Designing for Children
- With focus on 'Play + Learn'

Engaging Educational Interactions for Primary School Students

Pragati Saraf, Indian Institute of Technology Guwahati, India, pragati18@iitg.ac.in
Dr. Keyur Sorathia, Associate Professor, Indian Institute of Technology Guwahati, India, keyur@iitg.ac.in

Abstract: The government supported primary schools lack adequate infrastructure, adequate number of specialized teachers, inferior teaching methods and poor motivation among teachers due to teaching overload. This results in poor learning outcomes among students. Research suggests the increased engagement, playfulness, interactivity and practice-based learning approaches increase motivation and encourage students to actively participate in learning activities, hence providing an opportunity to increase learning outcomes.
This paper is divided into two sections. First, we present findings of a user study conducted with 15 school students of grade 1 to grade 3 in two government primary schools followed by 3 design concepts. The user study reveals the importance of playful activities, rewards for motivation, use of the audio-visual medium for explaining concepts, practice-based exploratory exercises in a classroom environment

Key words: Engaging, Interactive, Playful, Practice-based learning, Government schools

1. Introduction

Technology is transforming education, especially the relationship between teachers and students. Many primary schools now provide a laptop or tablet in the classroom. Mobile technology has the potential to change the dynamics of education. Mobile learning has many advantages, some of which being: personalization, collaboration of interactions, peer learning, mobility, etc. all of which together was not possible before. The range of sensors available on many of the advanced devices like camera, mic, touchscreen, geolocation, accelerometer, gyroscopes, etc. which can be used to come up with novel concepts for mobile learning. Photos, audio and video recording, integration of Augmented Reality (AR), scanning, google maps, etc. can prove to be useful as an application to enrich the learning experience. This paper presents concepts for creating engaging

educational interactions by using digital interfaces to implement practice-based learning approaches.

2. Aim and Objective

2.1 Aim

The overall aim of the study was to propose concepts which can enhance the learning outcomes by increasing engagement, interactivity and applying practice-based learning approaches which motivate the students to participate and enjoy classroom activities.

2.2 Objective

The objective is to identify different methods of engaging interactions which can help the students practice and learn educational content, which is taught to them in school. Also, help students exercise practice-based learning in the absence of a teacher.

3. Motivation

There is a lack adequate infrastructure, adequate number of specialized teachers, inferior teaching methods and poor motivation among teachers due to teaching overload in the government supported primary schools. Various steps are being taken by the government to raise the standard of education in these government primary schools. Studies have shown that there is a lot of scope of improvement in areas where the students can perform better. The main reasons for this are poor content; primitive methods of teaching, lack of engagement and interactivity in teaching. Lack of engagement and practice-based teaching methods is something which needs to be worked upon.

4. User Study

Primary research was conducted through observational Study to understand the behaviour of students and analyze learning patterns.

4.1 Methodology

- Direct Observation Technique
- Photography and Videography

4.1 Objectives

- Understanding the behaviour of students.
- Understanding what motivates the students and engages them.
- Understanding how students learn in the class.
- Understand how students respond to other students in the class.

- Observe how students performs activities in the absence of teacher.

4.3 Observational Study

School 1 – Akshara Pre-Primary School, IIT Guwahati

Scenario: Total Teacher: 1, Total Students: 32

Activity given: Drawing Shapes, Writing sentences

Class time: 12:00 pm to 1:00 pm

Figure.1 Students playing artifacts while in class

Figure.2 Students interacting

Figure.3 Teaching each other

Figure.4 Stickers

School 2 – Montessori Government Primary School, Jabalpur

Scenario: Total Teacher: 1, Total Students: 20 (Class-KG 2- Class 1)

Activity given on Day 1: Writing words, Drawing

Activity given on Day 2: Working with clay, Using aids

Class time: 1:00 pm to 3:00 pm

Figure.5 Students group together to show written words

Figure.6 Students learning with the help of flash cards

4.4 Primary Insights

- Students were found to be involved in playing with pencil box, colours and pens during the classes.
- Fancy stickers grab attention of students, during free time, students were found making stickers with paper, drawing and colouring.
- Students try to teach each other. Practicing peer learning would give better results.
- Students tend to see pictures and associate it with the meaning of the word. Thus, visuals represented in the book play an important role.
- Different seating arrangement (students facing each other in 2 rows) in rural schools lead to more interaction among peers.
- Students were encouraged to study when rewarded (clicking pictures, applaud from teacher). Usage of slate for quick practice was found to be more engaging.
- Excited and engaged when involved in a group learning activity, competitive to showcase their own work to the teacher.
- Learning spellings and meanings with the help of songs helped students learn effectively.
- Students grouped together to recite poems in front of the camera which enabled learning in a fun way.
- Students were bored when taught with a lot of instructions and text books.
- Usage of flash cards did not prove to be very effective because of limited availability of cards and lack of exploratory exercises.
- Collaboratively working in groups of two or four helped them learn new things in a better way from each other.
- Using aids for learning created an engaging environment, but difficult to ensure individual learning of each student.
- Students were comfortable using mobile phones to search things online using speech-based interaction.

5. Design Concepts

With the use of affinity map and brainstorming, the findings of user study were translated into 3 design concepts aimed to increase learning outcomes in 3 activities - (i) constructing of words and related sentences (ii) identification and learning of antonyms and (iii) identification of basic geometric shapes. These 3 activities were suggested by the school teacher as they indicated poor learning outcomes among the students.

5.1 Concept 1: Word Filter

Word filters uses a front camera of a tablet to capture the words and sentences written by the students on notebook or slate. The tablet is placed at a designated place in the classroom. If the students write the correct word and related sentences the camera creates a filter relevant to the word and puts it over the face of the student.

5.2 Concept 2: Learn Antonyms

learn antonyms uses touch-based gestures to teach the concept of antonyms of given words and characters. For example, students can learn about short & tall words by pinching-in a short human character on a tablet. Pinching-in gesture translates the short character into a tall character, hence making the sessions engaging and playful.

5.3 Concept 3: Play with shapes

Play with shapes enables students to capture random pictures of their surrounding environment to identify different shapes from the captured picture and then draw something new using the shapes collected. It enables students to learn about the shapes via everyday environment and objects.

6.Scenarios

For the 3 concepts, different scenarios were build, a user scenario simply describes a basic story of an action or goal that a user wants to accomplish.

6.1 Scenario 1: Word filter -> Practice words

Step 1: Teacher teaches words in class, student practices different words.

Step 2: Student stands in front of the tablet, where he is asked to write a word.

Step 3: Student writes the word and shows it in front of the tablet.

Step 4: Camera detects the written word and checks if it is correct.

Step 5: Camera creates a filter related to the word shown and puts it over the face of the student.

Similarly, filters for other different words could be created by the system. Words which are animals or birds could be put as face filters and words which are things could be put in the environment in that filter.

6.2 Scenario 2: Word filter -> Practice sentences

Step 1: Teacher teaches words in class, and introduces ‘Uses of AND’ in the class.

Step 2: Teacher gives the student a task to write one word from the board

Step 3: Students come in groups of two’s and show it in front of the camera.

Step 4: Camera of the device recognizes the words and combines them to form sentence with ‘AND’.

Step 5: Once the sentence is formed, students get to see a selfie filter put over their faces.

6.3 Scenario 3: Learn antonyms

Step 1: Student is taught about antonyms in the class. (example: tall - short)

Step 2: To explain the opposite words, teacher gives a tablet to the students to perform different gestures (pinching in, double tap, etc.), to reveal different forms.

Step 3: The student plays with the words by gestures and understands the difference between tall and short.

Other sets of opposite words could be explained using various gestures.

6.4 Scenario 4: Play with shapes

Step 1: Teacher introduces students to different types of shapes.

Step 2: Then teacher instructs the students about how to use the tablet and click pictures.

Step 3: Students go to the school garden and click pictures of the surroundings.

Step 4: Camera of the tablet identifies shapes and places it over the image, students need to drag and drop these shapes to collect them

Step 5: The system counts the collected shapes and after which student clicks on the draw button.

Step 6: After clicking on draw button, an incomplete image appears on the screen, students have to place the collected shapes and colour the image to complete it.

7. Final Design Components

The application, comprises of three activities (i) Word filter which teaches constructing words and related sentences (ii) Learn antonyms which teaches identification and learning of antonyms and (iii)Play with shapes which teaches identification of basic geometric shapes.

Figure.7 Home Screen

Word Filter: The screen shows two options:

- **Practice words**
  To practice words which uses vowel sounds
- **Practice sentences**
  To build sentences using ‘and’, ‘in’, ‘on’ and ‘under’

Activity: The student gets to select one vowel sound and practice the word corresponding to it.

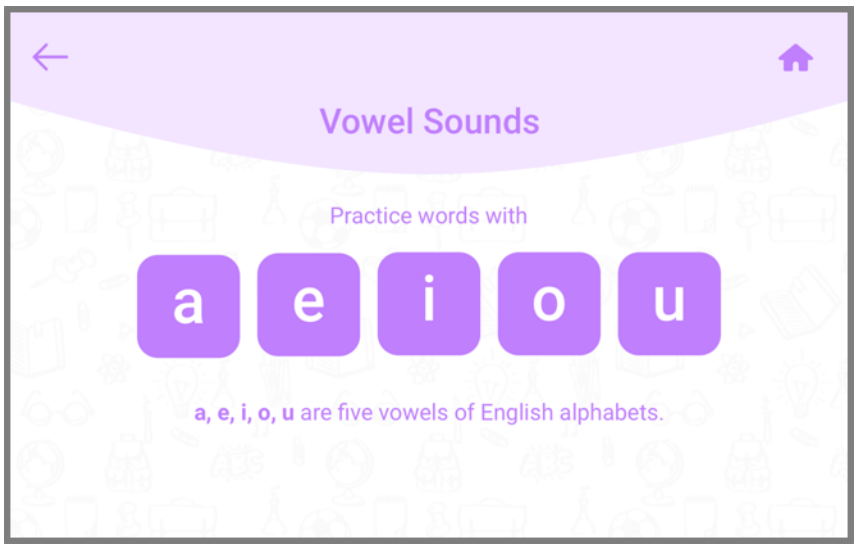

Figure.8 Vowel Sounds

Detection Screen

The front camera of the tablet starts on the screen showing the student holding the slate. The student need to tap on the play button and listen to the word and write the word on his/her slate. Once done, he/she needs to show the slate in front of the camera.

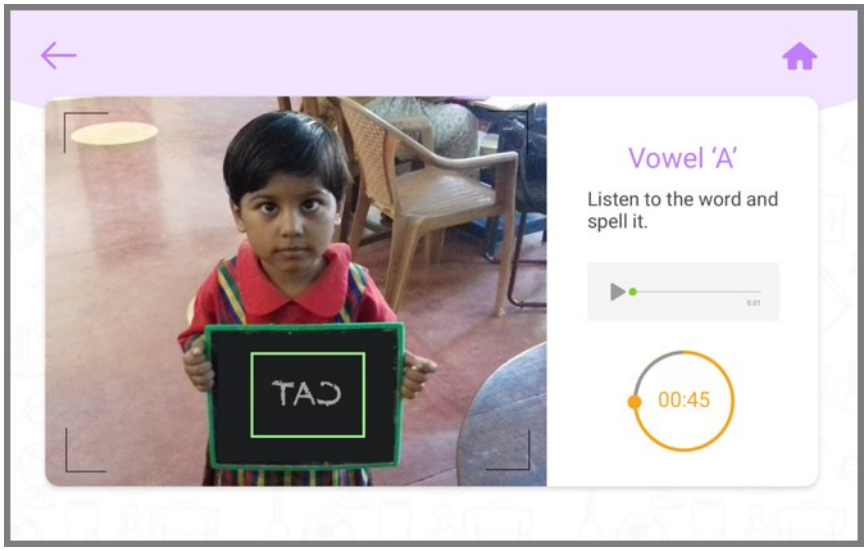

Figure.9 Detection Screen

Filter Screen

The screen detects the word written by the student using image processing. If correct, the system appreciates the student visually and to make the experience more engaging and effective, graphical filter gets applied on the face of the student.

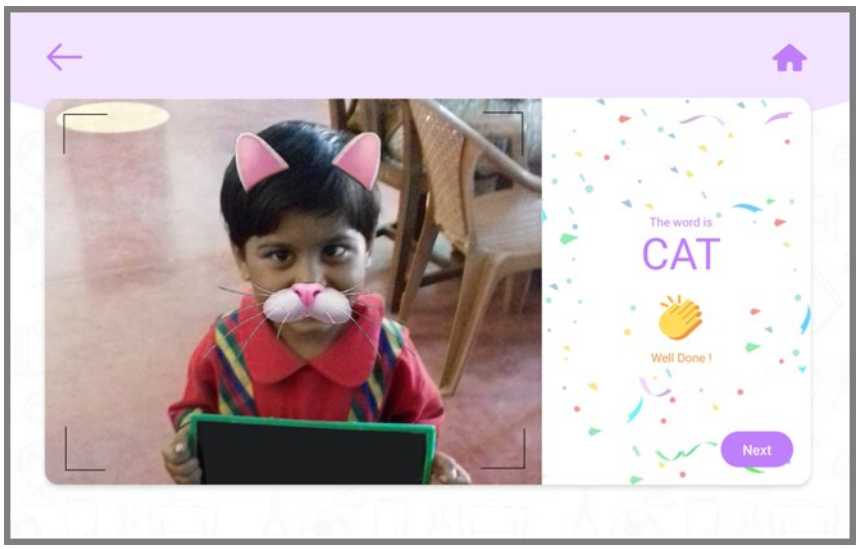

Figure.10 Filter Screen

Learn antonyms

This screen shows combinations of antonyms from which students get to select a pair to perform gestures and explore different forms.

Figure.11 Learn antonyms

Instruction Screen

This screen shows a graphical animated instruction to show how to interact with the object to reveal the opposite form.

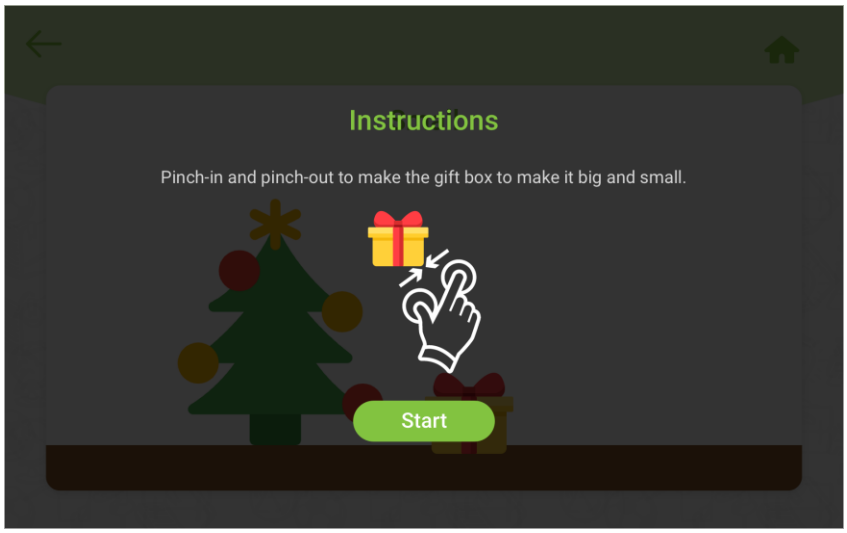

Figure.12 Instruction Screen

Animation for 'Small'

Initially the object (gift box) is of small size.

Figure.13 Screen animation for ‘small’

Animation for ‘Big’

On pinching-out, the size of the object becomes bigger, showing the opposite of small.

Figure.14 Screen animation for ‘Big’

Play with shapes

This activity helps the students to collect different shapes from the environment using camera. Once done, the student can draw images using the shapes (as prescribed by the system) and finally colour them using colours.

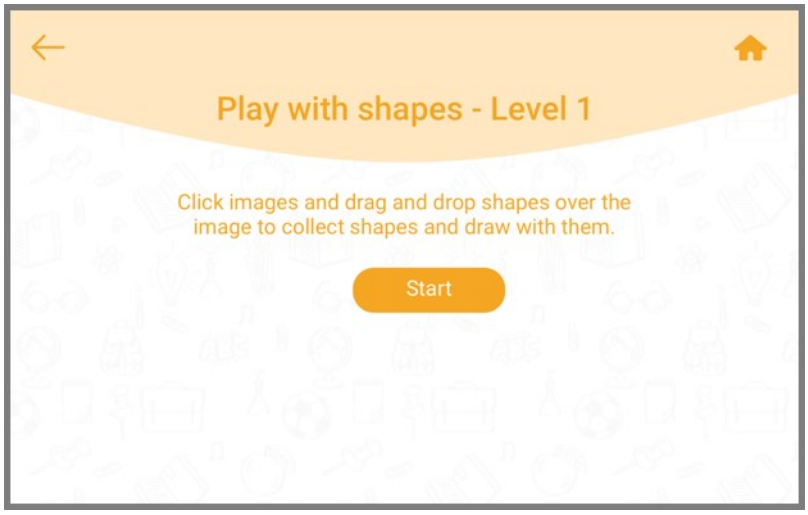

Figure.15 Play with shapes

Camera Screen

The activity starts with the camera. The student feels free to capture a scene from the environment. The camera clicks the picture and goes to the next step.

Figure.16 Camera Screen

Shapes detection Screen

The application uses image recognition technology to detect the basic shapes (square, rectangle, circle, triangle, etc.) from the captured image. The student can see all the detected shapes in different colours. The student need to drag the shapes from the image and drop in the shape panel on the right side of the screen.

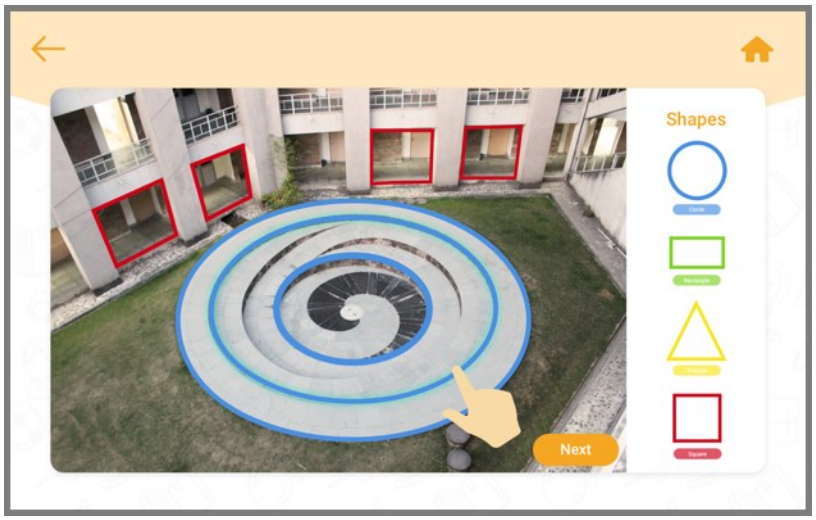

Figure.17 Shapes detection screen

Drag and drop shapes

As the student collects all the shapes, the counter of total no. of a particular shape increases accordingly.

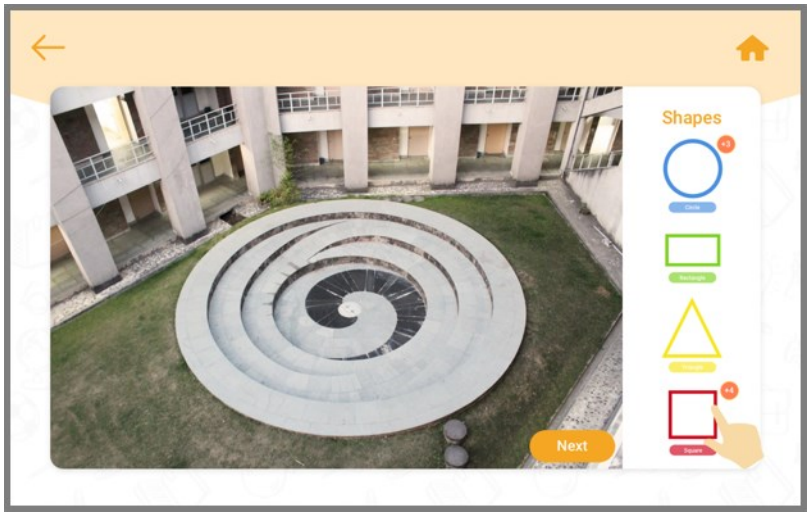

Figure.18 Drag and drop shapes

Drawing completion screen

This screen suggests a drawing according to the shapes collected by the student. The student needs to drag the particular shape and drop on the canvas to draw the image.

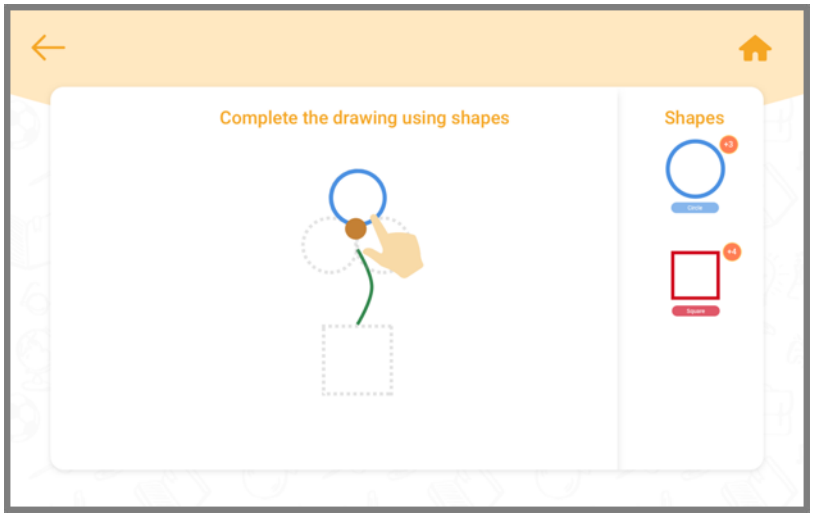

Figure.19 Drawing completion screen

Appreciation screen

Once done, the student is shown with the final colored drawing and also gets appreciated by the system.

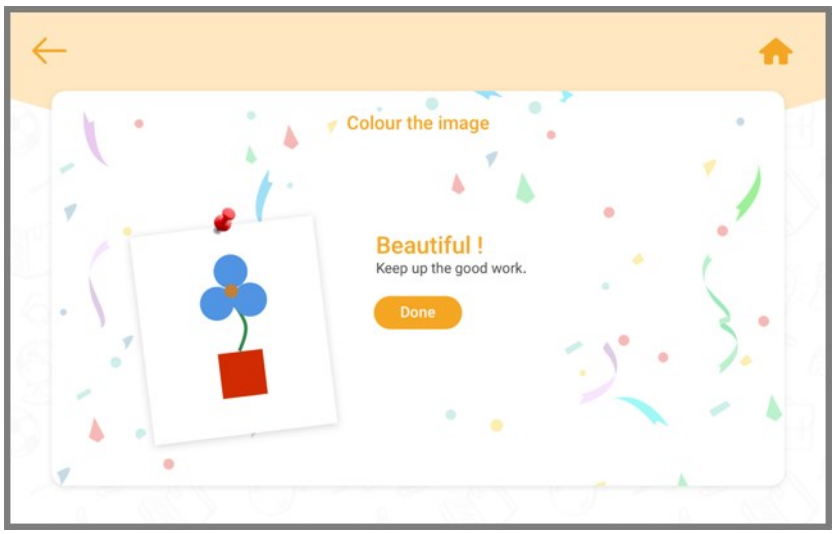

Figure.20 Appreciation screen

8. Conclusion

All the concepts propose a different set of learnings to the students. The concepts are designed for practice sessions where the activities are taught by the teacher. Students can use these 3 concepts to practice taught activities to strengthen their learning. The first concept, Word filter mimics the mental map of students who are encouraged to learn more when rewarded and find it engaging to interact with the camera. It helps students learn with the help of practice-based learning. The second concept, learn antonyms has a

playful and interactive approach to teach antonyms with the help of touch-based gestures. The Third concept, play with shapes helps students identify shapes from the surroundings and create new drawings which replicate the behavior of making and collecting stickers found during the user study. It also acts as a reward for the completion of an activity.
In future, we look up to creating more content for all the 3 activities and further test it among the students to get the feedback and iterate the concepts to make it more effective and engaging.

Acknowledgement

I would like to thank Ms. Mridula Goswami Sarma (Principal, Akshara School) and Dr. Shashi Saraf for giving me permission to visit and perform user study at Akshara School, Guwahati and Montessori Government School, Jabalpur, respectively. I would also like to thank the faculty member, Department of Design for their highly stimulating inputs at each stage of progress of this project.
I would also like to thank all the participant, professors and students for their incredible co-operation and my friends for helping me in several circumstances.

References

Zaranis, N., Kalogiannakis, M., & Papadakis, S. (2013). Using mobile devices for teaching realistic mathematics in kindergarten education. Creative Education, 4(7), 1-10.

Flores, P. Q., Flores, A., & Ramos, A. (2017). The smartphone in the context of the classroom in the primary school and in the higher education.

Technology, C. (2018). Understanding factors affecting primary school teachers ' use of ICT for student-centered education in Mongolia Shengru Li , Shinobu Yamaguchi and Jun-ichi Takada Tokyo Institute of Technology, 14(1), 103–117.

Tong, Y., & Tong, Y. (n.d.). Mobile Learning in India SCOPE, IMPACT AND IMPLICATIONS. Retrieved from https://www.academia.edu/29350695/Mobile_Learning_in_India_SCOPE_IMPACT_AND_IMPLICATIONS

Mang, C., Brown, N., & Piper, L. (2017). " Old school " meets " new school " : Using books and tablets to improve information literacy and promote integrative learning among business students.

International Journal of Management Education, 15(3), 449–455. https://doi.org/10.1016/j.ijme.2017.07.003

Pruet, P., Ang, C. S., & Farzin, D. (2016). Computers in Human Behavior Understanding tablet computer usage among primary school students in underdeveloped areas : Students ' technology experience , learning styles and attitudes. Computers in Human Behavior, 55, 1131–1144. https://doi.org/10.1016/j.chb.2014.09.063