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Investigating College Students' Views on Mathematics Learning Through Reflective Journal Writing

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ABSTRACT

The study on reflective journal writing (RJW) and its benefits as assessed by the teachers has long been an inclination in mathematics education. However, little research has been done to explore the feelings of students towards RJW and how such has an effect on their mathematics learning. This study aimed to describe the feelings of the students about RJW. Being a qualitative type of research study, data were acquired through focus group discussion and were analyzed using axial coding. Results revealed that RJW (i) provided opportunities for the students to construct meaning and express personal views and ideas; (ii) built a connection between the teacher and the students; (iii) through the use of prompts, allowed the students to relate mathematics to real-life facts improving their understanding of the subject; (iv) helped the students build association of ideas using their prior knowledge and experiences; and (v) enabled the students to develop self-awareness. The findings suggest that when students are engaged in reflective writing experiences which explicitly promote meaning-making or self-questioning, teachers create an opportunity for them to see how the process of writing can enrich their mathematical learning.

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1. INTRODUCTION

In the recent years, researchers have been increasingly interested in the role of reflection and writing in learning mathematics. Studies show that inclusion of reflective writing activities in the curriculum is helpful to both students and teachers [1-2]. As defined by Lew and Schmidt: Reflections are processes that a learner undergoes to look back on his past learning experiences and what he did to enable learning to occur, and the exploration of connections between the knowledge that was taught and the learner's own ideas about them [4].

In a study of Odafe [3], reflection teaches students to be thoughtful of how they learn. He further adds that it helps students develop their study habits and participation in mathematics classes. Although the impact of self-reflection is not manifested to a measurable effect translating to improvement in academic performance, Lew and Schmidt [4] argued that it is helpful to a certain extent in enhancing student learning. Students do demonstrate some growth in self-reflection such as growth in their abilities to self-reflect on how and what they have learned.

Writing is a means by which one can express reflective thinking. According to Minton [5], writing drives a student to slow down, allowing him to process information thoroughly, and review the mathematical concepts studied. It gives them the opportunity to construct their own knowledge [6] and express their understanding [7] in the subject. Moreover, it promotes self-questioning that enables him to set the stage and

see how it can enrich his mathematical discovery [8]. Writing in and about mathematics makes students facilitate meaningful connections about the concepts learned and themselves as learners [9]. This enables them to express how they apply mathematics to solve problems encountered in daily lives [10]. This agrees to the study made by Card [11] wherein utilizing daily writing activities in the classroom was found to play a role in mathematical conceptual understanding and problem-solving abilities of the students.

To record their thoughts, students are usually asked to keep a journal. The study of Klein, Pflederer, and Truckenmiller [12] revealed that alongside cooperative learning and multiple intelligence activities, student journaling reflected greater appreciation from among the students which consequently increased their motivation. Including writing in mathematics curriculum deviates the students' focus to sole mathematical computation and gives them confidence to express their ideas and have a deeper understanding of the content [13].

Literature offers evidence that teachers, aside from the students, benefit from giving writing activities like journaling to their students. Powell [14] pointed out that "writing to learn mathematics is transformative not only for learners but for instructors as well" (p. 174). This is supported by the study of Addison [15] which revealed that students' journals increase the teacher's awareness of his students' comprehension of concepts, feelings, and attitude towards the subject. It sets an avenue for him to ponder upon the successes and challenges of teaching mathematics. Journal writing of the students strengthens the line of communication between them and the teacher [15-16]. It assists the teacher in planning instructional methodologies and assessment of his students' understanding [7] and even difficulties [3]. Not only does it provide the teacher with another strategy for target students to communicate their thoughts but it also allows the teacher "to stay in touch even with the most quiet and reserved student" [15]. Additionally, journal writing affords the opportunity for the students to communicate to their teacher mathematical ideas, which is one of the goals stressed in NCTM's standards [17].

However, most of these studies have failed to focus on exploring the feelings of college students towards reflective journal writing (RJW) and how such has an effect on them especially in their mathematics learning. Literature already provides enough data to show that benefits of journal writing are described based on the ratings of the teachers and *not* of the students who are the focal participants in the activity. Research has tended to focus on how the activity is instrumental in the success of teaching and learning mathematics as expressed by the teachers. How the students exactly feel about RJW, its strengths and weaknesses, is still not completely uncovered. Additionally, a considerable amount of research has been done on students in the primary school to investigate their levels of achievement and metacognition in expressing their needs in terms of mathematics teaching and learning through RJW [11-18-20]. Yet, less attention has been paid to studying students in the college level.

In De La Salle Lipa, students are honed to be critical thinkers, being one of Expected Lasallian Graduate Attributes. In the attempts of the School to support endeavors that will enhance critical thinking skills of the students, i.e. promoting constructivist's teaching, transformative learning, and discipline-based teaching approaches (DLSL Pedagogical Framework), efforts employing strategies that will target improved cognitive skills will surely be favorable. Despite how the literature conveys that journal-keeping improves critical thinking skills of the students [4,24], no research utilizing RJW in mathematics class appears to have been conducted in De La Salle Lipa to date. Implementation of the said activity and exposition of the college students' views and sentiments on the use of RJW as a medium to learn mathematics remain a pressing and timely issue. Hence, it is of interest to carry out a research that will give a clear picture of how the activity in a mathematics class is perceived by the students.

The paper focuses on journal writing as a regular mathematics class activity. It aims to describe the feelings of the students about RJW. Specifically, it seeks to answer the following questions.

1. What are the thoughts and feelings of the students about RJW as a mathematics class activity?
2. Do the students find journal writing helpful? If yes, in what way?
3. How does reflection play a role in one's mathematics learning?

It was made clear to the students that their journal writings will not be evaluated as part of their grade computation. That means they are free to write and express themselves openly in the activity.The results of the study focus solely on the students' thoughts on and perceived effects of RJW. It is not used to evaluate the content or the manner the subject was taught.

1.1. Theoretical Framework

The study is anchored on Kolb's Experiential Learning Theory (ELT). The theory defines learning as "the process whereby knowledge is created through the transformation of experience according to Kolb, as cited by Kolb [25]. Knowledge results from the combination of grasping and transforming experience". The ELT model portrays learning as a four-stage cycle composed of the concrete experience, reflective observation, abstract conceptualization, and active experimentation. In simple words, the cycle touches upon

experiencing, reflecting, thinking, and acting in a repetitive process. The cycle begins with one's immediate or concrete experience. The learner reflects on this experience to give meaning to such [26]. This reflection (or meaning) is digested into abstract concepts which breed new implications for action. These implications serve as drivers in building new experiences [25].

Svinicki and Dixon [26], in their study The Kolb Model Modified for Classroom Activities, added to Kolb's model certain activities that support the different phases of learning in the cycle. Teachers have the primary role of constructing learning order that leads his students throughout the whole cycle. In a mathematics class for example, a teacher may use simulations or games, problem sets, and examples in order for him to give his students a concrete experience. Under reflective observation, discussion, brainstorming, and journal keeping are believed to compel the students to "reflect on their experiences and the experiences of others" (p. 142). While, lecture, model-building exercises, projects, and analogies could foster abstract conceptualization. And lastly, simulations, projects, and homeworks gives the students inferences which they could apply in building new experiences.

The concrete experience, crafted by the teachers, is given to the students for the latter's gathering of facts. This is the stage for which they describe the actual event. From this, journal writing sets the mood for them to be more reflective of what they have experienced and how they feel about it. Questions such as "What did I learn?" and "What do I need to improve on?" can serve as guides in the students' reflection. Through this, they will find meaningful connection of the knowledge that they have gained with themselves as learners. Careful thought will make them understand and explain why things happened. This leads the students to be more strategic in planning what to do next which enables them to build a new experience.

2. RESEARCH METHOD

This is a qualitative type of research study; in particular, a case study. It documents thoughts and feelings of the respondents. Patton and Cochran [27] wrote that qualitative research is typified by its aims relating to understanding a certain matter and methods which generate words rather than numbers. It involves naturalistic and interpretative approach to the world letting the researchers "study things in their natural setting, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them" [28].

In first week of the classes in the first semester of School Year 2016-2017, the nature and purpose of this study were discussed with the students. Likewise, the teacher-researcher asked for their consent to be part of the study. The participants in the study were the six third year Bachelor of Science in Education Major in Mathematics students of De La Salle Lipa enrolled in Differential Calculus class.

RJW was introduced to the students as a regular class activity. In the study made by Carter [29], adding writing to reflective journals to daily routine in mathematics class enhances students' thinking skills. Usually at fifteen minutes before the end of each meeting, a journal question or prompt was provided by the teacher-researcher for the students to reflect on. The question or prompt did not necessarily have to be related to the topic discussed during the day. Rather, it was commonly something that the students are able to relate to or express themselves on. In addition, the teacher made sure that through the prompt, she can probe on the students' feelings so as to elicit feedbacks from them. As stated by Amir & Lianghuo [20], "the journal allow us (teachers) to gather information on our pupils, monitor their understanding of the topic, and most importantly, it brings us closer to our pupils" (p. 10). Further, it is a good avenue for students to provide feedback and express their needs in terms of mathematics teaching and learning.

There were days when the students are asked to share to the class the entries they have in their journal. Addison [15] pointed out that having students share and explain their written work to each other would cause students to think about their own solutions and consider the solutions of others, not to mention the likelihood of prompting more detailed work on their part. Feedbacks are oftentimes provided by the teacher as a means to give appreciation for their entries and also to give encouragement to those who need it.

The data were gathered through a focus group discussion (FGD) among the student participants scheduled at the end of the semester. The purpose of focus groups according to Krueger and Casey [30] is to "promote a comfortable atmosphere of disclosure in which people can share ideas, experiences, and attitudes about a topic". Qualitative methods such as focus groups allows the researcher to have a broader view of the reality as they pay more attention to voices of the participants in the study [31,32].

To probe into the students' insights on RJW, the following questions were outlined for the FGD.

1. What are your thoughts and feelings about RJW as a mathematics class activity?
2. Do you find journal writing helpful? If yes, in what way?
3. How does reflection play a role in one's mathematics learning?

An experienced qualitative researcher was asked to facilitate the discussion. The facilitator started the FGD with a briefing of the participants about the process of the discussion. They were informed that there

will be no right or wrong answers. With the permission of the student participants, another research assistant was invited to audio-record and note-take during the session. However, it was assured to the students that any information that will be gathered during the session will be dealt with confidentiality and anonymity.

For the analysis of data, a transcription grid was developed for the responses in each of the questions resulting to three grids. The responses were carefully and objectively coded. The grids were studied all together. Similar and associated (preliminary) codes were noted then grouped together to determine the themes that emerged. Frequencies of responses were recorded as well to identify the significant issues that became apparent during the dialogue.

3. RESULTS AND ANALYSIS

3.1. Thoughts and Feelings about RJW

Based on the responses, different yet interconnected opinions on RJW surfaced during the dialogue. Three students conveyed that the activity allowed them to express themselves freely. Student 1 stated, *"I can write what I learned and what I feel especially if I understood the lesson."* Student 2 shared the same opinion by saying: *"Since we are told to write exactly what we want, I felt that I could speak my mind on the journal when I find the lesson difficult for that day."* Consequently, RJW enabled the students to tell the teacher things they cannot say verbally. Student 3 recalled that through the journal she is able to communicate to the teacher the topics she find confusing, on which she emphasized *"I could not tell directly to the teacher that I do not understand the lesson without worrying about being offensive."*

Another perception articulated about RJW is that it is a means to evaluate one's own performance in the class. Student 3 recounted that through the journal she can reflect on *"what skills she is lacking of, what topics she needs more studying on, or whether she listened enough or not during discussion."* Student 6 believed that performance is improved by claiming: *"I can recall during an exam what I have written in the reflection like my own mistakes and thus, I am able to correct it."*

In the foregoing, while most of the students viewed RJW as a medium to communicate, it is interesting to note that one perceived it as an aid to relate mathematics to real-life setting. Student 4 declared, *"Through reflective journaling, I feel that I am in the real world as opposed when doing just pure computations, without applications."* She adds, *"In the activity, I am able to relate mathematics to real life."*

3.2. Benefits of Journal Writing

The notion that RJW is *not* graded instigated most of the benefits of the activity. For one, the students felt that journaling sets an avenue for them to open themselves up without restraint. Student 4 affirmed this by saying, *"Our previous journal writing activity was graded; hence, it somehow limit what we can share. This (RJW), on the contrary, allowed us to share whatever we want to say."* And because the students can write in the journal even their own frustrations from past mistakes, RJW served as a constant reminder for them to do better. Through the journal, the students realized their strengths and weaknesses and used them to improve themselves. As Student 5 put it, *"Journal writing helped me a lot. It made me discover my strength and weakness through reflection."*

Aside from the "not graded" feature of the activity, feedbacks coming from the teacher proved to have brought about other rewards of RJW. Feedbacks took away the anxieties of the students in the subject. Students felt that their needs are addressed promptly since the journals are collected every meeting by the teacher and given feedbacks right away. Student 3 shared that she was encouraged to write because she *"receives feedback rather than a communication that is one-sided."* She stressed, *"A connection is built."* RJW is thus sensed as a two-way communication between the teacher and the students.

Lastly, the students believed that the reflective activity enabled them to connect more with their past learning due to the given journal prompts. Student 2 mentioned that through the meaning-making questions she is able to *"relate math to real-life".* She further added that *"The use of prompts made RJW different from their past reflective activities wherein the main point is only to write what has been learned during the meeting and nothing more."*

3.3. Reflection's role in mathematics learning

Majority of the comments given by the students concerning the role played by reflection in one's mathematics learning tended to fall along its gains. Generally speaking, reflection improved one's mathematics learning. According to Student 4, she is able to write in the journal the topics or points they find difficult. Further, she expressed that reflection served as a guide for the students to know and focus more on the areas they need to improve on.

"When a quiz is announced for the next meeting, I can go over the journal. I am able to point out what I find difficult and it is where I focus when I study. My preparation is more guided and organized. I concentrate on what I find complicated. I get to pay more time and attention to such." (Student 4)

This idea is seconded by Student 2 who thought that writing down their own weaknesses makes it possible for them to overcome them and excel in the subject. Hence, reflection motivated the students to do better. Their journal entries served as a communication with themselves as learners and a reminder for them as well to apply what they have written. Student 3 narrated that when she writes *"I need to improve this"* in the journal, she is *"motivated to do so."*

The use of journal prompts became a channel for the students to learn mathematics. Student 2 recalled what she mentioned about how prompts helped her to *"relate math to real-life"*. Student 4 immediately gave a follow up reaction saying, *"Mathematics is better understood when it can be related to something."* Because reflection prompts allowed the students to connect their learning to real-life situations, they felt that Mathematics is better understood and makes more sense when it is related to real-life picture.

3.4. Analysis

Five themes emerged as regards students' views on RJW as a mathematics class activity. First, RJW provided opportunities for the students to construct meaning and express personal views and ideas. The writing activity allowed the students to freely express their feelings. According to Yang [34], mathematical diary writing is not only a good way for students to represent their thinking, but also a constructive way for them to communicate with themselves and with their teachers. Students' being able to write in the journal the topics they find difficult relates to the study made by Amir and Lianguo [20] which stated that journal writing provides an avenue for the students to express their needs in terms of mathematics teaching and learning.

The preceding claim leads to the idea that RJW built a connection between the teacher and the students. Reflection establishes a personal relationship between the learner and the teacher [10] providing an opportunity for the students to realize when to ask for help and contribute to the teaching-learning environment [3]. It provides the teacher with information on what his students learned and what the students have difficulties learning. This conforms to what Van Der Molen [1] wrote in his study that reflective math journaling within the classroom was beneficial for both the instructor and the students. Addison [15], in his study, mentioned that the "lines of communication between the teacher and students strengthened as the writing activity proceeded". In this study, feedbacks proved to have worked for the benefit of the students, taking away the anxieties they have for the subject. Sadler [21] described it as a "deliberate dialogue that aims to help students to overcome their difficulties". Hattie and Timperly [22] pointed out that students often seek information about "how they are going" although they may not always welcome the answers. Receiving feedbacks clearly encouraged the students to write. This connects to a research made by Odafe [3] that when teacher and students become partners in mathematics teaching and learning process, reflection process results in improved student learning environment.

Third, through the journal prompts, RJW allowed the students to relate mathematics to real-life facts improving their understanding of the subject. Kenney, Shoffner and Norris [23] who likewise used prompts in their study found out that the meaning-making activity helped the students to reflect on their own learning. Cook and Craig [10] wrote that through writing, students can express how they use mathematics in their lives and how they solve problem. Parsons [9] documented that students "made significant changes in approaches to learning and also made deep and meaningful conceptual connections" through writing in mathematics. He further adds that activity actually enabled the students to facilitate meaningful connections about what they learn and themselves as learners.

The journal being an aid for the students to build association of ideas using their prior knowledge and experiences is the fourth theme that to come up in this study. Results revealed a clear emphasis that RJW was perceived as a means by which students recall their learning. In the study conducted by Lew and Schmidt [4], there are three general categories on which students reflect on. One of which is summary of what has been learned. The process of writing forces a student to slow down and allow him to thoroughly process information and review mathematical concepts studied [5]. It deepens learning for longer retention of concepts [10].

Last of all, through journal writing, students were able to develop an awareness of the self while immersed in meaning making prompts. Because writing promotes self-analysis and reflection among students, it reveals where they have misunderstandings or problems [10]. In the study, students were able to reflect on their strengths and weaknesses, making it possible for them to overcome them. This connects to the study made by Edwins [19] which confirmed that writing reflectively drives students to become enthusiastic and eager to set goals to better themselves.

4. CONCLUSION

While RJW was strictly reflective writing, it was found out in this study that utilizing writing activities would certainly enhance the mathematics learning experience of the students. The goal in this study is to explore how college students view mathematics learning through RJW in hopes of gaining insights on how writing might help both teachers and students explore mathematics in a way they find practical and constructive. This study showed that by engaging students in reflective writing experiences which explicitly promote meaning-making or self-questioning, teachers create an opportunity for them to see how the process of writing can enrich their mathematical learning. It makes the students realize that learning mathematics does not always have to be about doing calculations. Rather, doing mathematics may go hand in hand with reflective writing as it can propel deeper the students' understanding of the subject. Essentially, by using reflective writing activities, teachers lay the groundwork for the students to experience mathematics favorably.

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