ISSN: 0974-8571 Vol.13 No. 2 December, 2021

*International Journal of Computational Intelligence in Control*

# Digitalised Mobile Communication Technologies in Math Education: How to enhance Students' Mathematical Communication Skills in Elementary School using Interactive Technologies

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***Date of Submission: 16th June 2021 Revised: 28th August 2021 Accepted: 22nd September 2021***

***How to Cite:*** **Chairil Faif Pasani and Euis Eti Rohaeti. (2021). Digitalised Mobile Communication Technologies in Math Education: How to enhance Students' Mathematical Communication Skills in Elementary School using Interactive Technologies, International Journal of Computational Intelligence in Control 13(2), pp. 107-112**

*Abstract* - **Though mathematics is taught and examined as one of the compulsory subjects in the elementary schools across Indonesia, it is continuously being taught in a traditional manner. Which involves rote learning, day to day working out assignments and emphasizing student memorization which appear boring and tiring to students of the 21st century. The present study examines the use of technology in selected elementary school math classrooms in Banjarmasin in Indonesia, in an effort to discover 'how interactive technologies can help to enhance student's mathematics communication skills. Students Learning achievement and mastery of mathematical communication skills can be attained through better learning methods. In this research, data collection was conducted using a questionnaire to collect the data from 30 fourth (4th) grade students from two State elementary schools both found in Banjarmasin. The findings indicate that the elementary school teachers highly believe that interactive technologies are important in the enhancement of elementary school students mathematical communication skills. Further, the respondents reported a higher frequency of conceptual communication and comprehension after the interactive lessons were conducted. The findings revealed positive significance regarding the contribution of technologies in learning math among students, especially when the selected technologies were practically tried. Lastly, it has been established that learning math using interactive technologies is more effective than the use of conventional learning methods and it leads better grade achievement and improved conceptual comprehension and mathematical communication skills of the students.**

*Index Terms* - conceptual communication and comprehension, Interactive learning, interactive technologies, mathematics learning.

## INTRODUCTION

Moving away from the traditional approaches of teaching and learning mathematics is an important aspect in the elementary school curriculum of today's rapidly changing world. The expeditious evolution of technology demands teachers to empower their students to be responsible users of technology [1]-[3] in all aspects of life. Time has come which requires the future generation to forego the rudimentally ways of acquiring knowledge, such as the process of ceaseless rote classroom exercises, constant practicing and memorization [1], [4], [5]. The twenty-first century teaching requires the provision of appropriate classroom resources for students and teachers, comprised of internet, video, print, media and television, among others.

Learning mathematics through interactive technologies can enhance student's communication skills right from the elementary school to a higher level of education. This means that technology can develop individual logical thinking and in turn, improve one's communication skills, if only teachers and students use the said technology tools to strengthen students coping and learning new mathematical concepts and skills, not only technology, as the end point of the instruction [6]-[11].

This study is in line with [12], [13] and [14] who are of the view that learning experiences attained through technologies promote the development of problem-solving skills, reasoning skills, and comprehension of mathematical concepts, which enhance a better understanding of concepts by students. With many researches coming up on the use of technology to teach mathematics, concepts can be explained thoroughly through more attractive and interactive technologies. In an example by Picha [15] on edutopia website she illustrates interactive use of technology by students in learning mathematics. A collaborative learning with the aid of technology that promotes problem solving, flexible thinking, and hence, improved communication skills of students [16], [17]

Wang [18] in one of his writings as a guest blogger mentions five math technology tools which help to facilitate students collaboration, hence enhancing their math communication skills, such tools are: sum dog- which is a digital learning tool that focuses on the use of interactive mathematical activities to enhance learning; Google classroom- this helps in classroom management and promotes students collaboration; Haiku deck- with this tool, students are encouraged to choose fonts and layouts from the existing templates and images in order to help them develop designs of their own choice; Plickers- this technology tool is used to obtain formative assessment of students, irrespective of whether they have their own gadgets or not; and Popplet- is an online resource to capture and organize ideas [18]. This means that there are many forms of interactive technologies which can be used shape math communication skills of elementary school students. The present paper examines and seeks to explain why interactive technologies are important in enhancing elementary school students' math communication skills.

## LITERATURE REVIEW

Interactive technology has become a fundamental component in human development; it has therefore become a basic necessity for schools of this modern time. It must, therefore, be adopted at all levels of education, including in the teaching of math at primary. According to Scharaldi [19] with technology, there are varying opportunities for instruction in math's classrooms. For instance, the possibility of mobile communication as the most common interactive technology device leads to fast and quick interaction and communication of individuals, hence making it become an easily accessed reliable form of technology. This makes it more appropriate in supporting learning within schools, including elementary schools. Because of its easy accessibility, a mobile phone as a portable device can easily facilitate students' engagement and collaboration at a low cost more so if they are good using telecommunication company promotions. It encourages and promotes communication within students and also with their teachers within a shorter period of time.

With the existing move and willingness by many world governments to make public information open and easily accessible, has led to many mobile making companies and the telecommunication industry to provide and promote easy communication and contacts among individuals through widespread mobile facilities for people worldwide [20]. Indonesians and other races internationally, are moving away from the use of fixed lines due to the present widespread production of cheap and easily accessible mobile phones which make communication and collaboration fast and easy. People can now more easily connect with one another via apps such as google duo, WhatsApp, Facebook among others.

Indonesia is one of the countries in Southeast Asia, where the number of mobile users has surpassed fixed-line subscribers [21]. Well as the previous phone generations were designed and built with only the voice service, currently, they have been improved and filled with new designs with varying capacities, which make interaction and connectedness easy. For instance, with the present-day generation of mobile phones, there are features which keep on updating apps, like: WhatsApp, Imo Beta, Line, Skype, face book, google duo, email, Short Message Service (SMS), Multimedia Messaging Service (MMS). With the present-day new apps, there are more people becoming familiar and addicted to these new upcoming mobile phone technology features, thus pulling people from the varying levels of society, including elementary school educators and students within Indonesia and Banjarmasin in specific. It, therefore, becomes reasonable to introduce interactive technologies to learners from elementary schools.

Most teachers and students engaged in learning and teaching consider mobile phones to be a necessary part of keeping learning going and interactive. It allows them to keep in touch with one another at virtually all times. Teachers can talk to their students while students can collaborate with others encouraging better and understanding and communication of concepts obtained during class hours at all time. They can interact with one another while outside class whether shopping or at home etc. However, concerned researchers such as Chesley [22] and Fischer [23] are left wondering and asking whether with technology, our social

cohesions and values of society are safe.

Though there researchers with the social cohesion and values of society, in regard to the use of new interactive technologies in learning, other researchers such as Boase et al [24] and Haythornthwaite [25] have established that most social networks as the one of the tools of new interactive technologies, are designed by people from communities and with families, so in most cases, their innovations support social relationships and at the same time advance positive interactions and communications leading to the support in developing good collaboration and engagement skills of people who at times may not even know another before, hence good for mathematics learning of the students since they can easily exchange required and necessary information from one another.

Interactive technologies have turned out to be effective promoters of better cooperation and collaborations and effective channels for communication at a broader scale by the varying individuals of society [26]-[28]. This has led to more and further studies regarding best practices and functions of technology in a pluralistic society, including its use in math classrooms across the globe. In a study conducted by Jin [29] it was established that phone interactions and communication have almost a similar impact just like direct interactions between people. For instance, it was discovered that loneliness can also occur in a situation one's phone goes without any contact for a day. It therefore, implies that through mobile there can be more serious interaction within students and between teachers and students and also with teachers themselves. This is in a way of connecting with family, teachers and friends (peers from class). It can thus be argued out that through interactive technologies help students strengthen their mathematical communication skills because the strengthen bonds between students and teachers, facilitate friendships, and build mutual support and cooperation among the learners.

Studies have also revealed that communication through a number of media and channels, including mobile phones, via emails and also other such ways may lead to better ties and relationships more those people involved in direct communication [25]. In another study [30] it was found that technologies encourage better relationships and also can facilitate students learning.

Relatively, the above studies did not fully examine the importance of mobile phone communication in learning mathematics but looked at the aspect of how people communicate and interact [31]. The results of the study on mobile communication among students could be different from those of the peers outside the school system. Thus, the present study investigated how interactive technologies, especially mobile phone communication supports the enhancement mathematical communication skills through addressing and answering the questions related to this study. To find out the importance of mobile phone communication in math learning. The researchers, therefore, wanted to investigate how interactive technologies enhance communication among students at elementary schools.

The present study will illuminate on the importance of interactive technologies, especially mobile phone communication in math instruction and thus the teachers who had been reluctant to use phones to communicate with their students will be inspired to adopt this new technology leading to improvement in their comprehension and understanding of the mathematics concepts via collaboration and engagement through interactive technologies. It will also add on the existing literature on interactive technology studies which could be used as a form of reference for future studies.

This study is guided by the Attachment theory. It is a theory propounded in the 80's regarding relationships and connectedness between individuals. In education, this theory works to promote cooperation and collaboration within students and also between students and their teachers. It simply, argues for stronger ties and cooperation of individuals more so in the teaching of math to the young generation. Therefore, for the case of students, each learner is an attachment figure of the other and this can be noticed in the way they relate and communicate with one another during classes and after class hours.

Learning engagement and collaboration among students or learners influences their performance. In other words, existing relationship will either positively or negative affect individual performance. In previous studies [32] & [33], it was found that an individual with better roots and attachment has a better and positive standing in society with a higher level of trust from other members of the surrounding, including the school community. Attachment influence is very strong, because it penetrates each and everything, even influences performance of the students within the schools.

According to Katz and Aakhus [28] are of the view that each group of people will always their strength to develop more superior ways of interaction, something that influences people's communication. This in turn also affects the communication channel and tools, because those favored are the owners of the provided channels and medium for such communication. Licoppe [34] provides a clear example of the mobile phone, which has been designed in the way that it fulfills the mission of the designer. Integrating technology learning provide creates an atmosphere that that leads to testing of problems solving skills, critical thinking skills, and argumentation skills [35], hence promoting better communication skills among students.

## RESEARCH METHOD

In the present study, a survey was conducted using a questionnaire to collect the data. The respondents were students or staff in two government schools in Banjarmasin. The thirty questionnaires were distributed, and all returned for data analysis. Data was analyzed using SPSS Windows Version 17 for both descriptive and inferential statistics. All the participants possessed a mobile phone. The sample size was 30 respondents.

A demographic profile of the survey is categorized by gender, age group, nationality, period in school, physical distance of the school and period of using mobile phone in learning. The male respondents were 50 per cent, likewise the females (50%). The age-group of 9 years old reported the highest percentage of 53.3, followed by (11 years and above) with 40 per cent and 12-13 years with 6.7 per cent. In terms of period of study, the students with 9 years dominated the sample with 40 per cent, followed by (more than 10 years) with 33.3 per cent. Collaborating learners accounted for 60 per cent, while those using interactive technologies recorded 40 per cent.

### Measures

Instruction mobile communication was measured through 16-items and respondents were asked to indicate the level of agreement to the statements by using Likert's 4-point scale, which includes: 1= strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree.

As the research, I also measured the importance of mobile phone communication in teaching math's through three questions. One of them, ,Is mobile phone communication important to your learning?' The respondents had to indicate the level of importance ranging from 'extremely important to not at all important'. The second question was, ,do you think it is important for each student to have a mobile phone to communicate with one another?

In order to find answers for the patterns phone communication within the learners and with peers, I asked respondents to indicate the frequency of sending message, calling classroom group member in a day. The researcher also asked the participants to answer the frequency of their peers calling them and receiving messages. They also had to indicate the kind of messages they normally send and receive from their collaborating students or friends. Still under the same section, the questionnaire required participants to mention who often initiates the first mobile phone communication, either yourself or your collaborating friend. For the researcher, to tap the respondents' response on the reasons for mobile phone communication in math teaching, an open-ended question was asked last in the questionnaire and the respondents were free to answer/state the reasons they deemed fit. The respondents had to state any five common reasons for communicating with other students on mobile phone.

## FINDINGS AND DISCUSSION

### Digitalized Mobile communication Technology

The researcher analyzed the data using the 2-independent samples MannWhitney U (non-parametric) and found significant differences between the students with regard to the way mobile phone communication supports their learning of math concepts. The female had a higher mean rank of 19.83, the male had a mean rank of 11.17, and the p-value of 0.007 was significant. The Z-test was 2.708.

When the researcher analyzed through Cross tabulation, the female agreed to most of the items measuring mathematics mobile phone communication unlike the male who strongly disagreed on some items. On an item whether one cannot do without a mobile phone, 46 per cent females strongly agreed that they cannot do without a mobile phone while 20 per cent males strongly agreed. On the other hand, 60 per cent of males 'agreed' that they cannot do without a mobile phone while 46.7 per cent females agreed.

### Importance of digitalized mobile phone communication in learning mathematics

The Mann-Whitney test indicated that the male had a higher mean rank of 18.47, the females had 12.53. Therefore, the males highly believed that mobile phone communication was important to their learning, in a way of strengthening the collaboration. The p-value of 0.059 was not significant, so there were no significant differences between male and female students with regard to their communication in class. The Z-test of 1.891 was also

not significant.

### Frequency and use of mobile phone

Still, the Cross-Tabulation results showed that male students had 60 per cent frequency of communication via messages compared to the female students. The female students reported 53.3 per cent in regard to the use of digital gadgets in communication for learning interactions in a day. However, the p-value of 0.409 was not significant. With regard to receiving messages, the females reported 46.7 per cent within 3-4 times a day. The males had 40 per cent within 3-4 times in a day.

On the number of times the students call each other, the males accounted for 73.3 per cent in 1-2 times a day while the females had 66.7 per cent in 12 times a day. On the frequency of receiving calls from fell students, the females reported 66.7 per cent and the males had 53.3 per cent in 1-2 times a day.

### Reasons for mobile phone communication in instruction

The respondents' reasons for communicating with others using mobile phone could be summed as; keeping up with updates, sharing feelings and emotions, strengthening relationship, knowing about the new concepts and math formulas, keeping closer, sharing each other's problems and difficulties e.g., about studies, it is the easiest way to communicate (you can get immediate feedback). This could be explained by the synchronous nature of mobile phone where you can get feedback immediately through calling and messaging unless some one's phone is off.

Most respondents mentioned that they keep close to one another, know what is happening, and get updates through mobile phone especially for students in the same group doing the same assignment.

The above findings are partly in line with [37], who found that mobile communication promotes feelings of closeness between partners leading them to achieve desired outcomes such as commitment to one another and enhanced understanding, hence better communication skills.

Some respondents did not bother to answer the open-ended question on the reasons for mobile phone communication in math learning. However, the researcher had given them ample time to complete the questionnaire but even when the researcher cross-checked on receiving the filled questionnaire and found that the last questionnaire was not answered, some declined to answer it. The diverse opinions regarding this question could have helped the researcher to uncover the prudent issues on why interactive technologies, such as mobile phones enhance communication skills of the learners.

Another limitation is on the small sample size of 30 respondents. It is hard to generalize the findings of this study on such a small sample. A clear conclusion cannot be drawn, and thus future research can replicate the same study by using a more representative sample. However, we cannot rule out the importance of this study on adding to the available literature on interactive technology usage in the teaching of mathematics for better communication skills.

## CONCLUSION

The results have significance in showing the need for continued communication in learning especially by using the fastest and easiest means of technologies. The research questions for this study are answered through finding out the ways which enhance students' mathematical communication skills. The results indicate that the students cannot do without mobile phone communication especially in this Information society where we need updates from others, friends, and the situation at large. By and large, the results of the study illuminate on most common reasons for communicating with other students and teachers. The outstanding reason is on maintaining a strong cooperation and collaboration through keeping in touch, sharing updates, emotions, feelings, knowing about new concepts and ensuring that learning takes place through the use of technologies.

## ACKNOWLEDGEMENT

We take this opportune moment to thank colleagues who have all positively encouraged us in writing this manuscript and processing it until publication. We also thank support of our institutions which have continuously promoted academic publishing.

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