

Development of and User Experience With the Comprehension Strategies Mobile App (COSMA)

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The purpose of this research was to develop guidelines for the production of an educational mobile application and to assess the opinions of its users (students and teachers). The study included 10 students with learning disabilities and 10 teachers from private special education rehabilitation clinics who work with them. Teachers were asked to incorporate the COSMA (comprehension strategies mobile app) into their weekly reading comprehension instruction. Teacher and student views of the COSMA were obtained through semi-structured interviews after they had used the mobile application for four weeks. Descriptive analysis was used to analyze the interviews. Students appeared to be enthusiastic about using the COSMA and wanted to continue working with it. In addition, it was well received by the participating teachers, who reported noticing improvements in their students' performance after using the app. The findings are discussed in greater detail.

Keywords: **Learning Disability, Reading comprehension, Mobile App, Strategy Instruction, Instructional Technology**

Introduction

Among students receiving special education support, a large number are diagnosed with learning disabilities (LD) (Cortiella, 2011). Individuals with LD have average or above-average intelligence but struggle with skills like reading, writing, mathematics, communication, and self-regulation owing to problems with cognitive processes, including attention, memory, information processing, as well as auditory and visual perception (Scruggs & Mastropieri, 2003). Reading failure is particularly common among students with LD, often linked to decoding and reading fluency issues. However, studies have revealed that some students demonstrate poor reading comprehension even though they have adequate reading fluency (Hulme & Snowling, 2011). For example, comparisons of students with LD and their typically developing peers have revealed that the former do not employ reading comprehension strategies, have insufficient knowledge of relevant strategies, or do not know when and how to use the strategies they do know (Dermitzaki et al., 2008).

Reading comprehension can be improved by means of cognitive and metacognitive strategy instruction (Gajria et al., 2007; Gersten et al., 2020; Kim et al., 2012; Sanders et al., 2019). But while it is critical to expand students' repertoires by teaching them strategies that they can apply to a variety of scenarios, their metacognitive skills must also improve so that they can transfer such strategies to a variety of contexts and use them as needed (Berkeley & Larsen, 2018).

Investigating the impact of self-questioning strategies instruction on the reading comprehension performance of students diagnosed with LD in fifth grade,

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Rouse et al. (2014) found that students' reading comprehension skills improved following intervention; specifically, they learned strategies and were able to apply them to a variety of text genres. Different strategies are used in many reading comprehension intervention studies, several of them involving multi-component interventions (Swanson et al., 2017). For example, Ritchey et al. (2017) found that a strategy package intervention consisting of reviewing the text, activating prior knowledge, finding the main idea, summarizing, and considering the question-answer relationship implemented in small groups improved the students' reading comprehension performance. Similarly, Doganay-Bilgi and Özmen (2018) noted that students' reading comprehension scores improved after an intervention that included identifying the aim of reading, activating prior knowledge, prediction, selecting critical information, controlling predictions, and summarizing strategies. Finally, a recent study on the impact of the TWA strategy (Thinking Before, While, and After) on the reading comprehension performance of sixth-grade students with learning LD confirmed that the TWA intervention improved students' comprehension of descriptive texts (Firat & Ergül, 2020).

Thus, many studies have shown that reading comprehension strategy instruction is effective (Sanders et al., 2019); however, to maximize the impact of these interventions, instruction should be varied, employing a variety of tools, materials, and presentations. Thus, teachers must create opportunities for all students to actively participate in activities that are customized to their interests and abilities (Capp, 2017). The universal design for learning (UDL) framework can serve as a guidance for teachers to that end (Edyburn, 2010). Specifically, according to the Center for Applied Special Technology (CAST), UDL is based on three key ideas: providing (a) different means of representation, (b) multiple means of action and expression, and (c) many methods of participation (Meyer et al., 2014). Given these conditions, instruction can be modified to meet the needs of different individuals. Technological tools and software play a key role in diversifying instruction by allowing for greater flexibility and ease (Izzo & Bauer, 2015) with which material is presented and how students evaluate their knowledge and skills and by providing opportunities for students to develop their abilities and practice more often (Thomas et al., 2019).

The use of technology, including mobile applications and computer programs, in reading comprehension intervention studies is gaining in popularity. For example, in recent years, studies have been conducted with typically developing students (Sung et al., 2008; Wijekumar et al., 2017), students with poor reading comprehension (Horne, 2017; Hughes et al., 2013; Park et al., 2017), and students with LD (Cullen et al., 2014; Hall et al., 2014; Özbek & Ergül, 2021). The interventions used a variety of strategies and supports, and while the results differed, the students' motivation to engage with the programs remained consistent.

Among existing interventions found to improve reading comprehension, the iStart program (McNamara et al., 2006) contains paraphrase, prediction, and monitoring strategies, as well as visual interface components. CASTLE, a computer-based strategy intervention program (Sung et al., 2008), includes questioning, monitoring, highlighting, visual organizers, and concept maps. More recently, Hall et al. (2014) developed a software program called Strategic Reader for students with LD

based on the UDL principles. The software includes reciprocal teaching strategies such as question generation, summarizing, predicting, graphing, and selecting important information. Further, Howorth and Raimondi (2018) examined the impact of adopting a digitally supported Thinking Before, While, and After (TWA) strategy on the reading comprehension of students with autism spectrum disorder. The intervention improved the accuracy and quality of students' oral retellings of main ideas and details, as well as their performance on general comprehension questions. Finally, in a recent study, researchers examined at the effectiveness of a mobile app called ProVoc, created to increase vocabulary (Potocki et al., 2021). Findings showed that the app improved participants' vocabulary and had a notable transfer effect on their reading comprehension skills.

The Present Study

COSMA was created using a design and development research model developed by the researcher in a previous study. A tablet-based program, COSMA combines reading comprehension strategies with visual features for teachers to use in class and for students to utilize at home with their own tablets. The purpose of the present study was to examine how students and teachers reacted when a mobile application was used to enhance teaching in the context of UDL. For this purpose, answers to the following research questions were sought.

1. What are the teachers' and students' opinions about using COSMA to improve reading comprehension?
2. What are the opinions of teachers and students on COSMA's contribution?
3. What are teachers' and students' suggestions and perspectives on educational technologies?

Method

Research Design

The study employed a phenomenological design – a qualitative research method that is used to investigate the meanings of participants' perceptions or lived experiences of a phenomenon, as well as to gather in-depth knowledge about these meanings (Patton, 2001). This method was chosen because it enables the collection of in-depth and detailed data from participants. Qualitative research methodologies take a holistic approach and use inductive analysis to generate insight (Yildirim & Şimşek, 2011).

Subjects and Setting

To choose participants, interviews were conducted with private special education rehabilitation clinics in the Buca district of İzmir province, Turkey. Teachers were informed about the study, and signed permissions were obtained. Fourteen teachers were chosen in the first round. Given the need for access to tablet computers (the researcher provided tablet computers to teachers who did not have access to one), parental consent, institutional approval, and group size in qualitative research, the study was limited to 10 student and teacher pairs – 10 Turkish-speaking fourth-

grade students (6 boys, 4 girls) with LD and their teachers (7 women, 3 men). Three of the teachers had completed undergraduate programs in special education and seven had completed undergraduate studies in primary-level teaching. The average age of the teachers was 36 (range: 25-41).

For students to be included in the study, their teachers had to volunteer to employ COSMA in their classes. Students were chosen among classmates who demonstrated 90 percent reading accuracy (number of accurate words read throughout the entire text) and reading fluency of at least 50 correct words per minute, with reading fluency standards based on the length of a COSMA session. Participating students demonstrated no other disability than LD. The nature and scope of the study was explained to the families, who were required to provide written consent for their children to take part.

Data Collection Tools

During the data collection process, the participating students and teachers used the COSMA in their reading comprehension activities for at least four sessions. COSMA was downloaded onto their tablets by researcher. After that, data were collected through interviews with students and teachers. The interviews were conducted using semi-structured interview forms generated by the researcher (see Table 1).

Table 1. ***Interview Questions***

Students	Teachers
How was reading with COSMA? What do you think about studying with it?	How was using COSMA with your student? What would you like to tell us about your experience?
If you have a tablet at home, (with your tablet) do you want to read with this application?	Do you think COSMA can be useful for students?
Which features of COSMA did you like the best?	Have you seen a change in your student's reading comprehension performance as a result of using COSMA?
How can we make COSMA better? What do you recommend?	Have you seen a change in your student's motivation to read as a result of using COSMA?
Did you have difficulty using this application? What did you find difficult about it?	What are your suggestions/expectations regarding software to be developed for students?

The Comprehension Strategies Mobile App (COSMA)

COSMA is a mobile app created by the researcher that integrates reading comprehension strategy support with visual features. In a previous single-subject study, the app was found to be effective in improving the comprehension performance of fourth-grade students with LD (Özbek & Ergül, 2021). A design and devel-

opment research model (Richey & Klein, 2014) was used to create the app. Based on scientific facts and expert perspectives, design and development research provides a foundation for the development of products to solve a problem.

To begin, existing products and research were examined in order to assess student needs as well as identify effective interventions and supports. Following a review of the literature, a decision was made to develop a mobile application for fourth-grade students that would include informative texts and strategy instruction supports. The process is illustrated in Figure 1.

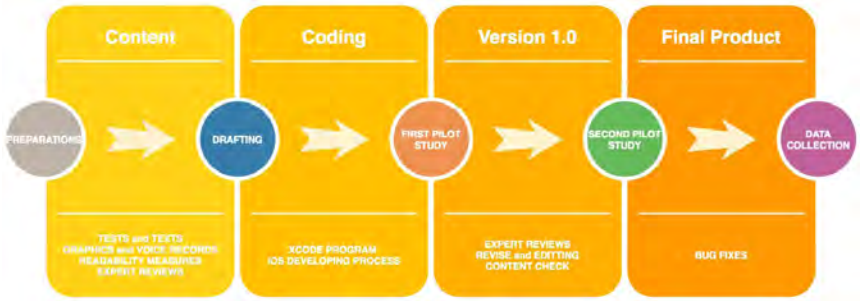

Figure 1. **Steps of App developing process**

Development and Pilot Studies of the App. The contents were prepared first in the application development process. The researcher wrote all of the texts, and expert opinions were subsequently sought from teachers working in schools (Turkish and primary teachers) as well as academics working in special education, Turkish education, and primary education departments in Ankara University. After the texts were edited based on expert advice, their readability levels were assessed and revisions were made.

Following completion of the final versions of the texts, question types for multiple-choice tests were determined, and 10-question tests were created for each text. Corrections were made and finalized after obtaining expert opinion from measurement and evaluation experts.

After the texts and tests were completed, the design phase for the application's visuals and menus began. Visuals reflecting the topic of each paragraph of text, as well as voice recordings of animated characters, were created. Design decisions were then made, such as feedback formats, menu order, customization and settings, and home screen arrangement. Researcher collaborated with a graphic designer to maximize visual features and complete the first draft. The coding phase began after the first draft.

Using the Xcode program, a computer engineer created version 1.0 of the COSMA, which was used in the first pilot study to assess the reactions of fourth-grade typically developing students. Academics from the computer education department provided expert reviews. Version 1.0 was revised and edited in response to academic critics and observations from the first pilot study. Researchers double-checked the

content for errors. Following the revisions and corrections, a second five-week pilot study was conducted with two students with LD. Students completed all of COSMA's content. Following the second pilot study, the final revision phase took place, taking into consideration the errors that were discovered, the difficulties that were encountered, and the suggestions of the students.

Content of the App. When users launch the app on an iPad, they are greeted by the login screen and are expected to create a profile or select an existing profile. The main menu is divided into four sections: My Readings, My Reading Performance, Settings, and Summaries (see Figure 2).

The text section consists of 10 texts, from which students are free to select. The first page of text is intended to activate background knowledge. This page contains photos for each paragraph based on the text structure, as well as photos related to the paragraph topics. The app prompts students to look at the photos and consider what they know about the topic. All texts have six paragraphs. The first paragraph (page 2) is brief and intended to pique the student's interest. The actual reading using strategies begins on the third page. COSMA instructs students to look at the photo and guess the topic of the paragraph. When they answer correctly, the paragraph appears on the screen, and they read it.

Figure 2. **Screenshots of COSMA**

As shown in Figure 2, there is a green button under the paragraph that says "Okudum," Turkish for "I Have Read." When users interact with the app, animated characters demonstrate self-instruction strategies such as "If I read it carefully, I can understand it better," "Do I need to read this paragraph again?" or "Is there any word in the paragraph that I don't understand?" "We're doing fantastic! Hurray!" A paragraph-shrinking question appears on the screen when users press the "I Have Read" button. Students must select the correct answer in order to go on to the following paragraph.

The following three paragraphs adhere to the same format. The final paragraph bids the reader farewell. On this page, the animated character demonstrates a strategy for self-instruction: "Now it's time to answer questions, I can do it!" Students respond to 10 multiple-choice questions displayed on the screen. The animated character asks them to retell what they have learned from the text. Students press the microphone button, and if they try to turn it off before three minutes have passed, COSMA prompts them to explain the text further. COSMA provides feedback once they have completed the retelling section.

Data Collection Procedure and Analysis

The data collection took place during the fall semester of the 2019-2020 academic year. Teachers were briefed on the mobile application and its features prior to the study. Teachers were informed that they could use the application in any way they wanted within their lesson plans. A brief introduction to UDL was also provided, along with the message that it is critical to diversify lessons in order to maintain students' attention and motivation. COSMA was used in weekly lessons by all teachers and students for four weeks. Lessons last 45 minutes, and reading a text on COSMA takes approximately 15-20 minutes, depending on the students' reading fluency.

All interviews were conducted by the researcher, who holds a doctorate in special education and has prior experience collecting data via semi-structured interviews. Individual interviews were conducted in a quiet room in the special education clinics and lasted approximately 15-20 minutes. With the participants' permission, voice recordings were made during the interviews. The researcher listened to all interview recordings and subsequently transcribed them.

The descriptive analysis method was used to analyze the data. First, a framework is developed around the research questions, the conceptual framework, and the dimensions of the interview questions to establish the themes around which the data will be organized and presented. At this stage, direct quotations are also chosen. Finally, the findings are summarized in plain language and accompanied by direct quotations (Yildirim & Şimşek, 2011).

The researcher concluded each interview with a member checking technique in order to increase the study's internal validity. That is, the researcher summarized the participants' responses from his notes and obtained full agreement on the responses. For external validity, researcher defined how participants were chosen and the criteria for their inclusion in the study. The research's validity was also enhanced by including quotations from teachers and students in the study group.

Two independent researchers analyzed the data and compared their findings. Both hold doctorates in special education and have conducted qualitative re-

search in the past. They were provided with the data set and tasked with replicating the descriptive analysis and coding of the participants' responses. Consensus and divergence were used to determine the data's reliability. The reliability formula (reliability = Consensus / (Agreement + Disagreement) x 100) was used. The agreement rate was calculated to be 94 percent (Huberman & Miles, 1994).

Findings

Analysis of participants' answers in the interviews led to three themes: COSMA Experience, COSMA Efficiency, and Suggestions and Expectations. Students (S1, S2, etc.) and teachers (T1, T2, etc.) are represented with codes in the following discussion of their answers.

Students' Answers to Interview Questions

COSMA Experience

In the interviews with students, the first question was, "How was reading with COSMA, and what are your thoughts on studying with it?" To elicit a more detailed response, a follow-up question was asked, "How did you use the tablet in your lessons?" When students' responses were analyzed, it was discovered that they used the tablet computer in conjunction with their teachers and that they enjoyed the tablet-based study. S1 stated, "We studied together with my teacher; I was able to do it on my own after my teacher demonstrated and I read. I already own a tablet and am familiar with its operation. It was enjoyable; we viewed the photographs." S3 stated, "First, we completed my homework. Then my teacher handed me the tablet, which I used to read. When Elif [the animated character] inquired, I told her of the text I had just read. It was pleasant."

The third question involved the features of the application that they found most appealing and useful. The students were asked, "Which features of COSMA did you enjoy the most?" followed by the complementary question, "Which features aided you the most?" Participants indicated their preferred features of COSMA in a variety of ways, including that they enjoyed (a) listening to their own retells ($n = 4$), (b) the performance feedback feature ($n = 5$), (c) the application's visual appearance and the accompanying images ($n = 7$), and (d) the text topics ($n = 3$). For instance, S5 stated, "Owls and elephants, their pictures were very nice; additionally, I listened to my voice, which was good; I really liked them." S9 commented, "The photographs were excellent; I enjoyed them. I answered all questions correctly, it turned green before and after reading, there were stars, which I examined and counted."

According to the students, the summarization of the paragraph question ($n = 4$), the retell section ($n = 5$), and the visuals reflecting the text's subject ($n = 10$) were the most helpful features. S10 stated, "The app asked me to tell about the things I learned, so I attempted to recall; she [animated character] then asked me questions, and then I listened to my voice; I really enjoyed it." S7 responded, "There were pictures while reading a page, for example, the elephant eats; the page I read is about what elephants eat; I looked at the pictures and remembered what I read."

The students were also asked about any difficulties they encountered while utilizing the mobile application. It is evident that all students ($N = 10$) found COSMA

to be simple to use and encountered no difficulties. S2 stated, "No, it was not difficult at all; I used it easily." S7 stated, "It was easy and quick to use."

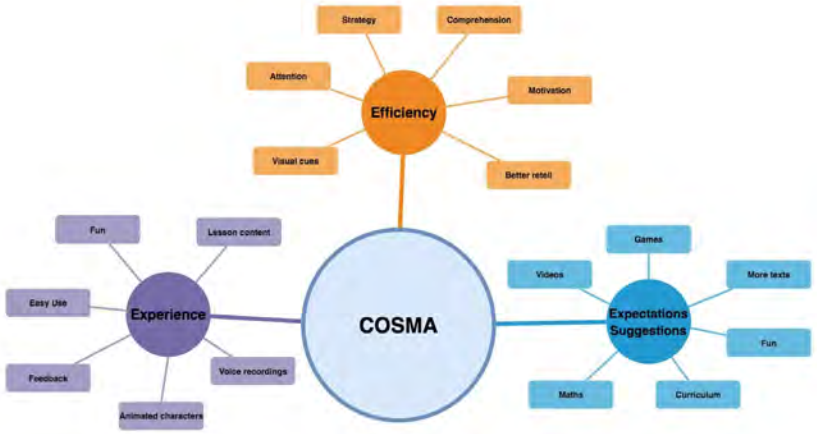

Figure 3. *Keywords From Participants' Answers*

COSMA Efficiency

The question "If you have a tablet at home, (with your tablet), do you want to read with this mobile app? Do you believe that working with this app would help you understand better?" was asked to determine whether the mobile application benefited students and to ascertain their motivations for continuing to use it actively. All of the students ($N = 10$) expressed a desire to continue studying with COSMA and enjoyed working with it. For instance, S3 stated, "My tablet is broken, I do not have a tablet now, but yes, I would work with it." S4 stated, "Let's install; I'll bring my tablet, I will work." S9 noted, "I remember the text better with pictures; they assist me; I'd like to study; I believe it would be better with more pictures; maybe there should be a video." According to S1, "Elif [animated character] assisted me while I studied, she spoke to me; for example, she asked if I understood, she assisted me while reading, there were pictures on each page, and then she said at the end -tell me what you learned- I believe it is helpful".

Suggestions and Expectations

Students were interviewed about their suggestions for improving COSMA and their expectations of educational technologies. Students' responses included adding games ($n = 8$), creating a section for math ($n = 4$), including videos in texts ($n = 3$), expanding character options ($n = 2$), timed reading ($n = 1$), and the use of comprehension scores to unlock games ($n = 3$) or unlocking new features ($n = 1$). Participant S10 stated, "To improve it, more pictures, videos, similar to YouTube, and I play games on my phone, you should make it more like games, allowing me to study and play simultaneously." S7 made the following suggestion, "Characters should move much more like jumping, and when I read well, a game can be unlocked

and I can play with my stars." S2 expressed her views in the following way: "I believe that there could be many more children; currently, there is only Elif and Okan; there should be more character options. I'd like to rename them and modify their clothing or hairstyle." Finally, S4 stated, "For instance, the app says 'Let's read together,' I read a sentence and app reads a sentence something like this would be nice [shared reading]. For instance, there could be a reading race. Additionally, we can add something new, such as exciting and adventurous stories."

Teachers' Answers to Interview Questions

COSMA Experience

The first question asked of teachers during the interviews was, "How was your experience using COSMA with your student? What would you like to share with us about your experience?" Teachers were asked about their use of COSMA in their classrooms and its contribution to their instruction. An examination of the teachers' responses revealed that they used the COSMA in a variety of ways, depending on their students' individualized education plans (IEPs). T1 stated, "In the first lesson, my student was overjoyed to see the tablet, and as a result, I used it as a reward in the following three lessons. To begin, we practiced word drills. I stated that if he performed well, we would work with the tablet as a reward. It was enjoyable to use; he didn't work alone, we used the app together. For instance, when animated characters serve as a model for a strategy, I inquired as to what the character said and how we can use this strategy. We discussed the photographs on the activating background knowledge page. I instructed him to look at the images and then respond to the prediction questions. It was a unique experience." T10 explained how he attempted to use COSMA for a different purpose. "As you are aware, the app records students' retellings. Following the app study, I instructed my student to listen to the recording and attempt to write her own retelling. We conducted a dictation exercise using her own voice. This was an improvised segment of the lesson that I did not plan."

Similarly, other teachers stated that they used the program with their students and adapted it to become course content. To the first question, T8 responded, "The most critical component of my student's IEP is reading comprehension. We previously completed TWA strategy instruction by using cue cards. I found the app useful; it was interesting to work in a different format; it provided an opportunity for my student to generalize. After all, students must read from a screen as well. I began the lesson with your program, as our primary objective is reading comprehension. It did not exhaust my student, I asked him to read aloud, we read several paragraphs twice, and I instructed him to find the correct answer to the paragraph summarization questions by re-examining the paragraph." Another participant, T7, stated, "I am already making arrangements to diversify the instructions in accordance with the approach you mentioned [UDL]. For instance, we have card games and sentence construction games; we do not solely rely on text reading. This program is useful for being a part of the lesson, but it is insufficient on its own."

The second question posed to teachers was, "Do you believe COSMA could be beneficial to students?" To elicit additional information, participants were asked whether they intended to continue using the mobile app in their lessons and which

positive and negative features drew their attention during the evaluation process. Teachers generally expressed positive attitudes toward using COSMA in their classrooms and stated that they would like to continue doing so (n = 8). COSMA was deemed useful by all of the teachers (N = 10). T5 commented, "I believe that this app would be beneficial; additionally, I like it because it provides instant lesson content. Additionally, it simplifies the teacher's job of monitoring students' progress." T10 stated, "I can say that your app has changed my opinion of tablets; in particular, the restricted-use feature is excellent, and the class-level texts are pretty good; it's sometimes difficult to find well-written class level texts." T3 noted, "This app is great; it is colorful, has animated characters, and has beautiful graphics. Moreover, the strategy support is brilliant; I wish there were more texts in this app; I intend to continue using it."

When the teachers were asked which COSMA features they liked the most, their responses included the following: creating separate profiles for students (n = 7), performance feedback and record keeping (n = 8), visual support (n = 4), text and test quality (n = 5), and systematic strategy modeling of the app (n = 3). T1 elaborated, "Creating profiles is an excellent idea; I like it because it enables me to work with other students on this tablet and easily track their performance. Additionally, the performance feedback section is a great way to monitor progress." T9 stated, "The primary difference between reading from paper and reading from a screen is the visual features such as animated characters, pop-ups on the screen, and dynamic presentation, which children find entertaining." T4 noted, "I'm not sure where you got the texts, but they're good as well; I read them, and the tests are good as well; they have a variety of question types." Another teacher, T8, suggested a way to incorporate the program into the educational system, "It is beneficial that the app records the audio when students retell the text; this way, they can listen to it later and the app keeps their test scores. We are required to report on the progress of students' IEP goals on a regular basis. It would be extremely beneficial if there was a feature for creating reports from the data collected in the app."

COSMA Efficiency

The third question asked of teachers during the interviews was, "Have you noticed an improvement in your students' reading comprehension performance?" In addition, follow-up questions such as "How were the test results, did he/she have difficulty with the retell section?" were asked to elicit further information from participants. Teachers reported seeing some improvements in their students' reading abilities. "I have seen development," T10 stated, "As far as I can tell, there has been an increase in multiple-choice question scores, and in the retell section, the app is demanding more from children, and as you know, the app warns students to tell more, and students work harder to complete." T8 commented, "I saw positive changes; he was motivated, his test scores improved, and he read carefully to earn more stars." T5 noted, "He was motivated, which was excellent, and he answered more questions, but I'm not sure this is sufficient to indicate that his reading comprehension has improved." Similarly, another participant, T9, responded to this question as follows: "The app includes numerous aids such as visuals and questions during reading to help students retain information and perform better on tests. I'm not sure if this rep-

resents a genuine shift in their reading comprehension. He only used it four times."

"Have you noticed a change in your students' motivation to read?" was the fourth question asked of teachers during the interviews. Additional questions included, "How did the students react and did they exhibit any behaviors that caught your attention while working?" Teachers emphasized the importance of students' motivation for using COSMA. All teachers ($N = 10$) reported an increase in students' motivation and desire to study with COSMA. For instance, T6 stated, "My student was incredibly curious; she was curious about the app and, as a result, she was incredibly eager to study. I believe that motivation is the most critical factor." T3 commented, "I noticed that he was cautious when answering the prediction and summarization questions; he worked hard to get it right on the first try, which caused him to read carefully, which I believe improved his test performance. Normally, he is not as focused when reading printed texts." T2 noted, "My student was extremely focused on the prediction and summarization questions, and she attempted to answer correctly on the first attempt. She does not have attention issues, but she demonstrated significantly increased focus on the app. She was delighted to use the tablet. When she saw her test score and the golden trophy on the screen at the ending of the tablet session, we shared applause and high fives."

Suggestions and Expectations

The final question asked of teachers during the interviews, "What are your suggestions/expectations for the software that will be developed for students?," probed teachers' suggestions for improving COSMA and their expectations of educational technology, including emerging technology. Teachers expected more content, a longer duration of use ($n = 7$), strong visual features such as videos and animations ($n = 4$), curriculum compatibility ($n = 4$), and suggested gamification and learning while having fun ($n = 4$). T7 commented, "I would gladly use this type of app, but there should be many more texts; perhaps after all texts are read, a new package of texts would be available as an update." Another participant, T8, stated, "There should be videos or animations related to the topics of texts. This can increase children's motivation and allow them to maintain their focus for a longer period of time." T2 suggested, "Perhaps you can make this app much more game-like, so children can learn while they play and have fun; additionally, curriculum is critical; while apps and programs are wonderful, we cannot use them excessively if they do not reflect the curriculum goals."

T5 added, "I believe there is a need for more comprehensive programs. While there are programs for reading fluency and comprehension, there should also be programs for other areas of the curriculum, such as mathematics. It would be ideal if there was a tracking and reporting system compatible with IEPs that could be used to monitor a child's development. After all, we are directly accountable to the Ministry of Education. The institution's reports are constantly reviewed." T1 presented his views as follows, "It would be beneficial to employ such programs. However, constant use of the same program can develop a routine, and after a while, children may lose motivation. Additionally, we should use a variety of tools to help students generalize the skills they learn. Naturally, we must also withdraw support so they can gain independence.

This, I believe, is critical; I believe that technological programs can be structured in this manner, gradually fading support is important."

Discussion and Conclusion

The purpose of this research was to examine the use of technology within the context of universal design for learning to enhance the lessons of students with learning disabilities and to gather participating students' and teachers' perspectives on this experience. Based on an analysis of the findings, it became clear that teachers and students had both common and distinct responses to their experience with COSMA. The most obvious point of agreement was that the students were willing to use the mobile application and were motivated to work with tablets in their lessons. This finding is consistent with those of previous studies showing that the use of technology results in an increase in motivation (Coleman & Heller, 2010; Grunér et al., 2018).

Technology-assisted reading skill interventions have been studied for a long period of time, combining current technologies and previous research findings. Specifically, numerous studies have studied the results of the assistance of technology to improve early literacy, decoding, reading fluency, and reading comprehension, with different levels of effectiveness reported (Ledbetter-Cho et al., 2018; Swanson et al., 2020; Xie et al., 2018). Although studies comparing screen reading and paper reading performance have found no significant differences, touch screens can be beneficial by providing more practical opportunities, providing instant feedback, and presenting information in a variety of visual and auditory formats (Furenes et al., 2021; Kong et al., 2018). Similarly, in the present study, students stated that the mobile app's graphics and strategy support assisted them in recalling information more effectively.

Teachers were introduced to the program prior to the study and informed that they could incorporate it into their lessons as they pleased. Subsequent interviews revealed that teachers made a variety of adaptations, including enriching their students' lessons to align with IEP objectives, utilizing the mobile application to generalize printed instruction, and presenting reading practice via the mobile application as a reward for reading fluency performance. The mobile application's purpose is not to meet all of students' reading comprehension support need, but to provide them with as much variety as possible in their instruction. Eight out of the 10 teachers agreed that there should be a greater variety of texts with a longer duration of use. Teachers in private special education rehabilitation clinics work with a large number of students and do not have enough time to prepare for each lesson (Yavuz, 2019). COSMA enables teachers to monitor students' progress and assists them in preparing lessons in a short amount of time. In this context, it is critical, therefore, that new applications and software address the needs of teachers in schools and private institutions. The teachers' definition of the mobile application as "immediate course content that enables the tracking of a student's development" created the impression that such applications could be widely integrated into the system. Similarly, various studies indicate that touch screens have the potential to enhance lessons and provide convenience for teachers (Petersen-Brown et al., 2019; Xie et al., 2018).

Children today are born into a technological world and learn to use touch screens at an early age. As a result, most possess the knowledge and skills necessary

to operate touch-screen devices and have positive attitudes toward these technologies (Oliemat et al., 2018). This is a reality that we should accept and exploit in instruction. Students' responses revealed that they viewed the app critically, including suggestions for a variety of visual features such as video, animation, and additional visuals. One student proposed earning the right to play with the program in the same way he earned stars for correctly answering text comprehension questions; another requested additional character options and the opportunity to edit them. Students made recommendations not only for visual characteristics but also for educational activities. For instance, some students expressed a desire for a similar program on reading fluency to be available on a tablet. The fact that all participants stated that they easily used the application, that they wished to continue working with it, and that the application helped them remember what they read indicates that the COSMA is effective and user-friendly.

In turn, the suggestions and criticisms of the teachers who participated in the study provide critical information for the development of programs that are tailored to the needs of special education teachers. Specifically, the teachers recommended that mobile applications adhere to the curriculum and IEP goals. Additionally, they stated that the mobile application should contribute to the progress reports they have to present at periodic accountability meetings by generating system data. Finally, they noted that utilizing a variety of tools would help students generalize the skills they acquired and that they could continue to incorporate COSMA into their lessons.

The method section above contains detailed information about the COSMA development process. As the research team that developed the program, we took a multidisciplinary approach and enlisted the assistance of experts from various fields. It is believed that collaboration between professionals in the fields of computer engineering, graphic design, ICT education, and special education is critical for improving product quality. When existing software was analyzed, it became clear that the products have limitations in a variety of dimensions. For example, there are significant content issues in projects to which specialists in special education do not contribute, conversely, the products that educators attempt to create are typically technically limited and unimpressive in terms of graphics and design. Therefore, collaborative studies are needed to ensure both effective strategies and useful digital features. To meet teachers' and students' expectations, educational technology projects should involve a variety of professionals. It is critical to meet teachers' expectations, as they may be hesitant to incorporate educational technologies into their lessons (D'Agostino et al., 2016).

There is an increasing demand for highly interactive mobile applications that are developed collaboratively. Teachers actively use products in their classrooms that they believe will benefit their students. Given not only teachers' but also students' interests and preferences in technology, there is a strong demand for applications with strong visual aspects and dynamic content presentation. Almost all participants, teachers and students alike, emphasized the importance of games and having fun. It is critical, therefore, to conduct extensive research on the gamification of educational technologies.

Implications for Practice

Teachers in this study benefited from the mobile application in a variety of ways, depending on their personal work style and the performance of their students. The use of technology in education does not mean that the teacher's role is eliminated or that printed materials are replaced by screens. Rather, by incorporating mobile applications and computer programs into lessons, we can increase dynamism and richness. Teachers can benefit from the conveniences that mobile applications provide in terms of record keeping and performance tracking. Teachers do not need to use tablets or computers for the duration of their lessons. However, using an app that is appropriate for relevant educational objectives will break the routine and motivate students. Throughout the COVID-19 pandemic, most students have been required to work from a screen, and the difficulties many encountered as a result highlight the importance of incorporating screen reading activities into traditional instruction in order for students' skills to be generalized.

Limitations

The study's primary limitation is that it included only teachers who work one-on-one with students in private special education clinics. Due to some participants' lack of access to a tablet computer, the researcher was unable to work with a larger group of participants as he had to provide some teachers with tablet computers. Another limitation is that participants were interviewed after four sessions of working with the mobile application. After a longer period of use, re-evaluation of the participants' perspectives may have revealed new perspectives and insights.

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