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MATHEMATICS DISPOSITION AND TEACHERS' READINESS TO ADOPT INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) FOR MATHEMATICS INSTRUCTION IN CROSS RIVER STATE

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Abstract

The study examined mathematics and teachers' readiness to adopt ICT for mathematics instruction in Cross River State, Nigeria. To guide this study, two research questions and two null hypotheses were formulated. The research design employed in the study was survey design. The population of the study consisted of 6,800 mathematics teachers in public secondary schools in Cross River State. The sample of the study comprised 444 mathematics teachers selected using simple random sampling technique across the three Senatorial Districts of Cross River State, Nigeria. From the administered questionnaire, data were analyzed using Pearson's Product Moment Correlation coefficient. The findings of the study revealed that mathematics disposition and pedagogical innovation are significantly related to teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria. It was recommended that the teachers should have positive mathematical disposition and equip themselves with social skill, communication skill, and professional performance in order to motivate students and grow their positive disposition toward mathematics learning and teachers should go for further studies to be well acquainted with modern teaching techniques which ICT is an integral part to improve their teaching experiences

Keywords: Mathematics Disposition, Teachers, Readiness, Information and Communication Technology, Classroom & Instruction

Introduction

Mathematics education has a very important role in the successful development of the quality of education in Nigeria because mathematics can construct a logical and systematic mindset that enhances the ability to face various problems. A person must have a good mathematical literacy in order to interpret the data, solve daily problems, provide an explanation in numerical, graphical and geometric as well as communicate using mathematics (Ojose, 2011). The purpose of learning mathematics is to develop the ability to explore, develop conjecture, arrange reason logically, resolve non-routine, communicate mathematically and use mathematics as a tool of communication. It also enables one to connect between mathematical ideas and between mathematics and nature other intellectual.

Mathematics as a subject area is generally thought of as difficult and complicated. As a result, it is culturally acceptable for a student or a teacher to refer to themselves as ―not a math person‖, while in contrast, it is not acceptable to be ―not a reading person‖ (Epstein & Miller, 2011). This general acceptance of not being good at math stems from an underlying phobia or negative disposition that some students, and teachers have toward mathematics.

Disposition is a tendency to behave consciously, frequently, and voluntary to achieve certain goals. These behaviors include self-confident, persistent, curious and flexible thinking. In the context of mathematics, the mathematical disposition with regarding to how students complete a math problem: whether confident, diligent, interested, and flexible thinking to explore various alternative resolution. In the context of learning, mathematical dispositions related to how students ask, answer questions, communicate mathematical ideas, work in groups, and solving problems (Kent, & Noss, 2002). Mathematical disposition is a tendency to think and act positively. This trend reflected the students' interest and confidence in learning mathematics and a willingness to reflect on their own thinking (Anku, 1996).

A broad definition of the mathematics disposition is ―a tendency to think and act in positive way‖ which reflects in students‘ willingness to ―persevere‖ when they are performing mathematical computations and problem solving (National Council of Teachers of Mathematics, 1989:233; cited in Anku, 1996). Beyers (2011) describes the term ―disposition towards mathematics‖ or ―Mathematical disposition‖ as including three mental models, ―cognitive, affective, and conative‖ which are directly related to students‘ or teachers‘ beliefs about the nature of mathematics, the level of difficulty in mathematics, and their attitudes towards mathematics. Consequently, a person‘s disposition towards mathematics, affects his/her willingness to ―engage in a mathematical context (e.g., doing and/or learning mathematics)‖. Disposition according to Perkins, Jay, and Tishman (1993: 4), consists of a triad of interacting elements, these being: inclination, which is how a learner feels towards a task; sensitivity towards an occasion or the learner‘s alertness towards a task; and lastly ability, this being the learner's ability to follow through and complete an actual task. Mathematical disposition is therefore a broad concept that could bare several interpretations and might include several psychological attributes that could be measured individually or as a whole such as attitudes, self- concept, motivation and anxiety

Mathematics disposition is related greatly to the success of learning mathematics. Students need to confront the problem of mathematics disposition, foster responsibility in learning, and develop good work habits in mathematics. This is very important characteristics of the students. Students will not necessarily use all the material they have learned, but it is certain that they require a positive disposition to deal with a variety of mathematical problems in their lives. By directing students to qualify disposition of mathematics, the mathematics can instill motivation, appreciation, contributions, interests, beliefs, confidence, and perseverance. Such things have been lost in the implementation of mathematics learning in the classroom.

Mathematical disposition is the desire, consciousness, and a strong dedication on students to learn mathematics and implement a variety of mathematical activity (Sansome, 2016). A common assumption in mathematics learning is reliant on the cognitive domain where

achievement and success in mathematics depends on skills and knowledge attainment. In alignment with social-constructivist learning theory, learning and achievement in mathematics rely on a combination of both affective and cognitive domains where the affective domain explores the development of one‘s mathematical disposition according to attitude and achievement (Palincsar, 2005). Mathematical disposition is a productive attitude or positive attitudes and habits to see mathematics as something logical, useful, and worthwhile. Student disposition toward mathematics is a major factor in determining reviews their educational success (Kilpatrick, Swafford & Findell, 2001). The disposition of mathematical includes a willingness to take risks and explore solutions of problems as diverse, persistence to solve challenging problems, take responsibility for reflection on the work, appreciating the power of communication of mathematical language, willingness to ask and propose other mathematical ideas, a willingness to try different ways to explore mathematical concepts, has the confidence of his ability, and look at problems as challenges.

Teachers and Students' mathematical disposition is said to be good if the teachers or student likes challenge and involves themselves directly in solving problems. In solving these problems, students feel the emergence of confidence, hope, and awareness to look back at the results of their thinking (Siregar & Lisma, 2019; Kusmaryono Suyitno,, Dwijanto, & Dwidayati, 2019). The importance of disposition in mathematics learning is to form a conscious, regular, and voluntary tendency to behave in a certain way that leads to achieving of specific goals for mathematics learners. In the context of mathematics, a mathematical disposition is related to how mathematics students and teachers view and solve problems; Is it done with confidence, curiosity by looking for alternative solutions, persevering, and being challenged, and the tendency of students to reflect on their way of thinking (Feldhaus, 2014).

On the other hand, the concept of mathematics disposition cannot be devoid of the new innovation in pedagogy**.** Pedagogical innovations are therefore of importance to determine further interventions for learning refinement and future research directions and enhancing instructional strategies in our schools. It depends on the context and purpose of the term being used in studies. For instance, Law, Chow and Yuen (2005) characterize the innovations based on technology-supported significant changes in learning practices that lead to positive student outcomes and are sustainable and transferable. In the higher education context, pedagogical innovations were simply characterised by an intentional action that aims to improve students learning in a sustainable manner (Walder, 2014). It seems that practical improvement is the keyword for every single innovation.

Pedagogical innovations with reference to this work involves actions of developing new learning resources as interventions for improving educational practices. Pedagogical innovations are of importance to determine further interventions for learning refinement and future research directions. It therefore involves identifying research gaps, or simply discussing a particular matter with aim of improving teachers‘ pedagogy (Snyder, 2019). Thus, there is a need to look into account of past literatures before running this study. Particularly in design research, it is pivotal to have an extensive literature review as preliminary research to gain evidence-based theoretical inputs leading to a better understanding of the problem, context, and relevant topics (McKenney & Reeves, 2018; Plomp, 2013). By doing so, it helps to make the design of the following interventions more.

Educational innovations mathematics learning in Nigeria have not been clearly described in a systematic way leading to the lack of future learning and research directions. Several recent literature reviews concerning mathematics learning merely conceptually discuss particular issues such as project-based learning with realistic mathematics education (Handayani, Mariani & Asikin, 2019), mathematics concept based on traditional arts (Wulandari & Mariana, 2018), and mathematical modeling (Hartono & Karnasih, 2017). Although these simple literature reviews are indeed interesting, those have few contributions to solve contextual learning problems and direct specific research agendas.

In school system, pedagogical innovations were simply characterised by an intentional action that aims to improve students learning in a sustainable manner (Walder, 2014). It seems that practical improvement is the keyword for every single innovation. Pedagogical innovations in this study focus on learning resources through the introduction of ICT development as interventions for refining mathematics education practices. The present study therefore describes innovations of teaching and learning in mathematics, identifies underlying problems, and outlines models used in the previous studies in order to provide rooms for learning improvement and propose forthcoming research agendas. Law et al. (2005) characterizes the innovations based on ICT-supported significant changes in learning practices that lead to positive student outcomes and are sustainable and transferable.

Integrating ICT for mathematics classroom instruction.

Information and Communication Technology (ICT) integration in mathematics education as a form of innovation provides mathematics teachers with innovative teaching methods which motivate students learning, support their independent learning and active participation in the discovery of mathematics concepts and topics. As a result, helps the students to have deeper understanding of the mathematical ideas. The integration of ICT in the teaching and learning of mathematics helps students have better achievement in mathematics. These potentialities of the ICT make its integration in the mathematics classroom a promising practice, but the success of this practice is dependent on various factors, among which are the following: teachers' perceptions of their ability in ICT, teachers' attitudes towards ICT contribution to the mathematics teaching, teachers' attitudes towards ICT contribution to students' mathematics learning, teachers' emotions towards the use of ICT in the mathematics classroom, teachers' feelings of self-esteem and control in the presence of ICT in the mathematics classroom, and teachers' intentions to actually integrate ICT in their teaching (Numer &Wajeeh, 2018). This study therefore examined mathematics disposition pedagogical innovation and teachers‘ readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria

Mathematics theoretically provides a simple restoration of logical reasoning and knowledge. It makes it as a specific subject compared to others and shows an easy way to learn other things. Development is a continuous process, which is continuously underway. Providing and acquiring an education is one of the characteristics that set human beings apart from other living things. For advanced knowledge, people are continually improving their teaching-learning tools and strategies. Information Communication Technology (ICT) is an engine of innovation in education, and we can see in the 21st century, the psychological, socio-economic, and technological changes it brings to school. It has changed the role of information professionals and is becoming popular in the library (Das, 2019).

In Nigeria the prospect of ICT is a promising practice in the mathematics classroom, but the success of this exercise is mainly dependent on several issues, teachers‘ perceptions of ICT skills, teachers‘ attitudes toward ICT contribution to mathematics teaching, and teachers‘ attitudes toward ICT contribution to students‘ mathematics learning. Teacher Passion of ICT in the classroom mathematics, mathematics teacher in the presence of ICT in the classroom self- esteem and sense of control, and teachers aim to mobilize ICT in their education (Igwebuike, Kujoh & Ayuk 2021)). These possibilities of ICT integrate a proposed practice into the mathematics classroom. Although the above description of the factors affecting ICT convergence at the school is involved, this exercise will result only if certain conditions exist met. ICT in the classroom, especially in the incorporation of a positive outcome will depend on the following factors: teachers _attitudes to the contribution of ICT for teaching mathematics, mathematics education of students and teachers attitudes towards the role of ICT, arithmetic teachers to use ICT in the classroom sense, that presence of ICT in the classroom mathematics teachers‘ self-esteem and classroom administration ability to integrate ICT in education for teachers and attractions. While pre-service teachers solve math problems, they focus on the

social and socio- mathematical norms that are installed during the interactions of pre-service teachers (Tatsis, 2008)

For example, Buabeng-Andoh (2012) pointed at factors related to technological tools, the system, and teachers' preparation programs as influencing the integration of ICT in the classrooms. Factors related to the school could be: the available technical support for the teacher; the quantity, quality and type of available guidance, the organization of equipment in the school, where this organization would better ensure maximum access for all users, and school resistance for change, such as necessary organizational change enabling successful ICT use in the school. Factors related to the teacher could be: teacher's self-confidence regarding the use of technology, personal access level of the teacher for the ICT tools, availability of teacher's time to get to know closely and deeply the hardware and software needed to use ICT in the classroom as well as the availability of teacher's time to prepare learning materials suitable for the use of ICT in teaching. Another issue related to the teacher regarding ICT use in the classroom is associated with the resistance to change resulting from the non-willingness of teachers to change their teaching methods, and as a result their integration of ICT in the classroom is prevented or slowed.

Das (2019), carried out a study on Role of ICT for Better Mathematics Teaching. The objective of this study is to explore the role of the application of ICT tools in Mathematics teaching. Information and Communication technologies (ICT) are an integral part of daily life, including the teaching-learning process. Mathematics is considered the queen of all sciences. For a long time, the role of mathematics was reduced to the purely academic domain. But at present, the role of mathematics is not limited to the purely academic domain. It has entered the field of technology and industry. This paper highlighted the importance of the integration of knowledge and communication technologies (ICT) into the teaching and learning of mathematics in Teacher-Training College and School level. The methodology of the research is a different type involving an interpretative, conversation, observation and study secondary sources, like books, articles, journals, thesis, university news, expert opinion, and websites, etc. Finally, meaningful suggestions are given.

Information and Communications Technology (ICT) is considered a powerful tool for educational change and reform. Several previous studies have shown that the appropriate use of ICT can raise educational quality and connect learning to real-life situations (Van Weert & Tatnall, 2005). ICT assists in transforming a teaching environment into a learner-centered one (Sanchez & Education, 2011), learners are actively involved in the learning processes in ICT classrooms, and they are authorized by the teacher to make decisions, plans, and so forth (Lu & Hou., 2010). In mathematics education, ICT also provides teachers with foundational tools and means to help teachers change teaching methods, support students in independent learning, and actively participate in the discovery of concepts and mathematics topics. As a result, students gain a deeper understanding of mathematical ideas. Therefore, it can be understood that the integration of ICT in mathematics education is the result of the ability to apply ICT to help students achieve better in mathematics. These potentials of ICT make classroom integration a promising practice, but its success depends on various factors. Research on the use of ICT in mathematics education is also one of the ways to increase the effectiveness and feasibility of the applications of ICT in mathematics education.

Statement of the problem

The quality of human resources is a crucial aspect in the effort of educational development in Nigeria. The recent reform in Nigerian school system have presented another arrangement of techniques and measures that challenge the old contemporary method of teaching mathematics and require the infusion of a more advanced strategies using ICT. Nonetheless, teachers' disposition in mathematics and their interests in information technology (pedagogical innovation) has not yielded the require results. Despite how computer application is important in the present-

day learning, there is still some lacunas that needs to be filled that is the challenge of teachers' inefficiencies with respect to utilization of the available ICT facilities and in most cases the facilities are insufficient or not available at all. Nonetheless, based on the aforementioned challenges the researcher was poised to evaluate the relationship between mathematics disposition with pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria.

Objectives of the study

The objective of this study was to explain the relationship between mathematics disposition pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria. Specifically, the study sought to:

1. Determine the relationship between mathematics disposition and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria
2. Evaluate the relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria

Research questions

1. To what extent does mathematics disposition relate with teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria?
2. What is the relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria?

Hypotheses

1. There is no significant relationship between mathematics disposition and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria
2. There is no significant relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria

Methodology

This study made use of survey research design. This was to ensure that the sample has the characteristic of representing the entire population of the study. From the 6,800 mathematics teachers in the research area, simple random sampling was used to select 444 respondents used for the study. The data collected were analyzed with Pearson Product moment Correlation Coefficient (PPMCC) at 0.05 significance level and 442 degree of freedom.

Results

Hypotheses One: There is no significant relationship between mathematics disposition and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.** The result of the analysis is shown in Table 1.

Table 1

Pearson Product Moment Correlation (PPMC) of relationship between mathematics disposition and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria

Variables	$\overline{x}$	SD	r-ratio	Df	p-level
Mathematics disposition (X)	15.09	3.13			
			.369**	442	.000
Teachers' readiness to adopt ICT for mathematics classroom instruction (Y).	28.73	5.93			

*Significant at .05 level; p<.05.

To analyse the data in Table 1 Pearson's Product Moment Correlation Coefficient Analysis was used. The finding showed that mathematics disposition had a mean score of 15.09 with a standard deviation of 3.13 while teachers' readiness to adopt ICT for mathematics classroom instruction had a mean score of 28.73 with standard deviation of 5.93. The result further showed that the r- calculated value of 0.369 is greater than critical-r value of 0.062, tested at .05 level of significance and 442 degrees of freedom. Also, the p<.000 is less than p<.05. Hence, null hypothesis which stated that there is no significant relationship between mathematics disposition and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.** was rejected indicating that There is indeed a significant relationship between mathematics disposition and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.**

Hypothesis two: There is no significant relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria. The result of the analysis is shown in Table 2.

Table 2

Pearson Product Moment Correlation (PPMC) of relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria

Variables	$\overline{x}$	SD	r-ratio	Df	p-level
Pedagogical innovation (X)	15.12	2.73			
			.383**	442	.000
Teachers' readiness to adopt ICT for mathematics classroom instruction (Y)	28.73	5.93			

*Significant at .05 level; p<.05.

To analyse the data in Table 1 Pearson's Product Moment Correlation Coefficient Analysis was used and the finding showed that pedagogical innovation had a mean score of 15.12 with a standard deviation of 2.73 while teachers' readiness to adopt ICT for mathematics classroom instruction had a mean score of 28.73 with standard deviation of 5.93. The result further showed that the r- calculated value of 0.383 is greater that critical-r of 0.062, tested at .05 level of significance and 442 degree of freedom. Also the p<.000 is less than p<.05. Therefore, the null hypothesis which expressed that there is no significant relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.** was rejected indicating that There is indeed a significant relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.**

Discussion of findings

Data in Table 1 determined whether mathematics disposition relate to teachers' readiness to adopt ICT for mathematics classroom instruction. The first hypothesis result showed that indeed There is indeed a significant relationship between mathematics disposition and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.** This conclusion is in line with the work of Kilpatrick, Swafford & Findell,*(*2001), stating that Mathematical disposition is a productive attitude or positive attitudes and habits to see mathematics as something logical, useful, and worthwhile. Student disposition toward mathematics is a major factor in determining reviews their educational success. Mathematics disposition therefore has to do with the willingness to take risks and explore solutions of problems as diverse, persistence to solve challenging problems, take responsibility for reflection on the work, appreciating the power of communication of mathematical language, willingness to ask and propose other mathematical ideas, a willingness to try different ways to explore mathematical concepts, has the confidence of his ability, and look at problems as challenges.

Data in Table 2 determined whether pedagogical innovation relate to teachers' readiness to adopt ICT for mathematics classroom instruction The second hypothesis result indicated that there is indeed a significant relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria Pellegrino. This result is in line with the study carried out by Snyder (2019) who opined those pedagogical innovations involves actions of developing new learning resources as interventions for improving educational practices. Pedagogical innovation is therefore importance to determine further interventions for learning refinement and future research directions. It therefore involves identifying research gaps, or simply discussing a particular matter with aim of improving teachers' pedagogy.

Conclusion

In view of the findings of the study the researcher arrived at the conclusion that there is significant relationship between mathematics disposition, pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.** There is significant relationship between pedagogical innovation and teachers' readiness to adopt ICT for mathematics classroom instruction in Cross River State, Nigeria**.**

Recommendations

Based on the findings of the study, the following recommendations were given by the researcher

1. Teachers should have positive mathematical disposition and equip themselves with social skill, communication skill, and professional performance in order to motivate students and grow their positive disposition toward mathematics learning,
2. Teachers should go for further studies to be well acquainted with modern teaching technique which ICT is the integral part to improve their teaching experiences.

References

Anku, S. (1996). Fostering students' disposition towards mathematics: A case from a Canadian university. *Education*, *116*(4), 536.

Beyers, J. (2011). Development and Evaluation of an Instrument to Assess Prospective Teachers' Dispositions with Respect to Mathematics. *International Journal of Business &Social Science*, *2*(16), 20-32.

Buabeng-Andoh, C. (2012). Factors influencing teachers‘ adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 8 (1), 136-155

Das, K. (2019). Role of ICT for Better Mathematics Teaching. *International Journal of Education*, 7(4), 2582-1334

Epstein, D., Miller, R. T., & Center for American, P. (2011). Slow off the Mark: Elementary School Teachers and the Crisis in Science, Technology, Engineering, and Math Education.*Center For American Progress*,

Handayani, K., Mariani, S., & Asikin, M. (2019). Kajian Konseptual Pembelajaran Project dengan Pendekatan Realistik Berbantuan Media Youtube untuk Meningkatkan Kemampuan Komunikasi Matematis. *Prosiding Seminar Nasional Pendidikan Matematika Ahmad Dahlan*, *6*, 399–407.

Hartono, J. A., & Karnasih, I. (2017). Pentingnya Pemodelan Matematis dalam Pembelajaran Matematika. *Prosiding Seminar Nasional Matematika (SEMNASTIKA) 2017*, *1*, 1– 8.

Igwebuike, O., Kujoh, J. U & Ayuk, G.O *(2021).*E-learning facilities and implementation of educational technology curriculum in collages of education in Cross Riveer State, Nigeria. EVAIA*: International Journal of Ethics and Values*, 2 (1)

Kent, P., & Noss, R. (2002). *The mathematical components of engineering expertise: The relationship between doing and understanding mathematics*. Paper submitted to the Institution of Electrical Engineers Annual Symposium on Engineering Education, London

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding it up: Helping children learn mathematics* National Academies Press

Kusmaryono, I., Suyitno, H., Dwijanto, D., & Dwidayati, N. (2019). The effect of mathematical disposition on mathematical power formation: *Review of dispositional mental functions. International Journal of Instruction*, 12(1), 343-356.

Law, N., Chow, A., & Yuen, A. H. K. (2005). Methodological Approaches to Comparing Pedagogical Innovations Using Technology. *Education and Information Technologies, 10*(1–2), 7–20.

Lu, Z. & Hou, L., (2010). Research on a student-centred teaching model in an ICT-based English audio-video speaking class. *International Journal of Education and Development using ICT*, 6(3), 101–123. https://www.learntechlib.org/p/42381/ [Google Scholar]

McKenney, S., & Reeves, T. C. (2018). *Conducting Educational Design Research*. Routledge.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA:

Numer, B. & Wajeeh, D. (2018). Integrate ICT in the Classroom: The Case of Elementary and Middle School Arab Teachers in Israel.

Palincsar, A. S.(2005) Social Constructivist Perspectives on Teaching and Learning, *Studies in Educational Evaluation*, 38 (3), 107-120

Ojose, B. (2011). Numerical, graphical, and geometric, and communicate using mathematics. *Journal of Mathematics Education*, **4** (1), 89-100, (2011).

Perkins, D. N., Jay, E., & Tishman, S. (1993). Beyond Abilities: A Dispositional Theory of Thinking. *Merrill-Palmer Quarterly*, 39, 1-21

Plomp, T. (2013). Educational Design Research: An Introduction. In *Educational Design Research*. SLO.

Sanchez, J., & Education, E. A.-C. (2011). Teachers' opinion survey on the use of ICT tools to support attendance-based teaching. *Elsevier*, 56(3) , 911–915

Sansome, E. J. (2016). Building teachers' pedagogy practices in reasoning, to improve students' dispositions towards mathematics. *Theses.* Quesland Universty of Technology.

Siregar, M.A.P, & Lisman, E. (2019). The effect of disposition on student mathematics learning achievement in Medan State 28 junior high school. *Journal of Community Service and Reserch*, 3(1), 22-27

Snyder, H. (2019). Literature Review as a Research Methodology: An Overview and Guidelines. *Journal of Business Research*, *104*(2019), 333–339.

Tatsis, K & Koleza, E. (2008). Social and Socio- Mathematical Norms in Collaborative Problem- Solving.‖ *European Journal of Teacher Education*, 30(1) 89–100.

Van Weert, T. J., & Tatnall, A. (2005). *Information and communication technologies and real-life learning: New education for the knowledge society* (Vol. 182). Springer Science & Business Media. [Crossref], [Google Scholar]

Walder, A. M. (2014). The Concept of Pedagogical Innovation in Higher Education. *Education Journal*, *3*(3), 195–202. https://doi.org/10.11648/j.edu.20140303.22

Wulandari, A. T., & Mariana, N. (2018). Eksplorasi Konsep Matematika Sekolah Dasar pada Seni Tradisi di Desa Trowulan Mojokerto. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar*, *6*(7), 1–11