

# The Realities of Teaching Elementary Mathematics by Student Teachers: A Phenomenological Probe

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**Jo Ann M. Petancio & Amelia M. Bonotan**

Cebu Normal University, College of Teacher Education, Cebu City,  
Philippines

joannmpetancio@gmail.com; bonotana@cnu.edu.ph

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**Abstract** – *This study probed into the lived experiences of the student-teachers as they go through teaching Elementary Mathematics. Apart from Mathematics, these student-teachers who are generalists teach the other seven subjects. This phenomenological study was conducted during the first semester, school year 2017-2018 in Cebu Normal University-Integrated Laboratory School in Cebu City, Philippines. The researchers interviewed twelve student teachers and used Colaizzi’s method of data analysis. Results revealed that the essence of teaching Math from the lens of elementary student teachers is condensed in the following themes: a) Emotional mix-up; b) Challenging; c) Never stop learning and reach out for help; d) Success is a joint venture of teacher and student; e) Values count; f) We are work in progress. The researchers recommend that teacher education institutions may consider revisiting their policies and practices to strengthen the support lent by the supervisor, mentors and staff to the budding teachers; providing supplemental training and coaching towards improving the student teachers’ pedagogical content knowledge in Math; and providing the pre-service teachers with reflective strategies in processing one’s own experiences in teaching the subject. Moreover, since elementary student-teachers teach not only Math but the other subjects as well, the researchers also recommend that further researches may be conducted on topics related on how the teaching of the other subjects influence one’s way of teaching Mathematics.*

**Keywords** – *student teaching, Elementary Mathematics, phenomenology, Colaizzi’s method of data analysis*

## INTRODUCTION

Student teaching is considered to be the culmination of the students’ pre-service professional training. It is an initiation and practical training where the student-teachers apply the theories that they have learned [1]. It is viewed as a phase when student-teachers’ proficiency progresses faster and more intensively than any other moment thereby making it a predominantly stressful and challenging period in one’s professional development [2]. It is dubbed as the “keystone experience for the undergraduate, the most crucial phase of teaching preparation” [3].”

It is also a course that future teachers need to pass to be able to earn a Bachelor’s degree in Elementary or Secondary Education. Student-teachers in the elementary level, are groomed and honed to be “generalists” who have mastery in both content and pedagogy in teaching not just Mathematics but also the

other subject areas namely Filipino, English, Science, Values Education, HEKASI, HELE and MAPEH since they are expected to be able to teach all subjects in the elementary grades. Thus, they take turns in demonstrating how well they have mastered the content knowledge for eight subject areas, prepare daily lesson plans and instructional materials which they deem fit for the day’s lesson and anticipate the nuances which the teaching of a particular subject entail under the guidance of their teaching mentors.

Not all of these elementary student-teachers are inclined, motivated, well-equipped and confident enough to teach Mathematics. While quantitative researches abound on pre-service teachers and their Mathematics anxiety, competence and self-efficacy [4]-[10], there are very few qualitative researches about this area. Little is known about their concrete and actual experiences in

their teaching of Elementary Mathematics and how they make meaning out of these experiences. This motivated the researchers to conduct the study to address the gap of knowledge and probe into the “multiple realities” [11] of these student-teachers on their experiences in teaching Elementary Mathematics thereby making the voices of the student-teachers heard as far as their experiences in their teaching of Elementary Mathematics is concerned. The findings of this study are deemed useful and instrumental in coming up with interventions to better assist them in achieving more positive and successful experiences in teaching Mathematics.

**OBJECTIVES OF THE STUDY**

This study aimed to capture a deeper understanding of the lived experiences and multiple realities that the elementary student-teachers go through as they teach Mathematics. This study was further guided by the following questions:

- 1) What are the realities – stories of struggle and success, ways of coping and excelling – experienced by the student-teachers in their teaching of Elementary Mathematics?
- 2) What is the essence of these realities as viewed by the student-teachers?
- 3) How do these realities influence the views of student-teachers on what entails a successful teaching of Mathematics?

**Theoretical Underpinning**

The theoretical underpinning of this study is B.F. Skinner’s Reinforcement Theory [12]. It explains that one’s behavior is a function of its consequences. It is based on “law of effect”, that is one’s behavior with positive consequences tends to be repeated, but that with negative consequences tends not to be repeated.

The teaching of Elementary Mathematics was the observable behavior of interest in this study as experienced and described by the student-teacher participants. How positive and successful their experiences were in teaching elementary Mathematics as student-teachers would have influence on their future Mathematics teaching as professional teachers.

**MATERIALS AND METHOD**

The philosophical assumption of this study is ontological in nature as it espoused the idea of multiple realities as seen by the participants in the study [13]. This research is constructivist in perspective, too, with the assumption that a single event is characterized by

“multiple realities or interpretations” instead of a particular, observable reality [11].

This study utilized the qualitative research method, specifically the phenomenological design as it is the appropriate design for making possible the surfacing of deep issues and bringing insights that stimulate action [14]. The phenomenon of interest is the teaching of Mathematics with the elementary student-teachers as the ones experiencing it first-hand.

Descriptive Phenomenology was presented in the early 20th century by Edmund Husserl and Alfred Schutz as a major orientation to social science [11]. It is popular especially in education [13]. It was the task then of the researcher to be able to portray the core structure of the experience [11].

Further, the goal of the researchers was to stick to the facts and avoid any prior mental framework to describe as precisely as possible the phenomenon of interest [15]. This was achieved through “epoche” or bracketing wherein the researchers had to put aside their experiences to view the phenomenon under investigation in a new light [13]. Thus, it was critical for the researchers to establish a certain level of connection and empathy with each participant to acquire in-depth information [14].

**Participants**

**Table 1. Profile of the Student-Teacher Participants**

Participant	Age	Gender
<b>Ruth</b>	19	Female
<b>Reign</b>	19	Female
<b>Sharon</b>	20	Female
<b>Calvin</b>	22	Male
<b>Charity</b>	25	Female
<b>William</b>	27	Male
<b>Michelle</b>	20	Female
<b>Corinne</b>	19	Female
<b>Christel</b>	19	Female
<b>John</b>	20	Male
<b>Carina</b>	20	Female
<b>Mikee</b>	19	Female

Purposive sampling design was the preferred way for this qualitative research since generalization in a statistical sense was not its objective [11]. Also, a relatively small sample size was used in this research to pave the way for the abundance of information offered by the participants. The participants were Bachelor of Elementary Education student-teachers assigned in the fourth to sixth grades and have taught Mathematics for at least three times already in the integrated laboratory

school of a teacher training institution in Cebu City, Cebu. Twelve participants were tapped in this study since the point of saturation was achieved. They were interviewed using semi-structured questions. The interviews were audio-taped after getting the permission of the participants. The profile of the participants is shown in Table 1 with their pseudonyms.

### **Ethical Considerations**

The researchers explained the study, its merits and the expected form of participation to the prospective participants. They then solicited for the informed consent of the participants by signing a written form before the interviews started. The informed consent form in detail included the purpose of the study and how it will be conducted; the benefits for the participants; how the privacy, anonymity and confidentiality of the participants will be ensured, among others.

The study followed Colaizzi's (1978) method of data analysis. The first procedural step included the extraction of significant statements from the transcripts then formulated meanings were constructed from these. These formulated meanings were grouped into cluster themes then into emergent themes. The results were then put together to come up with a rich description of the lived experiences before they were validated from the participants who in turn confirmed and enriched these descriptions with new or pertinent data.

### **RESULTS AND DISCUSSION**

The themes of meaning that emerged were as follows:

#### **Theme No. 1: Emotional mix-up**

The participants identified a varied shade of emotions while teaching Mathematics. The feelings of nervousness, fear, worry and discomfort engulfed the student-teachers at the start of their actual teaching of mathematics. They eventually became comfortable and confident in the course of their teaching.

As William recounted: *"I haven't taught before. So I was more than worried. I had to read and read again my lesson plan in order for the topic to sink into my small brain. Still I found myself ill-prepared."*

Ruth also said: *"At first, I was not comfortable in teaching Mathematics because I feel that I lack the knowledge."*

These feelings identified by the participants characterize anxiety. Mathematics anxiety is predominantly observed among college students majoring in elementary education [6]. This is evident in one of the participant's responses where Calvin

remarked: *"At first I was nervous because I hate Math. I think the reason why I hate Math is because when I was in elementary, my teacher in Math was strict that's the reason why I hate Math."* Such response is also reflective of the fact that Math anxiety begins early, as early as second grade, triggered by a number of interweaving influences which results to negative effects on mathematics achievement [16]. Moreover, preservice teachers with high levels of Mathematics anxiety do not feel they are sufficiently ready to successfully teach it to elementary students [17].

Also a common fear of pre-service teachers is their Mathematics teaching anxiety [18]. However, Mathematics anxiety and Mathematics teaching anxiety are not always related [19], that is, an elementary pre-service teacher can be anxious about Mathematics but not about teaching Mathematics.

The accounts of the participants showed that they were capable of managing their anxiety, thus, preventing it from overwhelming them. William shared: *"With hindsight, my lack of confidence was pretty natural but at that point that I'm in front of the students I had to pull myself together and tell myself to relax and be confident everything will be okay."* Ruth also expressed: *"But when I started teaching it, I felt more relaxed and comfortable. I could really say that it is not harder than I thought."*

The ability of student-teachers to manage anxiety is important since anxiety in teaching mathematics affects the mathematics achievement of students. With lower levels of anxiety about teaching Mathematics, students' mathematics achievement increases [7]. Moreover, emotional management, as one of the dimensions of emotional and social intelligence, is now supposed to be an important variable in the development of young adults into professionals [2].

#### **Theme No. 2: "Challenging"**

Participants expressed how challenging the teaching of mathematics is. Two subthemes emerged out of this theme.

**a) Not a piece of cake.** It has been ingrained in the minds of the student-teachers that the subject is difficult per se as well as teaching it. Carina stated: *"This subject is one of the complicated subjects to teach."*

There are also topics in Mathematics that the student-teachers themselves find difficult. William narrated: *"Every time I encounter my math topic I really find it difficult."* William was assigned to teach the topics on fraction, decimals and percentages.

Some pre-service teachers had negative attitudes about math and decreased math competence [7]. As

such, there is an increasing concern for the subsequent impact on learners if pre-service elementary teachers continue to possess limited mathematical knowledge [6]. Even if a teacher's mathematical knowledge is not the sole factor affecting one's teaching, this will possibly affect their future classes [20].

Alongside the teaching of the subject are classroom management issues that student-teachers need to address. Christel shared: *"There are some students who show no interest in listening and learning the lesson. Some were just talking, others were sleeping and doing some other stuff."*

Sharon also shared: *"It may be hard for the time is really limited to discuss further and test their (pupils) mastery on the lesson."*

Classroom management, identified as one of the main problems, is not surprisingly an urgent concern for beginning teachers since poor classroom management impedes teaching and learning practices which eventually can become a chief source for teacher stress [21].

**b) Not their cup of tea.** Furthermore, students' negative attitudes towards Mathematics contribute to the already taxing task of teaching the subject. Calvin said: *"My struggle in teaching Math is the students, because some of the students are not interested."*

John also mentioned: *"Being an elementary teacher is hard especially when teaching Math. Students are commonly having a difficulty in the said subject. Students cannot get the idea of a certain topic by the time it's taught."*

When teachers understand that positive or negative attitudes towards Mathematics are influenced by the interaction of individual, family, school and cultural variables and know how they can aid students in developing more positive attitudes, enhancement in Mathematics education can be attained [22]. This certainly poses an additional challenge for the student teachers as they find ways and means to make the subject fun, exciting and interesting for their pupils.

As Reign explained: *"Yet, we should do it in an interesting way so that students will listen attentively and enjoy the subject. I know that a lot of students don't like Math subject. But if we can teach it in a creative and interesting manner, I know students will love the subject and understand it better."*

### **Theme No. 3: Understand to teach, teach to understand**

The participants revealed that their experience of teaching Mathematics flowed from their efforts in

understanding the topic at hand towards thinking of ways and means to make the topic easy for their pupils to understand. Carina narrated: *"...I really find it hard at first thinking how will I make it easy to discuss for the students to understand it the easiest way possible. But how will I achieve my goal if in the first place I myself did not understand it. Ruth also said: "The second struggle that I have to face is that how to understand the concept/formula of my lesson. Because I have to understand it first for me to teach it to the class."*

These pre-service teachers are required to take Math content courses that seem to be limited compared to what is covered to teach, which prove to be too vast for most early childhood and elementary education programs [9]. Studying though at a level of Mathematics that is one level above that which they are likely to encounter in their job role gave them confidence and security in applying the Mathematics that they needed in the workplace [23]. However, no direct positive correlation exists between the formal education that teachers receive and their teaching so instead of teachers studying advance Math, what they need to acquire should be an in-depth knowledge at their teaching level [20].

Even so, a research finding shows that conceptual understanding of the subject is related to the teaching strategies, different mathematical representations, and explanations that a teacher may choose during instruction [24].

The student-teacher participants aimed at making the complicated topics in Mathematics simple. William recalled: *"I had to think very hard to find ways to make my topic simple and easy to understand by the students."* The participants are pre-service teachers who are expected to deliver the Math curriculum prescribed by the Principles and Standards for School Mathematics that came out in year 2000, that is described as "Mathematically rich, offering students opportunities to learn important Math concepts and procedures with understanding" coupled with learning how to teach Math in such manner - is indeed a difficult and complex process [25].

Reign stated: *"If I understand the topic, I can also deliver it well to the students in a way that they can understand."* This statement corroborates with the findings of a study that the confidence level of a teacher's ability to do and know Math corresponds to the likelihood for them to use developmentally suitable Math teaching methods in the classroom [16]. While confronted with diverse classroom situations, a teacher who has thorough Math knowledge, has an array of teaching strategies at his or her disposal [24].

**Theme No. 4: Two N's to cope: Never stop learning and No man is an island**

The participants identified these mechanisms to cope and/or excel in their teaching of Math: reading of books and other references, watching of videos, consulting fellow student-teachers and the mentor. They resorted to these mechanisms to learn the lesson and to teach it. Two subthemes arose out of this theme:

**a) Never stop learning.** Christel declared: *"I just read and read different books related to teaching of mathematics. There are some instances that I get confused about the lesson so what I did is that I also look for videos on what's the proper way of teaching the lesson."* Mikee also said: *"...I teach it...with some good references and video tutorials."* The responses of the participants demonstrated the need for teachers to know not just the subject but also how to teach it as well through watching the videos. The ability to show the interaction of Math knowledge with pedagogical knowledge shows the difference between a Math teacher from a Mathematician [26]. On the other end, insufficient knowledge restricts a teacher's ability to explain the content to students in a way that they can make sense out of it [24].

**b) No man's an island.** Reign cited: *"...I ask my co-Student Teachers if they have an idea about my topic so that they can help me to understand the lesson"*. Further, Mikee commented: *"Open-minded always for the corrections and suggestions from my mentor and co-student teachers."* The stories of success that the participants shared were attributed to the learning that they acquired from socializing with their fellow student teachers. The social aspect of becoming a teacher is at the core of some main accomplishments that occur during initial teacher education [2].

Also Reign said: *"I accepted the correction by my mentor because I know what she wants is that the students will not be confused about my lesson."* This shows how the student-teacher participant accepts her mentor's remark that will prove to be beneficial to the pupils. Observation remarks, both positive and negative, can considerably have also positive or negative impact on student teachers but nonetheless lead to effective learning of student teachers [1].

Further, Ruth said: *My mentor in Math gives me ideas on how to teach the subject. She is a mentor who understands and always guides me to the best road."* This illustrates that student teaching mentors are often emulated by their mentees since the latter believe that they have actual experience in the classroom thereby

making them the most significant figures in student teaching [1].

**Theme No. 5: The success is yours and mine**

The participants described their teaching of Math as successful whenever their pupils learn what they are supposed to learn as evidenced in pupils' high test results and also when they themselves are able to deliver the lesson well. When pupils get the idea easily and slow learners perform well- manifest that their teaching was successful. Calvin remarked: *"My success of course is when they learn the lesson."*

Without a doubt, every teaching is aimed at promoting learning. Quality of instruction matters in student achievement, that is, student learning is directly influenced by the teacher's instructional practices [24]. As Sharon recalled: *"The success in teaching Math is when the somehow slow in class, learned the lesson and got a high score in their test."*

Ruth also commented: *"the success in teaching the subject is that the students learn and I learn as well."* Reign shared: *"My first demo in Math is a success for me because I was able to follow my lesson plan, deliver it well and with confidence and the students also understand it."*

The responses reflected the positive insights of student teachers regarding their developing knowledge and skill. This is in consonance with previous study findings that emphasize the numerous gains and achievements that take place during teaching practice [2]. In the long run these achievements make them more qualified and, "the more teachers are qualified, the more their students are successful" [5].

**Theme No. 6: Work in progress**

The participants are able to make-meaning of their experience in teaching Math as an indication that they are a work in progress. Reign said: *"Sometimes, I receive corrections from my mentor. I didn't take it as a failure but as a learning experience."* Christel expressed: *"The experiences are stepping stones to become the best teacher. I accept the fact that I am not perfect..."*

Such replies from the student teachers show how they were able to re-frame their failures and transform them into learning opportunities. Student teaching experiences are essential as mastery experiences because these probably benefit teacher candidates' self-efficacy in teaching which in turn have an effect on teachers' manner of interaction with students and the effort teachers are disposed to put forth in achieving educational outcomes [27].

William pointed out: “*For me, teaching Math is like a performing art. No amount of reading or training will prepare you for the challenge of teaching it. You only get better with practice.*” This goes to show that their thoughts are not limited to pedagogical practices but instead covered a range of areas that concerned them as student teachers such as reflecting on one’s experiences in a variety of dimensions [28].

### **Theme No. 7: Values count**

Math teaching can be likened to going on a trip and bringing along a traveling kit. In this journey, the participants recognized as well a multitude of values to be practiced in teaching Math successfully. Reign remarked: “*To successfully teach Math, one must be prepared. When we say “be prepared”, it means that you mastered your lesson very well, you made instructional materials, provide interesting activities, and give lots of examples.*”

What the student teachers believed as essential in a successful teaching of Math are significant since the best predictor of a person’s actions are his/her own belief [27]. If they believe that preparedness will help them succeed in their teaching of Math, then this will be translated in their day to day actions.

Ruth commented: “*You have to mix the right ingredients to bake a delicious cake. That is also the same in teaching Math. You have to get the best values to teach it. The essential ingredients in teaching the subject are: understanding + knowing how to explain + patience + hard work = success.*” Other values identified by the student-teacher participants are perseverance, confidence, passion, effort, willingness, hard work, focus and trust in God. The student-teachers’ recognition of those values as essential to succeed in their teaching of Math means that they will use such values as ideals to live by. Teachers’ values are known to be influential in their own student’s values, academic behavior and achievement [29].

### **CONCLUSION AND RECOMMENDATION**

The experiences of the student-teachers in teaching Math involve a mix of strong emotions coupled with pre-conceived notions that the subject matter is difficult to learn and to teach. They cope by striving to understand and simplify the subject matter. They felt they have succeeded when their pupils understand the subject matter, too. They were able to make-meaning of their Math teaching experience as an indication that they are a work in progress. The study also revealed that in-depth knowledge of the subject matter; skills in preparing

pedagogically sound lessons, instructional materials and activities; and a value system were seen as ingredients for a successful teaching of Mathematics.

Further, the positive insights of student-teachers on their own holistic development and their emerging pedagogical content knowledge in Math can readily be translated into personal beliefs that somehow have a bearing on their future teaching practices as the Reinforcement Theory posits.

This implies that it will be very wise for teacher training institutions to promote an environment and culture that assist the elementary student teachers in achieving more positive and successful experiences in teaching Math through the following: a) presence of a strong support and supervision by the supervisor, mentors and staff; b) supplemental training and coaching on improving their pedagogical content knowledge in Math; and c) acquiring reflective strategies in processing their own experiences in teaching the subject.

Moreover, since elementary student-teachers teach not only Math but the other subjects as well, the researchers recommend that further researches may be conducted related to how the teaching of the other subjects influence one’s way of teaching Mathematics.

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### **REFERENCES**

- [1] Azure, J.A. (2015). Influence of the pedagogical content knowledge of college tutors to classroom practices of students. *American Journal of Educational Research* 3(10): 1216-1223.
- [2] Caires, S., Almeida, L. and Vieira, D. (May 2012). Becoming a teacher: student teachers’ experiences and perceptions about teaching practice. *European Journal of Teacher Education* 35(2): 163-178.
- [3] Bell, C.L. and Robinson, N.G. (September 2004). The successful student-teaching experience: Thoughts from the ivory tower. *Music Educators Journal* 91(1): 39-42.
- [4] Gann, M. (1999). The effects of the integration of thinking skills on pre service teachers’ beliefs about mathematics and teaching mathematics. (UMI No. 9960882). Retrieved from Dissertations & Theses: Full Text database.
- [5] Gokalp, M. (2015). Investigating Classroom Teaching Competencies of Pre service Elementary

- Mathematics Teachers. *Eurasia Journal of Mathematics, Science and Technology Education*.
- [6] Hadley, K.M. (2005). Mathematics anxiety of elementary teachers and its effect on student mathematics achievement. (UMI No. 3200363). Retrieved from Dissertations & Theses: Full Text database.
- [7] Hadley, K.M. & Dorward, J. (2011). Investigating the relationship between elementary teacher mathematics anxiety, mathematics instructional practices, and student mathematics achievement. *Journal of Curriculum and Instruction* 5(2).
- [8] Hamlett, B. (2008). Mathematics content knowledge of pre-service primary teachers: developing confidence and competence. Proceedings of the British Society for Research into Learning Mathematics. Perth, Australia: Key Centre for School Science and Mathematics, Curtin University of Technology.
- [9] Phelps, Christine M. (2009). Investigating the Development of the Pre-service Elementary Teachers' Mathematics Self-efficacy Beliefs and Learning Goals: A Review of Research and a Mixed Methods Study. (UMI No. 3360253). Retrieved from Dissertations & Theses: Full Text database.
- [10] Sloan, T., Daane, C.J. & Giesen, J. (February 2002). Mathematics anxiety and learning styles: what is the relationship in elementary preservice teachers? *School Sciences & Mathematics* 102(2).
- [11] Merriam, S.B. and Tisdell, E.J. (2016). *Qualitative Research: A Guide to Design and Implementation*. California, U.S.A.: John Wiley & Sons, Inc.
- [12] BF Skinner's Reinforcement Theory Retrieved from <http://www.managementstudyguide.com/reinforcement-theory-motivation.htm> on Octpber 27, 2017.
- [13] Creswell, J. (2007). *Qualitative Inquiry and Research Design*. California, U.S.A.: Sage Publications, Inc.
- [14] Lester, Stan. (1999). *An introduction to phenomenological research*. Taunton, U.K.: Stan Lester Developments.
- [15] Groenewald, T. (April 2004). A phenomenological research design illustrated. *International Journal of Qualitative Methods* 3(1): 1-26.
- [16] Geist, E. (2015). Math anxiety and the "math gap": how attitudes toward mathematics disadvantages students as early as preschool. *Education* 135(3): 328-336.
- [17] Dove, A. and Dove, E. (2015). Examining the influence of a flipped mathematics course on preservice elementary teachers' mathematics anxiety and achievement. *The Electronic Journal of Mathematics and Technology* 9(2): 166-179.
- [18] Peker, M. (2009). Pre-service teachers' teaching anxiety about mathematics and their learning styles. *Eurasia Journal of Mathematics, Science & Technology Education* 5(4): 335-345.
- [19] Brown, A.B., Westenkow, A. and Moyer-Packenham, P.S. (August 2011). Elementary pre-service teachers: can they experience mathematics teaching anxiety without having mathematics anxiety? *Issues in the Undergraduate Mathematics Preparation of School Teachers*.
- [20] Zembat, I.O. and Aslan, M. (June 2016). Prescriptions guiding prospective teachers in teaching mathematics. *Educational Sciences: Theory & Practice* 16(3): 735-769.
- [21] Akin, S., Yildirim, A. and Goodwin, A.L. (June 2016). Classroom management through the eyes of elementary teachers in Turkey: a phenomenological study. *Educational Sciences: Theory & Practice* 16(3): 771-797.
- [22] Can, I., Koydemir, S., Durhan, S., Ogan, S., Gozukara, C. and Cokluk, G. (October 2017). Changing high school students' attitudes towards mathematics in a summer camp: happiness matters. *Educational Sciences: Theory & Practice* 17(5): 1625-1648.
- [23] Kyffin, H. and Paneels, S. (2011). Mathematical needs: mathematics in the workplace and higher education. Retrieved from <https://goo.gl/oSrQg8>
- [24] Ngware, M., Ciera, J., Musyoka, P.K. and Oketch, M. (2015). Quality of teaching mathematics and learning achievement gains: evidence from primary schools in Kenya. *Educational Studies in Mathematics* 89: 111-131.
- [25] Jaberg, P.A. (2001). Elementary preservice teachers exploring teaching mathematics for understanding via action research. (UMI No. 3064494). Retrieved from Dissertations & Theses: Full Text database.
- [26] Gunhan, C. (2014). An investigation of pre-service elementary school teachers' knowledge concerning quadrilaterals. *Cukurova University Faculty of Education Journal* 43(2): 137-154.
- [27] Lee, J., Brown, A., Tice, K., Collins, D., Smith, C. and Fox, J. (December 2012). Assessing student teaching experiences: teacher candidates' perceptions of preparedness. *Educational Research Quarterly* 36(2): 3-19.
- [28] Mariko, S. (May 2011). Student teachers' reflective journals on teaching practice experiences. *Contemporary PNG Studies* 14: 67-83.

- [29] Yeung, A., Craven, R.G. and Kaur, G. (2014). Teachers' self-concept and valuing of learning: relations with teaching approaches and beliefs about students. *Asia Pacific Journal of Teacher Education* 42(3): 305-320.

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