 15 survey questions overall, with two additional qualitative questions. While insightful data were obtained, more comprehensive instruments may be used in future studies. Further experimental study is needed to explore how student perceptions are related to actual behaviors regarding the use of technology and CT.

Additional research may provide insights needed for teachers to control EFL classrooms. At the same time, this research can be used to foster student autonomy, giving learners the resources needed to effectively use technology on their own. In today's more autonomous world, students often need to behave as independent learners, who can make smart choices about the technology they use to foster learning. They may need to develop their own metacognitive strategies for integrating technology (technological knowledge) with information extraction and evaluation (content knowledge). They may also need to critically evaluate and explain their new-found discoveries to others (pedagogical knowledge). More research is needed to ensure that learners acquire the competencies needed to use both technology and CT effectively.

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Data Availability Statement: Data available on request due to restrictions (privacy reasons).

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Appendix A

Critical Thinking Survey

1. I have a clear idea about what the term 'critical thinking' means.
2. Learning critical thinking is an important part of my studies as a student
3. Teachers provide training in critical thinking in many courses.

4. It is not necessary to increase the role of critical thinking in the curriculum.
5. It is not the job of the teacher to teach critical thinking in the classroom.
6. Critical thinking is especially important in foreign language learning.
7. I need more instruction from teachers on how to develop critical thinking skills.

Appendix B

Technology Survey
Performance:

1. It will help me get better results in my subjects.
2. It will help me understand the subject material more deeply.
3. It will improve my IT/information management skills in general.
4. It will improve my career or employment prospects in the long term.

Engagement:

1. I get more actively involved in courses that use technology.
2. I am more likely to skip classes when materials from course lectures are available online.
3. Technology makes me feel connected to other students.
4. Tablets/laptops in class improve my engagement with the content and class.

References

1. Al-Wasy, B.Q. The effectiveness of integrating technology in EFL/ESL writing: A meta-analysis. *Interact. Technol. Smart Educ.* **2020**, *17*, 435–454. [CrossRef]
2. Chen, T. Technology-supported peer feedback in ESL/EFL writing classes: A research synthesis. *Comput. Assist. Lang. Learn.* **2016**, *29*, 365–397. [CrossRef]
3. Cuocci, S.; Fattahi Marnani, P.; Khan, I.; Roberts, S. A Meta-Synthesis of Technology-Supported Peer Feedback in ESL/EFL Writing Classes Research: A Replication of Chen's Study. *Languages* **2023**, *8*, 114. [CrossRef]
4. Hebebci, M.T.; Bertiz, Y.; Alan, S. Investigation of views of students and teachers on distance education practices during the Coronavirus (COVID-19) Pandemic. *Int. J. Technol. Educ. Sci.* **2020**, *4*, 267–282. [CrossRef]
5. Moorhouse, B.L. Teachers' professional digital competence after a period of online teaching: The case of Hong Kong primary school English-language teachers. *Asia Pac. Educ. Rev.* **2023**, 1–10. [CrossRef]
6. Winter, E.; Costello, A.; O'Brien, M.; Hickey, G. Teachers' use of technology and the impact of Covid-19. *Ir. Educ. Stud.* **2021**, *40*, 235–246. [CrossRef]
7. Seyyedrezaei, M.S.; Amiryousefi, M.; Gimeno-Sanz, A.; Tavakoli, M. A meta-analysis of the relative effectiveness of technology-enhanced language learning on ESL/EFL writing performance: Retrospect and prospect. *Comput. Assist. Lang. Learn.* **2022**, 1–34. [CrossRef]
8. Goldberg, A.; Russell, M.; Cook, A. The effect of computers on student writing: A meta-analysis of studies from 1992 to 2002. *J. Technol. Learn. Assess.* **2003**, *2*, 1–52. Available online: http://www.jtla.org (accessed on 20 May 2024).
9. Li, J. The mediation of technology in ESL writing and its implications for writing assessment. *Assess. Writ.* **2006**, *11*, 5–21. [CrossRef]
10. Renandya, W.A.; Ivone, F.M.; Hidayati, M. Harnessing the power of technology in ELT. *J. Stud. Engl. Lang.* **2023**, *18*, 143–160. Available online: https://so04.tci-thaijo.org/index.php/jsel/article/view/268591 (accessed on 5 May 2024).
11. Golonka, E.M.; Bowles, A.R.; Frank, V.M.; Richardson, D.L.; Freynik, S. Technologies for foreign language learning: A review of technology types and their effectiveness. *Comput. Assist. Lang. Learn.* **2014**, *27*, 70–105. [CrossRef]
12. Negoescu, A.G. The value of critical thinking in the language classroom. *Land Forces Acad. Rev.* **2023**, *28*, 303–308. [CrossRef]
13. Shadiev, R.; Yang, M. Review of studies on technology-enhanced language learning and teaching. *Sustainability* **2020**, *12*, 524. [CrossRef]
14. Monash University. What Is Critical Thinking? 2022. Available online: https://www.monash.edu/student-academic-success/enhance-your-thinking/critical-thinking/what-is-critical-thinking (accessed on 17 March 2024).
15. Abrami, P.C.; Bernard, R.M.; Borokhovski, E.; Wade, A.; Surkes, M.A.; Tamim, R.; Zhang, D. Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. *Rev. Educ. Res.* **2008**, *78*, 1102–1134. [CrossRef]
16. Hannafin, M.J.; Land, S.M. The foundations and assumptions of technology-enhanced student-centered learning environments. *Instr. Sci.* **1997**, *25*, 167–202. [CrossRef]
17. Liaw, M.L. Content-based reading and writing for critical thinking skills in an EFL context. *Engl. Teach. Learn.* **2007**, *31*, 45–87.
18. Bağ, H.K.; Gürsoy, E. The effect of critical thinking embedded English course design to the improvement of critical thinking skills of secondary school learners. *Think. Ski. Creat.* **2021**, *41*, 1–13. [CrossRef]
19. Al-Jarf, R. What ESL teachers should know about online writing tasks. *ELTAM J.* **2014**, *1*, 47–54.

20. Hsieh, Y.C. A case study of the dynamics of scaffolding among ESL learners and online resources in collaborative learning. *Comput. Assist. Lang. Learn.* **2017**, *30*, 115–132. [CrossRef]
21. Nussbaum, M.; Barahona, C.; Rodriguez, F.; Guentulle, V.; Lopez, F.; Vazquez-Uscanga, E.; Cabezas, V. Taking critical thinking, creativity and grit online. *Educ. Technol. Res. Dev.* **2021**, *69*, 201–206. [CrossRef]
22. Yoon, C. Individual differences in online reference resource consultation: Case studies of Korean ESL graduate writers. *J. Second. Lang. Writ.* **2016**, *32*, 67–80. [CrossRef]
23. Awada, G.; Burston, J.; Ghannage, R. Effect of student team achievement division through WebQuest on EFL students' argumentative writing skills and their instructors' perceptions. *Comput. Assist. Lang. Learn.* **2020**, *33*, 275–300. [CrossRef]
24. Ebadi, S.; Rahimi, M. An exploration into the impact of WebQuest-based classroom on EFL learners' critical thinking and academic writing skills: A mixed-methods study. *Comput. Assist. Lang. Learn.* **2018**, *31*, 617–651. [CrossRef]
25. Shanmugasundaram, M.; Tamilarasu, A. The impact of digital technology, social media, and artificial intelligence on cognitive functions: A review. *Front. Cogn.* **2023**, *2*, 1203077. [CrossRef]
26. Porter, A. The Problem with Technology in Schools. The Washington Post, 28 January 2013. Available online: https://www.washingtonpost.com/blogs/therootdc/post/the-problem-with-technology-in-schools/2013/01/28/cf13dc6c-6963-11e2-ada3-d86a4806d5ee_blog.html (accessed on 29 August 2020).
27. Menichelli, M.; Braccini, A.M. Millennials, information assessment, and social media: An exploratory study on the assessment of critical thinking habits. In *Exploring Digital Ecosystems: Organizational and Human Challenges*; Springer International Publishing: Cham, Switzerland, 2020; pp. 85–97.
28. Kraner, D. Digital culture and critical thinking through reading habits. In Proceedings of the International Interdisciplinary Scientific Conference: Readers and Reading in the Digital Age, Zagreb, Croatia, 11 November 2021; pp. 104–105.
29. OECD. *PISA 2018 Insight and Interpretations*; OECD: Paris, France, 2018; pp. 1–64.
30. Jeon, J.; Lee, S. Large language models in education: A focus on the complementary relationship between human teachers and ChatGPT. *Educ. Inf. Technol.* **2023**, *28*, 15873–15892. [CrossRef]
31. Liu, G.; Ma, C. Measuring EFL learners' use of ChatGPT in informal digital learning of English based on the technology acceptance model. *Innov. Lang. Learn. Teach.* **2024**, *18*, 125–138. [CrossRef]
32. Özdemir-Çağatay, S. Examining the use of ChatGPT in language teaching: Teachers' experiences and perceptions. In *Transforming the Language Teaching Experience in the Age of AI*; IGI Global: Hershey, PA, USA, 2023; pp. 1–24.
33. Nguyen, A.; Hong, Y.; Dang, B.; Huang, X. Human-AI collaboration patterns in AI-assisted academic writing. *Stud. High. Educ.* **2024**, 1–18. [CrossRef]
34. Urban, M.; Děchtěrenko, F.; Lukavský, J.; Hrabalová, V.; Svacha, F.; Brom, C.; Urban, K. ChatGPT improves creative problem-solving performance in university students: An experimental study. *Comput. Educ.* **2024**, *215*, 1–15. [CrossRef]
35. Creswell, J.W. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 3rd ed.; Sage Publications: Thousand Oaks, CA, USA, 2009.
36. Zhang, M. A survey of English majors' attitudes towards critical thinking. *Athens J. Humanit. Arts* **1985**, *9*, 27–48. [CrossRef]
37. Das, A.K.; Mishra, S. Questionnaire on learner use of technology. In *Technology-Enabled Learning Implementation Handbook*; Kirkwood, A., Price, L., Eds.; Commonwealth of Learning: Burnaby, BC, Canada, 2016; pp. 59–67.
38. Braun, V.; Clarke, V. One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qual. Res. Psychol.* **2021**, *18*, 328–352. [CrossRef]
39. Braun, V.; Clarke, V. *Thematic Analysis: A Practical Guide*; SAGE Publications Ltd.: London, UK, 2021.
40. Byrne, D. A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Qual. Quant.* **2022**, *56*, 1391–1412. [CrossRef]
41. DeCoito, I.; Richardson, T. Teachers and technology: Present practice and future directions. *Contemp. Issues Technol. Teach. Educ.* **2018**, *18*, 362–378. Available online: https://www.learntechlib.org/primary/p/180395/ (accessed on 4 May 2024).
42. Voogt, J.; Fisser, P.; Roblin, N.P.; Tondeur, J.; van Braak, J. Technological pedagogical content knowledge–a review of the literature. *J. Comput. Assist. Lang. Learn. (JCAL)* **2012**, *29*, 1–13. [CrossRef]
43. Brown, H.D. *Principles of Language Learning and Teaching*, 5th ed.; Pearson Longman: London, UK, 2007.
44. Purpura, J.E. An analysis of the relationships between test takers' cognitive and metacognitive strategy use and second language test performance. *Lang. Learn.* **1997**, *47*, 289–325. [CrossRef]