Teachers' Perceptions on the Use of a Mobile Math Learning Application in an Elementary Classroom

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Abstract: This study presents teachers' perceptions of the use of a mobile math learning application in an elementary classroom. Todo Math, a mobile learning application developed by Enuma, Inc., was used in this study. This application covers fundamental math concepts for K-2 students and provides 29 various mini games that support students' learning of early elementary math knowledge and skills. A total of 86 teachers who participated in the Todo Math Grant Program (conducted from 7/15/2014 to 6/30/2015) responded to the questionnaire that we created for this study. Based on the survey findings, we identify that teachers have a positive attitude towards the use of a mobile math application as a supplementary learning tool in an elementary classroom.

Introduction

Technology in Education

An integration of mobile devices such as Tablet PCs or iPads in educational environments has been recognized as a promising approach to promote students' learning (Banister, 2010, Bonds-Raacke & Raacke, 2005, Enriquez, 2010). Researchers have noted that, as a learning tool, mobile devices have useful features such as high mobility, availability of tools such as cameras and microphones, fast internet access, increasing computing power, and high-quality graphics (Ifenthaler & Schweinbenz, 2013). These features have the ability to promote various forms of technology-enhanced learning and instruction such as student-centered learning, game-based learning, interactive learning and collaborative learning (Ludwig, Mayrberger & Weidmann, 2011).

Technology-enhanced learning and instruction using mobile devices has been adapted to math education (Amin, 2010, Banister, 2010, Moreau, 2010, Ross, Morrison, & Lowther, 2010). And a growing body of studies have stressed the significant positive correlation between technology and learning, especially with regard to math learning (Alagic, 2003, Berk, 2010, Hamilton, 2007, Hubbard, 2000, Mendicino, Heffernan & Razzaq, 2007, Park, 2008, Rosen & Beck-Hill, 2012). Among the technology-enhanced learning methods, game-based learning in particular has gained popularity due to its ability to attract more students to learn through a process that is enjoyable. Generally, the term "game-based learning" indicates a learning activity that engages and holds learners' focus by encouraging them to participate during the lesson through gameplay (Razak, Connolly, & Hainey, 2012). Researchers such as Barab et al. (2005) and Squire (2003) attempted to introduce game-based curriculum into the math classroom. To do so, Barab et al. (2005) developed an educational adventure game (Quest Atlantis) using Scratch; Squire (2003) redesigned a commercial, off-the-shelf role-playing game (Civilization) and applied it to the classroom. Since then, a great number of technologies integrated into the classroom have been used to improve students' math ability and promote students' engagement.

However, teachers' adoption of technology for instruction is relatively low compared to the amount of technology available in today's classroom settings (Kopcha, 2012), especially considering that most teachers use technology for administrative purposes, such as grading, assigning homework and maintaining attendance, or for effective communication with school staff or parents (Kopcha, 2012). Teachers play a key role in the integration of technology within a school context. Without teachers' active participation in using technology in a classroom, it is not possible to successfully integrate mobile devices into the learning process (Ertmer, 2005). Thus, researchers (Ifenthaler & Schweinbenz, 2013, Ertmer, 2005) indicate that it is important to examine teachers' perceptions of

mobile learning tools in a real classroom setting and to identify the barriers that teachers faced when using mobile devices in real classrooms. This study collected teachers' feedbacks on the use of a mobile math learning application, Todo Math, through an online survey tool in order to understand their thoughts about using this mobile learning tool in their math instructions and what difficulties they experienced during the process.

Todo Math

Developed by Enuma, Inc., Todo Math is an educational learning application for iPad comprising fundamental math concepts for grades K-2 that utilizes a game-like format. This application is designed to help students with different learning styles and learning abilities be actively involved in learning math. Todo Math provides a variety of activities: daily practice, mission mode, free choice mode (including 29 multi-level games), and monster collection quizzes. As shown in Figure 1, Todo Math offers a variety of features that can enable teachers or parents to use it to help their students or children learn math. As a formal workbook, it offers daily practice to students (Figure 1a), so students can solve assigned problems every day using various mini-games. Furthermore, through the mission mode (Figure 1b), students can master math skills or concepts aligned with Common Core State Standards (CCSS, 2010). The monster collection shown in Figure 1c is designed to allow children to capture and collect monsters by completing math assessments. Students who want to explore various games can enjoy free choice mode (Figure 1d), which enables them to select which game and level they wish to play. In addition, students can check their own learning progress and choose various functions such as input mode, language, sounds and specific features for children with special needs (Figure 1e). Parents can also receive progress reports with information regarding their children's learning and additional education information from Parent Page (Figure 1f).

Todo Math uses a scaffolding approach to help students gradually learn and expand their mathematical horizons. For example, this application provides multiple mini-games to help students learn addition skills, like the games displayed in Figure 2. At first, students play a graphic-supported game by touching an object and listening to a counting-sound (counting in Figure 2). They are then introduced to an addition game with objects (cookies in Figure 2). After getting used to this game, they move to another addition game that pairs numbers with object-clues (falling blocks in Figure 2). Finally, they play a game with addition problems using numbers without object-clues (quick adding in Figure 2).
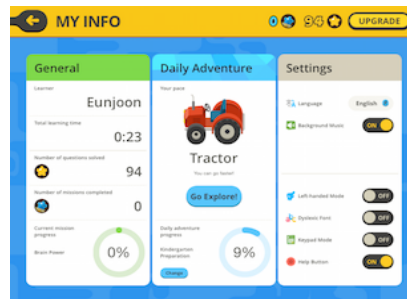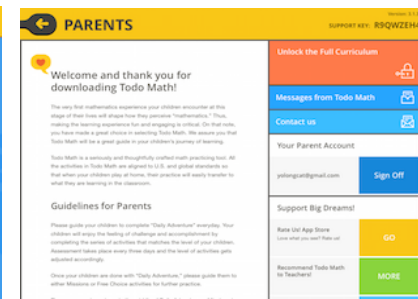

(a) Daily adventure

(b) Mission mode

(c) Monster collection

(d) Free choice

(e) My info

(f) Parent page
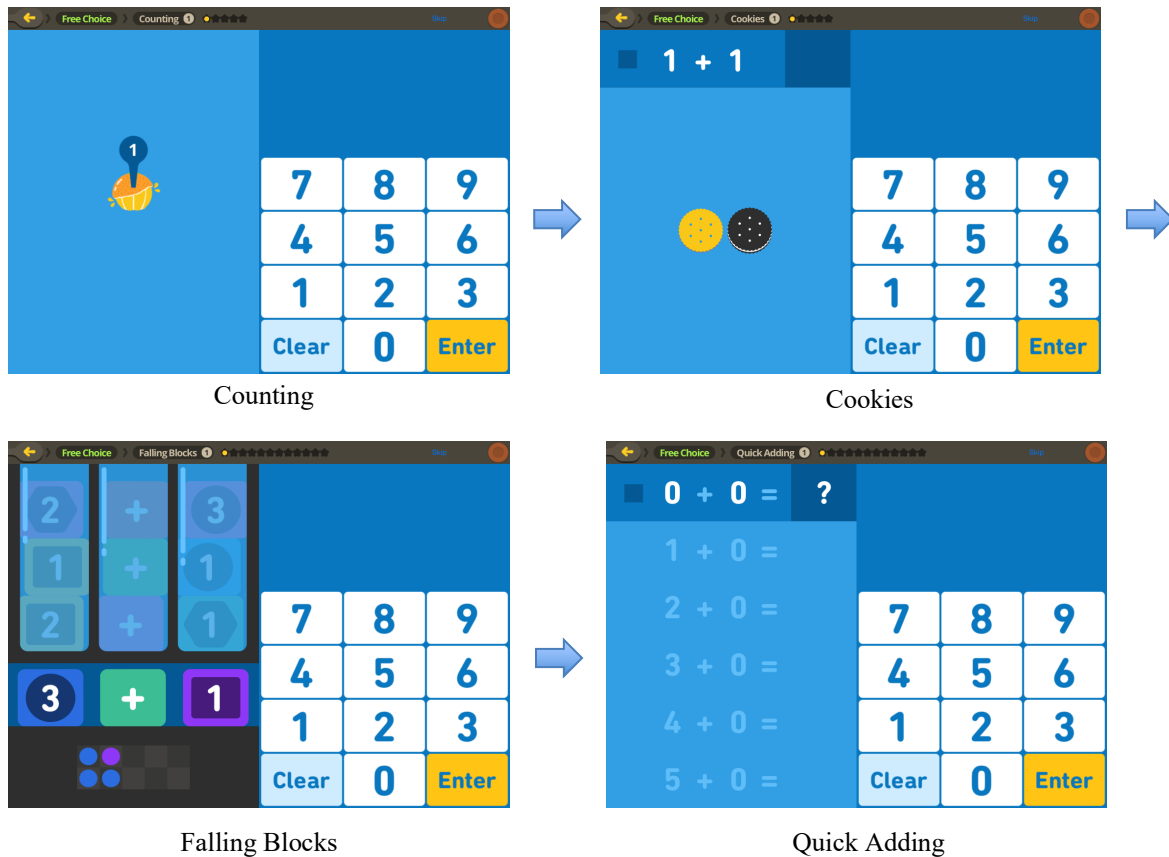
Figure 1. Features of Todo Math

Counting

Cookies

Falling Blocks

Quick Adding

Figure 2. Scaffolding approach used in Todo Math

Purpose

The purpose of this study is to investigate the perceptions of teachers who used a mobile learning application, Todo Math, in their classrooms with students aged 5 to 7 (grades K - 2). We intend to understand the benefits and challenges teachers perceived when using the mobile application as a math learning supplement in their classrooms. In addition, we try to identify important features for effectively implementing mobile learning applications in an elementary classroom setting.

Participants

The survey questionnaire was sent to 144 teachers who participated in the Todo Math Classroom Grant Program, with 86 of them responding to the survey. The study participation was on a voluntary basis. The participants completed the survey at their convenience between September 29 — October 13, 2015. Only 3 respondents were male and the rest of them were female. These teachers were from various school districts in the United States.

Method

The survey data was collected through an online survey tool, *SurveyMonkey*. A link was distributed by email to teachers participating in a Grant Program that Todo Math offered from 7/15/2014 — 6/30/2015. A total of

19 questions were asked in the survey, but in this study, we analyzed only seven questions associated with teachers' perceptions of the mobile learning application. Specific questions are listed in Table 1.

Question Number	Category	Questions
1	Overall satisfaction on the mobile learning application	How strongly do you agree with the statement: "I would recommend Todo Math to my colleagues."
2	Use of the mobile learning application in a classroom	How are you using Todo Math with your students?
3	Effectiveness of the mobile learning application as a learning tool	How does Todo Math help students learn?
4	Usability of the mobile learning application in a classroom	How strongly do you agree with the statement: "I use Todo Math in my class without any difficulty."
5		What difficulties have you experienced using Todo Math?
6	Evaluation of the mobile learning application	What do you like about using Todo Math with your students?
7		What features do you not like about the use of Todo Math with your students?

Table 1. Survey questions

Results & Discussion

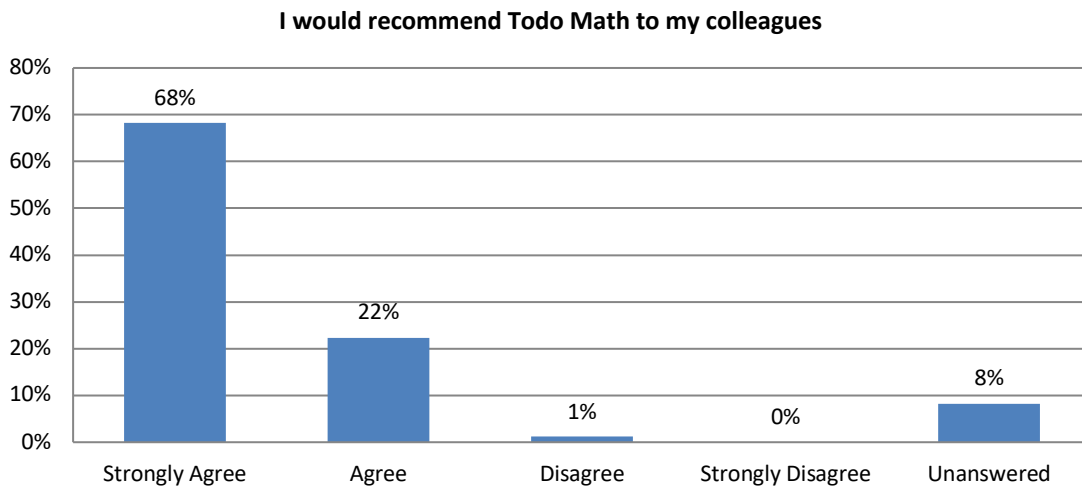**1. Overall Satisfaction on the Mobile Learning Application**

Figure 3. Teacher satisfaction with the use of Todo Math

All participants were asked to indicate how they felt the question "*I would recommend Todo Math to my colleagues.*" on a four-point Likert scale: Strongly agree, agree, disagree, or strongly disagree. As shown in Figure 3, 90.7% of the respondents answered, "strongly agree" or "agree" and only 1.2% of the respondents indicated "strongly disagree" or "disagree" with the statement.

2. Use of the Mobile Learning Application in Classroom

Q2. How are you using Todo Math with your students?

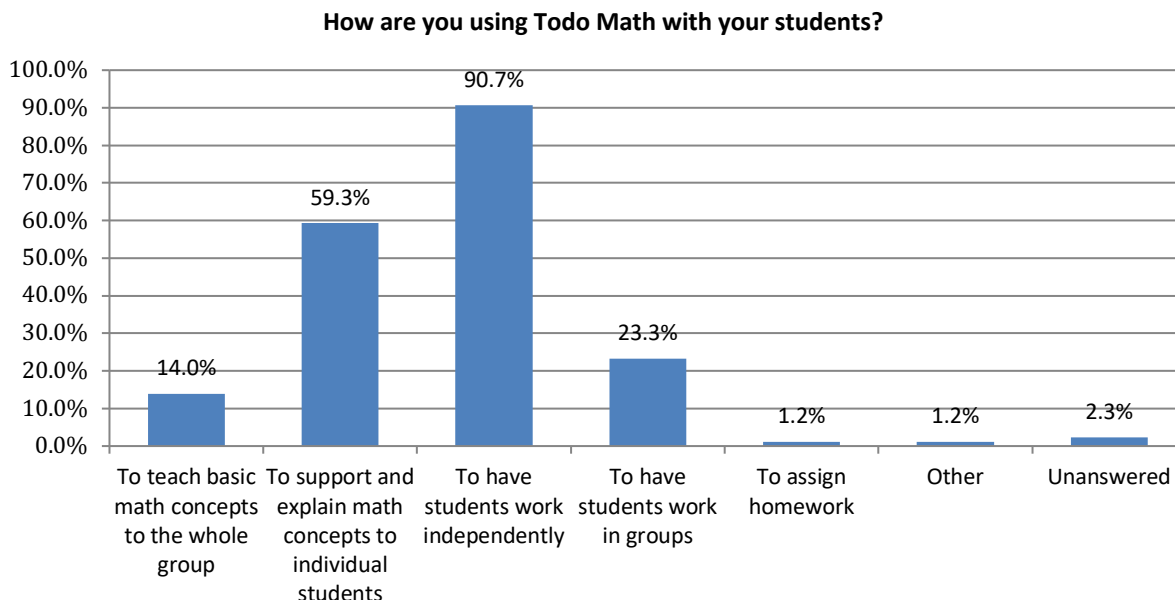**How are you using Todo Math with your students?**

Figure 4. How are you using Todo Math with your students?

This question was asked to understand how the teachers used the application in their classrooms. To help respondents answer this question, six response options were offered which are displayed in Figure 4. The respondents could choose multiple response options. As shown in Figure 4, 90.7 % of the teachers used this application to have students work with Todo Math independently. On the other hand, 59.3 % of teachers answered that they used it to support and explain math concepts to individual students. Respondents indicating "to have students work in groups" accounted for 23.3%. The respondents of other (1.2%) reported that they used Todo Math for a math station time.

3. Effectiveness of the Mobile Learning Application as a Learning Tool

Q3. How does Todo Math help students learn?

This question was designed to identify how teachers perceived the effectiveness of the app in students' learning. Four response options were presented in the questionnaire, and teachers could choose multiple responses. As shown in Figure 5, most teachers chose the first three response options: "promotes students' engagement", "used as a learning supplemental tool", and "teaches basic math concepts". Only 4.7% of the teachers indicated that they used "Todo Math" for homework. Additionally, 2.3 % of the responses were "other." For instance, one respondent answered, "Provides a fun and successful math experience to all students who need visual, concrete math. Our school math curriculum is heavily linguistic centered and both ELLs and low verbal students are unable to be successful with it. Todo Math is essential to giving them the math support and success they need to enjoy math."

Another teacher mentioned, "This is the only app that keeps students at different ages engaged….my students are used to struggling but this all allows them to progress at their own speed."
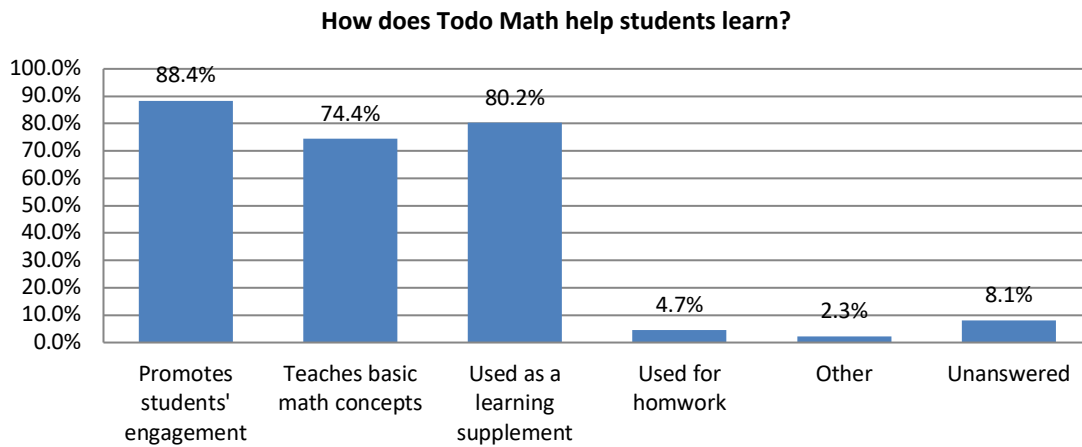
How does Todo Math help students learn?

Category	Percentage
Promotes students' engagement	88.4%
Teaches basic math concepts	74.4%
Used as a learning supplement	80.2%
Used for homwork	4.7%
Other	2.3%
Unanswered	8.1%

Figure 5. How does Todo Math help students learn?

4. Usability of the Mobile Learning Application in Classroom

Q4. How strongly do you agree with the statement: "I use Todo Math in my class without any difficulty."
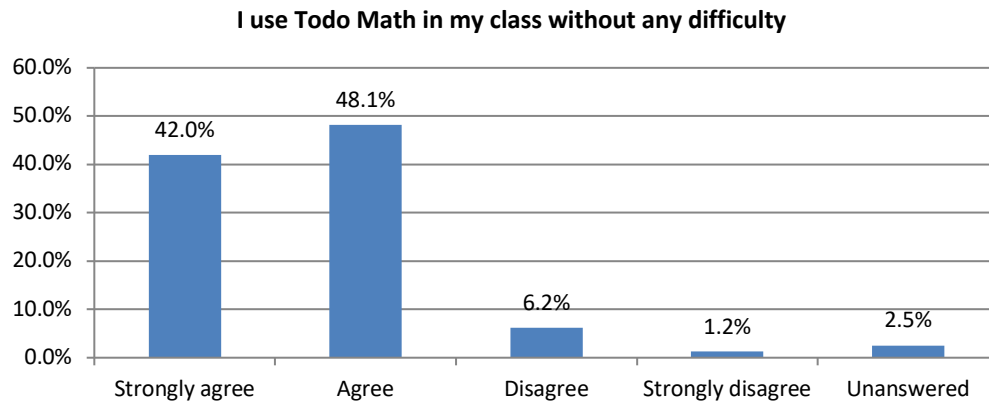
I use Todo Math in my class without any difficulty

Category	Percentage
Strongly agree	42.0%
Agree	48.1%
Disagree	6.2%
Strongly disagree	1.2%
Unanswered	2.5%

Figure 6. I use Todo Math in my class without any difficulty

This question was asked to investigate whether teachers experienced any difficulties when using Todo Math in classroom. The four-point Likert scale was used for this question. As displayed in Figure 6, 90.1% of the teachers indicated that they used "Todo Math" without any difficulty. Only 7.3 % of the teachers replied that they experienced some difficulties when using the application.

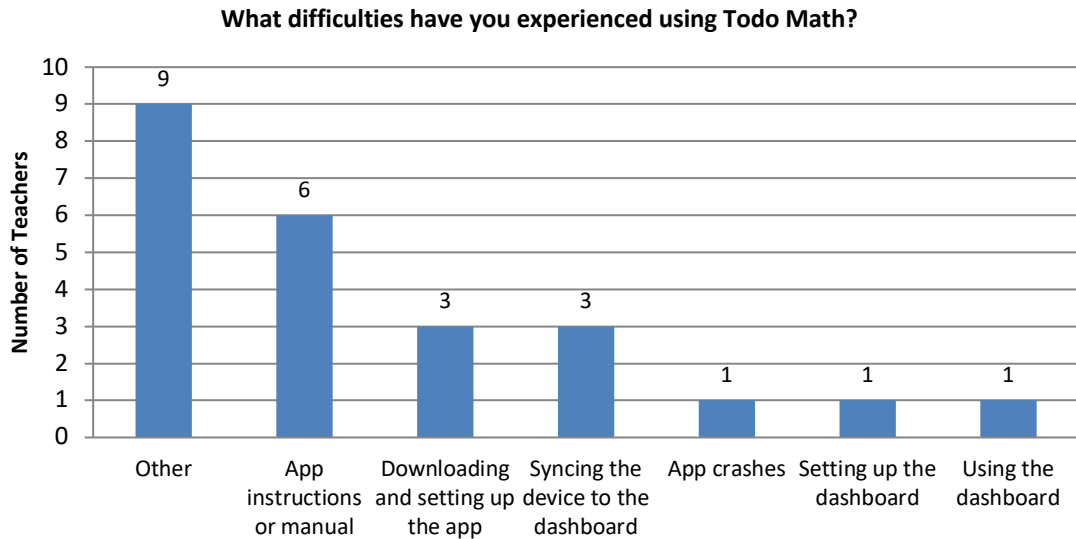*Q5. What difficulties have you experienced using Todo Math?*

What difficulties have you experienced using Todo Math?

Figure 7. What difficulties have you experienced using Todo Math?

To identify what difficulties teachers experienced when using Todo Math, we asked teachers to indicate specific difficulties they experienced. This question was for 11 respondents (those who answered in Q4 that they experienced difficulties) with seven response options shown in Figure 7. Six teachers indicated that they had a difficulties regarding app instructions or manual. Three teachers chose an issue of downloading and setting up the app, and another three teachers indicated an issue of syncing the device to the dashboard. App crashes (1), setting up the dashboard (1) and using the dashboard (1) were collected as problems that teachers experienced. In addition, nine respondents gave various answers to this question. For instance, one teacher wrote, "students struggle at times with app"; another mentioned, "This year I am having trouble getting my current class list on the app." Most responses were related to installing the application and students' proficiency in using the mobile application.

5. Evaluation of the Mobile Learning Application

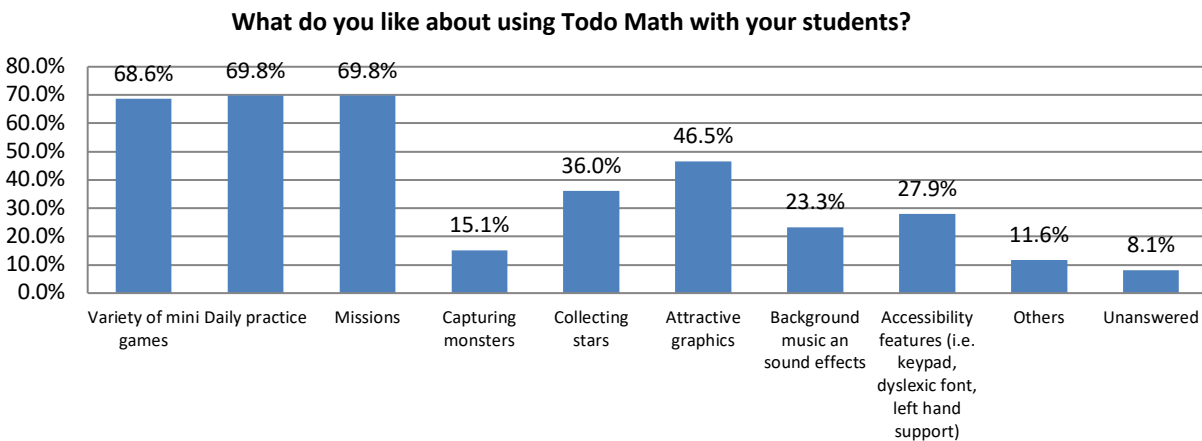*Q6. What do you like about using Todo Math with your students?*

What do you like about using Todo Math with your students?

Figure 8. What do you like using Todo Math with your students?

Q7. What features do you not like about the use of Todo Math with your students?

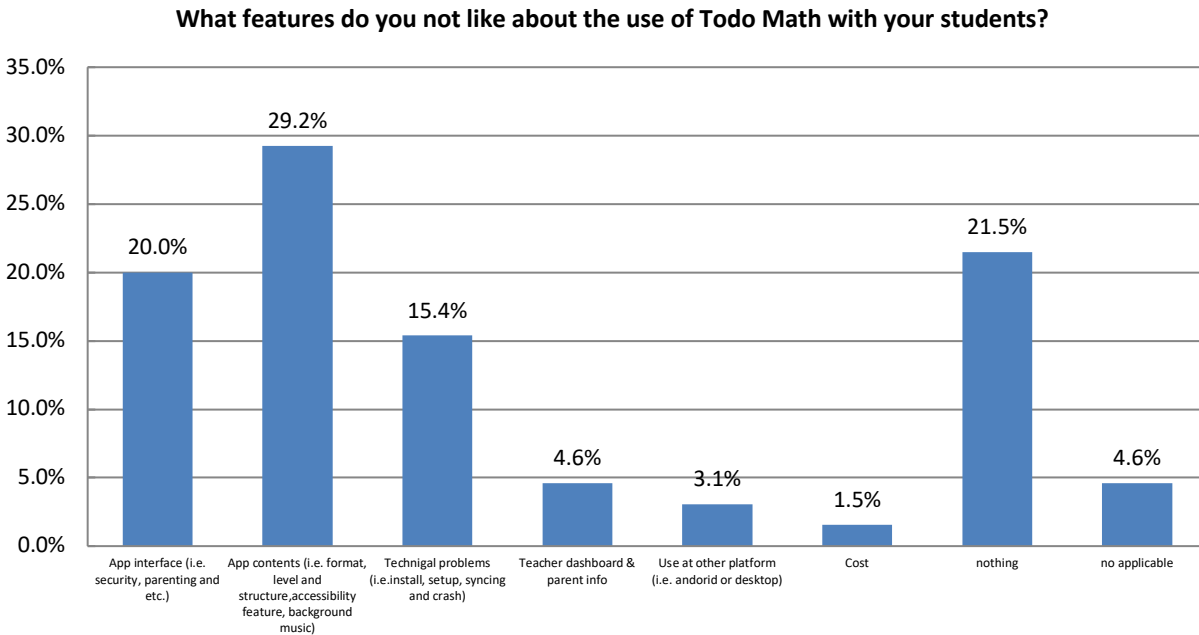**What features do you not like about the use of Todo Math with your students?**

Figure 9. What features do you not like about the use of Todo Math with your students?

These two questions are related to teachers' evaluation of the application. For the question 6, we presented multiple options for teachers to choose with the ability to include multiple responses. Teachers' responses to Q6 are displayed in Figure 8. Approximately 70 % of the teachers answered that they liked the daily practice, the mini-games, and the missions. These are all content features in the application. This means around 70% of the teachers liked this application because of the content. Attractive graphics (46.5%), collecting stars (36.0%), accessibility features (27.9%), music and sound effect (23.3%), and capturing monsters (15.1%) were selected as the next favored options. Moreover, 11.6 % of the teachers gave various opinions. For example, one teacher replied, "I think it is brilliant how your games are short and varied so that the interest does not wane." Another teacher responded, "I teach students with disability and this is by far favorite app last year and this year. I love it!"

For the question 7, no response options were provided to the respondents. Thus, teachers constructed their own responses, and we classified them into eight categories. The categories are displayed in Figure 9. In total, 65 teachers gave their opinions. 29.2% of the teachers replied that they did not like some application contents. For example, one teacher wrote, "I wish the topics were more specific." Another teacher indicated, "I wish it went past the 2nd grade, because I have both 2nd and 3rd grade." 20.0% of the responses are about the application interface. For example, one teacher wrote, "Children like to play together, but the individual names in the class do not foster a group work." Other pointed out, "I wish you could lock a certain student into their profile." 15.4% of the teachers reported technical problems such as installing, setup, syncing and crash. On the other hand, 21.5% of the teachers replied that there was nothing they did not like.

Conclusions

This paper investigated how teachers perceived a mobile application, Todo Math, as a supplementary learning tool, as well as what benefits and challenges those teachers experienced when using the mobile application in an elementary classroom. Most teachers were satisfied with the mobile application, responding that they would like to recommend the app to colleagues. Most teachers used the application to make students study independently. They indicated that this app helped students actively participate in the learning process. These results show that most teachers had positive perceptions of the mobile application as a successful learning tool by engaging students in the independent learning process. On the other hand, several teachers (7.3%) experienced challenges or difficulties

when using a mobile application. These teachers mostly had difficulties installing the application on their own devices and understanding how to use it. These challenges can be resolved by providing a detailed manual, regular workshops and customer service. For the evaluation of the application, a significant number of teachers liked Todo Math's game content features, including missions, daily practice and a variety of mini-games. This suggests that most teachers were satisfied with Todo Math because of its rich learning contents. Some teachers, however, addressed that some game contents should be improved or changed, such as difficulty levels or game-playing format. These findings may show that teachers desire to have more customized math learning contents (proper level, desired answering style and teaching approach) based on their individual needs. In summary, despite experiencing some technical difficulties, teachers enjoyed using Todo Math in their classrooms because they believe it helps students get more involved in their own learning by providing positive content and varied learning methods.

Acknowledgement

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