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## The Effect of Using Diary Writing - as an Assessment Tool - on Third Graders' Mathematical Achievement and their Attitudes towards it

Prof. Mohammad M. Al-Absi<sup>1</sup>

Prof. Nafez A. Bukaiei<sup>2</sup>

Faculty of Educational Sciences and Arts - UNRWA  
H.K.J.

### Abstract

**Objectives:** This study aims to explore the effect of using diary writing on third graders' mathematical achievement and their attitudes towards it. **Methods:** To achieve this, a mathematical achievement test was administered, and an open question is administered to the experimental group. **Results:** The study sample consisted of 68 students, distributed to two sections, an experimental group 33 students assessed by diary writing tasks, and a control group 35 students assessed using the traditional method of instruction. **Conclusion:** The study revealed that diary writing has a positive effect on improving students' mathematical achievement.

**Keywords:** Diary Writing, Assessment, Mathematical Achievement, Attitudes

### Introduction

Writing is a language skill that plays a very important role in students' learning. It can express their ideas, feeling, and experiences in certain place, time, and situation in a written form (Syarifah, 2020).

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1 Professor of Curricula and Methods of teaching math, (UNRWA). **Research Interests:** Curricula and Teaching, Measurement and Evaluation.

**E-mail:** absi702000@yahoo.com.

2 Professor of Educational Psychology, (UNRWA). **Research Interests:** Educational Psychology, Practical Education. **E-mail:** muneeb\_bukaiei@yahoo.com.

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Diary writing is a personal form of writing where a person maintains a diary to write about his/her personal life or a situation (Prasanna, 2021). Diary writing is one of the assessment tools used when implementing the authentic assessment in the learning process, in order to achieve an authentic and reliable picture about the students' performance in a realistic condition. It is an effective tool for both students and teachers (Klimova, 2015), it enables students to reflect on what and how they have learned, the difficulties they have faced during the learning process, and how to help them to overcome such difficulties. It is also useful for teachers to restrict students' favorable strategies in learning to implement them in their teaching and to overcome students' limits in the learning process, and when giving the student the opportunity to write about their thinking, this may develop their problem-solving skills (Hensberry & Jacobbe, 2012). Diary writing reflects the actual teaching and learning activities of the students, to express what they have learned, and link to their learning to their teaching and assessment practices (Tang, 2002).

Penzu (2022) states eight tips for students when starting a diary writing, which is at the beginning, may seem hard to start, but don't stress, because when you start getting words out, they will start to flow naturally. The eight tips are:

- 1 - Decide to write: you need to decide you want to start a diary.
- 2 - Decide what to write: this is the hardest part when writing a diary, but it is probably the most important. If you want your diary to be specific, decide what topic you would like to discuss during your entries.
- 3 - Create a schedule: when you have decided what you want to write in your diary, decide on a writing schedule that is appropriate for the topic.
- 4 - Set a time limit: to stay concise and on track is to set a time limit for your writing.
- 5 - Date your entries: to be able to look back through it and see how you have progressed over time.
- 6 - Create an introductory entry: what your diary will be about.

- 7 - Act like you're writing to a trusted friend: the best way to write is as if you're talking to your best friend.
- 8 - Have fun! Writing in your diary should never be a chore or a burden, so remember to have fun with it.

The use of diary writing is enjoyable for students, who are believing that their language and writing techniques have improved, and there were a desired change in emotions such as removing stress, keeping memories and strengthening the student-teacher relationship, when they use the diary writing (Sadeq; Akbar; Taqil & Shuqair, 2015). Using the diary writing regularly makes the students begin to try managing their life better, and it has an important role in the development of their writing ability (Dincel & Savur, 2019), and most authors see that a diary writing is used for the expression of personal feelings, thoughts and experiences on daily basis (Bazir, 2016), and it is useful in terms of learners' autonomy, self-awareness, and self-regulation (Beseghi, 2021). Meanwhile, others look at it as a kind of free-writing activity, without fear of being evaluated.

The diary writing should include some details (Rubin, 2003), such as:

- 1 - What problems do/did you have in class or with your homework? How did you deal with these problems? How well did these solutions work for you?.
- 2 - As you approach a task, what do you do before, during, and after to complete the task? Do you feel that what you did was useful? If not, can you think of something else that might work for you?.
- 3 - Describe how you feel as you work on the assignment or in class? What did you do about those feelings? Did it help? If not, can you think of something else that might work for you?.
- 4 - If this is your second or third assignment, what did you do differently, based on comments on your prior assignment by the teacher or your peers? Was it helpful? If so, why? If not, why not?.

Practically, the teacher is exposed to a number of obstacles when using the authentic assessment and implementing realistic evaluation tools (Shaker, 2020), such as: the number of students in the classroom, the time period available for implementing the various evaluation

activities, the lack of sufficient and appropriate consideration of individual differences between students, the great effort that is needed when preparing the tools, and finally the cost of material mostly.

The lack of using diary writing in the learning process in Jordan was clear in (Al-Zoubi, 2013) study, which investigated the degree of mathematical teacher's knowledge and utilization of the authentic assessment at the high primary grades in Jordan. The results showed that the practicing degree of authentic assessment strategy by Mathematics teachers was moderate except for the use of observation strategy which shows high level, meanwhile, the knowledge and the use of diary writing as an assessment tool was not found.

The educational literature dealt with the effect of using diary writing in the enhancement of learning process academically and psychologically on students. Der-Ching (2005) conducted a study about the effect of mathematical diary writing in developing number sense. The results showed that diary writing helps students to present and formulate their thinking through pictures, language, or symbols, and promotes children's problem-solving ability through explaining their ideas, it also helps teachers to investigate children's understanding and feelings about lessons. Quinones (2005) explored the effect of journal writing on student's attitudes and performance in problem-solving, on second grade students, who were asked to complete daily problem-solving prompts, and write about their problem-solving solutions, they were opposed also to an attitude survey. The results of the study revealed that 13 of 17 students showed growth of problem-solving performance, also the students showed change of attitudes towards problem-solving through the willingness to complete the problem-solving tasks. Karina & Tim (2012) carried out a study to explore the effect of Polya's heuristic and diary writing on children's problem-solving. They asked students to explain their thought processes when using the diary writing. The results of the study revealed that most students showed improvement in their solution strategies, which indicates that writing about thinking is useful for developing problem solving skills. Lee; Lim & Leong (2020) conducted a case study to investigate the effect of using mathematical writing workbook as a practical approach to increase students' problem-solving skills. The sample of the study consisted of thirty foundation students in engineer-

ing, opposed to writing to solve mathematical problems for a period of six weeks. The results of the study revealed that mathematical writing gave the students an opportunity to visualize, aware and recognize their problem-solving behaviors in words. Graham; Kiuahara & MacKay (2020) conducted a meta-analysis research, that examined if students writing about content material in science, social studies, and Mathematics facilitated learning. Participants of the study were students from grades 1 to 12. The results of the study revealed that writing enhanced and improved the learning process in the three grade levels (elementary, middle school, and high school), and students can apply writing in multiple ways to improve content learning. Irmayana; Harapan & Baene (2021) conducted a study about the effect of using diary writing technique on students' writing recount text. The sample of the study consisted of 32 ninth grade students of SMP Katolik Fatima 2 Sarudik in Indonesia, opposed to observation and test tools, by using one group pretest and posttest design. The results of the study showed that there are significant difference between pretest and posttest results in favor of the posttest, which means a significant effect of diary writing technique on students' writing recount text ability.

The current study comes to complement the literature on the subject of diary writing, in examining the effect of using diary writing - as an assessment tool - on third graders' mathematical achievement and attitudes.

### **Research problem**

The current study aims to examine the effect of using diary writing - as an assessment tool - on third graders' mathematical achievement and their attitudes towards it, it is considered as one of the rare studies in the Arab world that examines the effect of using diary writing - as an assessment tool - on third graders' mathematical achievement and their attitudes towards it.

This study tries to answer the following questions:

- Is there any statistically significant difference between means of the experimental group; assessed by using diary writing, and the control group; assessed traditionally on the Mathematical achievement test?
- What are the attitudes of the experimental group of using diary writing as an assessment tool in their learning Mathematics?

## Research hypothesis

The current study aims at testing the following hypothesis:

- There is no statistically significant difference at  $\alpha = 0.05$  between the mean scores of the experimental group and the control group on the Mathematical achievement test.

## Study significance

The importance of this study lies in shedding light on the importance of using diary writing in mathematics learning and teaching process, which may contribute to improving students' level of achievement and their acquisition of knowledge, skills and attitudes, that is necessary to learn mathematics. The study may also contribute to affecting teachers' teaching methods of mathematics, by adopting it as one of the alternative methods for evaluating students' learning.

In addition, the results of the study and similar studies may justify the adoption of using this method in textbooks by curricula administrators, to evaluate students' learning, in addition to the traditional assessment methods.

## Operational definition of terms

- **Diary writing:** is an assessment type in the learning process, which requires the students to write about their feeling and ability toward solving the questions, what is the most and least loved thing in the lesson, what is the new thing they learned today in the lesson.
- **Mathematical Achievement:** is the knowledge, understanding, and skills, that student has acquired as a result of an experience he passed. The mathematical achievement is measured by the student's score on the test, applied in the current study.
- **Attitudes towards Diary writing:** the attitude is an internal state of the individual, which provokes his behavior, and directs him towards achieving a specific goal. The attitudes towards Diary writing were measured by asking the experimental group about the benefits of using diary writing in their learning.

### **Limitations of the Study**

- **Subject:** The study is limited to the topic of division by a number of digits, and this limits its generalization to other topics in mathematics.
- **Gender:** The study was applied to the female category of third-grade students, and this limits the generalization of its results to the male category.
- **Place:** The study was applied to Al-taj elementary girls' school, and this limits the generalization of its results to other places.

### **Methodology and Procedures**

#### **Methodology**

The design of the study is a combination of: the quantitative quasi-experimental approach, with nonequivalent control group design was used to answer the first question, and the qualitative approach to answer the second question.

#### **Study Population and Sample**

The population of the study consisted of all third graders in Al-taj elementary girls' school, in Amman south area, at UNRWA, in the academic year 2021/2022, (n = 100). The sample of the study consisted of two groups. The first group (n = 33) were selected randomly as an experimental group, assessed by using diary writing, and the other group (n = 35) was selected as a control group, assessed by the traditional method.

#### **Study Instruments**

##### **Diary writings:**

Diary writing activities were designed and developed by the researchers, to be applied during the assessment process of the unit "Division on a number of one digit". Eight diary activities were given to the experimental group students as tasks related to the subject learned, during the assessment process. The control group was taught the same

unit traditionally, Through the teacher's presentation of the lesson procedures and activities, then assigning the students to solve and discuss the exercises mentioned in the book.

Diary writing activity consisted of a task to be answered, followed by the questions:

- What do you feel about the task?
- Do you feel that you are able to find the method to begin solving the task? Why?
- What is the most thing you love in this class?.
- What is the least thing you love in this class?.
- What is the new thing that you learned today?.
- Explain to your classmate what the topic of today's lesson means.

Appendix (A) reveals the diary writing form, used in the current study.

### **Mathematical Achievement Test:**

The Mathematical achievement test which applied in the current study was prepared and developed by the researchers, through preparing a specification table about the unit of division by a single-digit number, which covers the knowledge and skills included in the unit with different levels of different mental skills. Researchers chose a number of items that represent the subjects of the unit taught to the two groups 10 items. The test has been corrected by marking one score of each item, so the total score of the mathematical achievement test was 10.

As of validity, the Mathematical achievement test was presented to a number of arbitrators to give their suggestions about the test and its conformity with the specification table, and their suggestions were taken into consideration in modifying some items of the test. The test also was applied to a sample of 25 students of the study population (not included in the sample), and the consistency of each item of the test were calculated using the Pearson correlation between the item scores and the whole test scores. The correlation coefficients were between 0.43-0.86; an acceptable value for the purpose of the study. The mathematical achievement test was applied to a sample of 25 students of the study population and the reliability of the test were computed

using the split - half method. The reliability coefficient was 0.85, which is an acceptable value for the purpose of study. Appendix (B) reveals the mathematical achievement test in its final form.

### **The Attitudes towards Diary Writing Tool:**

The experimental group students were exposed to an open question to find out the advantages and disadvantages of using diary writing from students' point of view, through the qualitative approach. "What is your attitude towards using diary writing as an assessment tool in learning mathematics?".

The students were asked to write their attitudes as an Indefinite number of sequential points, so the students were free to write the number of points they deem appropriate.

### **Study Procedures**

- The two groups' results on the first month exam in Mathematics were considered as a pre- treatment test. This procedure is appropriate, because the students do not possess the knowledge mentioned in the post-test to examine them in this knowledge, and this leads to equivalent results between the two groups in terms of lack of knowledge.
- The experimental group was assessed during their study of the unit "Division on a number of one digit" by using the diary writing activities; meanwhile, the control group was assessed by the traditional method.
- The period of the study was four weeks, which took 8 lessons, by giving two activities in the week, divided in two lessons.
- After the completion of the study, a mathematical achievement test was administered to the two groups as a post-test, and an open question was administered to the experimental group to find out the attitudes towards diary writing using.
- Data were analyzed by using SPSS program to test the hypothesis of the study.

### Study Variables

- Independent variable: Assessment method, which has two levels: (using diary writing, traditionally).
- Dependent variable: Mathematical achievement.

### Statistical Analysis

To answer the first question, and to test the hypothesis of the study, one-way ANCOVA is used to compare the means of the two groups in the Mathematical achievement post- test, after removing the effect of the pre-test.

To answer the second question, students' responses are categorized as points, and the similar answers are classified and placed in one domain. Frequencies and percentages of every domain were computed to find out the most attitudes of students towards diary writing using in the learning process

### Results and Discussion

To answer the first question of the study, and to examine the hypothesis: descriptive statistics of the two groups on the Mathematical achievement post-test and the estimate values - in relevance to the pre-test results - were computed. They are shown in table 1 seen below:

**Table 1**

*Statistics of the Two Groups on the Mathematical Achievement Post-test and the Estimate Values in Relevance to the Pre-test*

Group	N	Pre-test		Post-test		Estimates	
		Mean (10 marks)	Std. Dev.	Mean (10 marks)	Std. Dev.	Adjusted Mean	Std. Error
Experimental	33	7.03	2.84	8.24	1.83	8.12	0.20
Control	35	6.60	2.13	7.06	1.81	7.18	0.19

Table 1 reveals that there are differences between the means of the two groups, in the post-test and the estimate values. To examine the significance of these differences, the ANCOVA test was administered. The results are shown in table 2 seen below:

**Table 2**

*Test Results to Compare between the Two Groups on the Mathematical Achievement Post-test in Relevance to the Pre-test.*

Source	Sum of Squares	Df	Mean Square	F	Sig.	Eta Squared
Pre	131.962	1	131.962	98.047	0.000	0.601
Group	14.963	1	14.963	11.118*	0.001	0.146
Error	87.484	65	1.346			
Total	243.309	67				

\* Significant at the significant level  $\alpha = 0.05$

Table 2 reveals that there are statistically significant differences between the means of the two groups, since the F- value was 11.118, with significance level 0.001, which is less than the critical value 0.05. Table 2 also reveals that Eta Square equals 0.146, which means that about 15% of the variance in the Mathematical achievement is due to the variance in the assessment using diary writing, which is classified as a large effect (Behache, 2019). Through Analyzing the results shown in table 1, and comparing the estimated means of the two groups, it is found out that the adjusted mean of the experimental group 8.12 is greater than the adjusted mean of the control group 7.18, and this means that the Mathematical achievement of the experimental group is much better than that of the control group. This result refutes the first hypothesis.

This result shows that using diary writing in Mathematics learning gives the students an extra power and potentiality in Mathematical achievement, and increases their level of achievement. This seems to be logical, since when applying diary writing in the classroom and asking the student to describe his feelings, and the extent of his ability to start solving the task assigned to him, this will develop his self-confidence and self-evaluation, and enhance his ability to reach the correct answer; to develop the emotional aspects of the learner, and gives him motivation and enthusiasm to learn, and this leads him to gain knowledge and understanding, and to achieve what he wants to learn better. Also, asking the student about determining the new thing or things that he learned in the lesson, will help him to be steady, by being able to

describe the progress of learning and the changes that occurred in his performance when exposed to the new situation, and this is confirmed when the student is asked to explain and clarify to his colleague about what has been learned in the class; so this may enhance the student’s learning and confidence in acquiring knowledge, and this is greatly reflected on his/her achievement.

The use of diary writings in the classroom can help teachers in the learning process, because they can identify students’ mistakes when evaluating the diary writings, so they can reform students’ conceptual misunderstandings, to improve their level of achievement. This result coincides with the study results of (Der-Ching, 2005; Quinones, 2005; Karina & Tim, 2012; Lee; Lim & Leong, 2020; Graham; Kiuahara & Mackay, 2020; Irmyana; Harapan & Baene, 2021) in the positive effect of using diary writing in improving the mathematical achievement.

To answer the second question: “What are the attitudes of the experimental group of using diary writing as an assessment tool in their learning Mathematics?”, students’ responses were categorized as points, and the similar answers were classified and placed in one domain. Frequencies and percentages of students’ attitudes towards diary writing using. They are shown in table 3 below:

**Table 3**

*and Percentages of Students’ Attitudes towards Diary Writing Using*

Percentage	Frequency	Item	No.
28	I can apply the division skill easily	1	70%
23	I can solve problems better than before	2	52%
17	My writing skill is improved	3	45%
15	I loved Mathematics	4	42%
14	I can help my colleagues	5	33%
11	I can express my feeling well	6	27%
9	I can know my mistakes and misconceptions alone	7	15%
5	I can study Mathematics alone	8	15%

Table 3 reveals that students’ attitudes towards using diary writing

focused more on helping them apply the division skill subject easier 85% of the students, and the ability to solve problems better than before 70% of the students. This result seems to be logical since using diary writing gives the student the opportunity to think about how to solve the task, what is the best method to begin solving, what are the difficulties during solving, what is the degree of correctness of the solution, and this leads him to successfully acquire knowledge, which includes concepts and skills and problem solving.

Table 3 also reveals that students' attitudes towards using diary writing focused less on the region of knowing mistakes alone 27% of the students and studying Mathematics alone 15% of students. This result can be interpreted in correlation with the educational level of the third class students, who face difficulties to study alone without asking for help from the teacher or the family, because they need some skills that are essential for the students to rely on themselves to reach the self-study approach, these skills relate to the learning styles and the mastering of communication skills, such as writing and reading, which are very important skills in using diary writing in the learning process.

### **Conclusion**

Diary writing is an effective method on raising students' mathematical achievement, through increasing their level of knowledge, understanding, skills and problem solving, by using such abilities to reach the solution.

### **Recommendations**

Depending on the study results, it is recommended for:

- Teachers to use diary writing in the learning process to assess students' learning of Mathematics.
- Curriculum administrators to adopt using diary writing as an assessment tool in the Mathematics curricula.
- Researchers to conduct other studies to explore the effect of diary writing in the learning process on samples of other communities and other variables such as: thinking, motivation, and writing ability.

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# أثر استخدام " كتابة اليوميات " - كأداة تقييم- في التحصيل الرياضياتي لدى طلبة الصف الثالث الأساسي واتجاهاتهم نحوها

أ. د. محمد مصطفى العبسي<sup>1</sup>      أ. د. نافز أحمد بقيعي<sup>2</sup>

كلية العلوم التربوية والآداب - الأونروا

المملكة الأردنية الهاشمية

## الملخص

**الأهداف:** هدفت هذه الدراسة إلى فحص أثر استخدام "كتابة اليوميات" في تحصيل طلبة الصف الثالث في الرياضيات واتجاهاتهم نحوها. **المنهج:** لتحقيق أهداف الدراسة تم إعداد اختبار التحصيل في الرياضيات كما تم عرض سؤال مفتوح على طلبة المجموعة التجريبية. **النتائج:** تكونت عينة الدراسة من 68 طالباً موزعين على شعبتين، تم اختيار إحداها كمجموعة تجريبية 33 طالباً؛ تم تقييمها باستخدام كتابة اليوميات، والشعبة الأخرى كمجموعة ضابطة 35 طالباً؛ تم تقييمها بالطريقة التقليدية، **الخاتمة:** أظهرت نتائج الدراسة أن استخدام كتابة اليوميات له تأثير إيجابي في تحسين التحصيل في الرياضيات.

**الكلمات المفتاحية:** كتابة اليوميات، تقييم التحصيل في الرياضيات، الاتجاهات

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- 1 أستاذ، قسم المناهج وطرق التدريس-تدريس رياضيات، (الأونروا). **الاهتمامات البحثية:** طرق تدريس المناهج، القياس والتقويم. **إيميل:** absi702000@yahoo.com
  - 2 أستاذ، قسم علم النفس التربوي، (الأونروا). **الاهتمامات البحثية:** علم النفس التربوي، التربية العملية. **إيميل:** muneeb\_bukaiei@yahoo.com
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