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# Enriching Pre-service Teacher Education with Keeping Learning Journals

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**ABSTRACT** Investigating the integration of learning journals into a pre-service teacher education course to promote reflection was the overall goal of this study. Studies about evaluating students' journals have generally analyzed them using a holistic and general approach without examining their content and levels of reflection. This study focuses on both contents, levels of reflection, and their relationship. The participants of the study consisted of 33 senior pre-service elementary teachers. The participants were asked to produce a learning journal entry each week at the end of the Science, Technology, Society, and Environment class, in which they were asked to reflect on what they had learned. A deductive content analysis was utilized to determine the levels of reflection of the pre-service teachers' journals. Deductive content analysis was used to determine the levels of reflection of the pre-service teachers' journals. The levels of reflection of the participants were moderate and did not show a pattern of improvement over time; instead, the levels of reflection depended on the content of the related class meeting. The feedback cycle should be reconsidered for further improvement in the journals.

**Keywords** Learning Journal, Reflection, Level of Reflection, Elementary Pre-Service Teachers, Writing

## 1. INTRODUCTION

Reflective journals, which are viewed as useful learning tools (Cengiz, 2020; Moon, 2007), can support students in many ways, such as reflecting on their learning; developing thinking skills; identifying prior knowledge and learning needs; determining the appropriate learning method; monitoring progress; and gaining self-confidence (Cengiz & Karatas, 2013; Cengiz & Karatas, 2015; Kazu & Demiralp, 2012; McDonald & Dominguez, 2009; Wilson & Jan, 1993).

Moreover, in addition to descriptions of the knowledge gained from daily activities, reflective journals provide a self-analysis of students' learning and learning situations (Wilson & Jan, 1993). In this sense, while keeping their learning journals, students are prompted to think about the learning process, consider their views as they change during the learning process, and review the knowledge they have gained. As Moon (2010) points out, journaling provides favorable conditions for learning and retention, as writing about new experiences, concepts, and ideas allow students to understand better and remember them. In addition, O'Rourke (1998) notes that carefully kept journals may help students reflect and synthesize knowledge and become more aware of their learning styles. Such awareness arises as students organize their thoughts and make sense out of a situation or stimulus (Moon, 2010).

Given these benefits, Boud (2001) emphasizes the use of reflective journals as an educational tool in formal learning to improve what is done and how it is done. Moon (2010) and O'Rourke (1998), moreover, associate reflective thinking with a deep learning approach. In this regard, Kim (2005) defines reflective learning as referring to *"the process of one's purposeful and conscious activity to monitor, analysis, and evaluate one's own learning in terms of achieving learning goals, sustaining motivation, making deep understanding, using appropriate learning strategies, and interacting with peers and instructors in order to construct new perspectives of learning that directly lead to improve learning process and performance"* (p. 11).

Reflective journals are used in many different areas in higher education to achieve the above-mentioned purposes (Dyment & O'Connell, 2011). These areas cover a wide spectrum of fields, from nursing (Dubé & Ducharme, 2015; Ross, Mahal, Chinnapen, Kolar, & Woodman, 2014) and medical education (Chen & Forbes, 2014) to teacher training (Kitchenham & Chasteauneuf, 2009; Liu, 2015; Poldner, Van der Schaaf, Simons, Van Tartwijk, &

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Wijngaards, 2014). In teacher education, in particular, reflection is required to train future teachers to reflect on their actions and think about their ideas, students, curriculum, and the world they live in (Liu, 2015). In this regard, Kitchenham & Chasteauneuf (2009) point out that teachers who do not reflect cannot go beyond imitating their past teachers, peers, and environment.

Much of the existing research on reflective journals has focused on examining the level of reflection found in student journal entries (Poldner et al., 2014). Various models have been presented to determine the levels of reflection (e.g., Boud, Keogh, & Walker, 1985; Merizow, 1981; Schön, 1983). Among these, the model proposed by Merizow (1981) has been more widely acknowledged. According to this model, reflection is sorted into two main categories as non-reflective and reflective actions. Non-reflective actions are habitual, thoughtful, and introspective, while reflective activities consist of content, process, and premise (Poldner et al., 2014). Kember, McKay, Sinclair, & Wong (2008) adapted Merizow's (1981) model to reliably code and determine the levels of reflection of students' writing according to a hierarchically order as habitual action/non-reflection; understanding; reflection; critical reflection.

Looking at other perspectives, Dyment & O'Connell (2011) reviewed the literature on the quality of reflection in the journals of undergraduate students and found that many different approaches were used to determine the reflective rates; they also found that reflections made by students varied in terms of their quality. Moreover, they reported that only two out of eleven studies said high-quality student reflection, while four of the reported studies indicated minimal reflection. More interestingly, the participants in the remaining five studies did not reflect at all and described events or concepts.

Studies about evaluating students' journals have found that journals have generally been analyzed using a holistic and general approach without examining their content and levels of reflection. In this sense, Poldner et al. (2014) recommend simultaneous evaluation of the level of reflection and the scope for a more realistic and detailed analysis. Liu (2015) likewise asserts that teacher educators should focus on how what and why pre-service teachers reflect and how these reflections affect their learning and teaching experiences in the classroom.

On the other hand, few studies have been found in the literature in which pre-service teachers' reflective content and their levels of reflection were discussed together (Körkkö, Kyrö-Ämmälä, & Turunen, 2016; Lee, 2005). Yet, because reflective journals enable students to understand and transfer both cognitive and metacognitive skills (Perkins, Simmons, & Tishman, 1990), the interrelatedness of these two learning areas makes it necessary to address both the levels of reflection of students and the content on which they reflect at the same time. Determining the content on which students reflect and associating this with their level of reflection allows for a deeper understanding of the relationship between reflection levels and content. Furthermore, understanding what students choose to reflect on can enable educators to encourage them to reflect on issues they are not necessarily inclined to consider.

In this study, to enable pre-service elementary teachers to successfully negotiate meaning in a Science Technology Society and Environment (STSE) course, they were asked to keep reflective journals on the topics taught and the learning and teaching methods used in the class meetings, as well as their attitudes toward and feelings about the course (Norton-Meier, Hand, Hockenberry & Wise, 2008).

Accordingly, the following research questions were investigated:

1. What were the levels of reflection evidenced in the pre-service elementary teachers' journals?
2. What type of content did the pre-service elementary teachers focus on in their reflective journals?
3. How were their levels of reflection related to the content and the length of the journal entries?

## 2. METHOD

The study was based on a qualitative research approach, which allows for studying a subject in detail, but with fewer participants or cases. As Patton (2002) argues, carrying out a study with fewer participants enables researchers to understand a point more deeply (Denzin, 2012).

### 2.1 Setting and Participants

The participants in this study consisted of 33 pre-service elementary teachers (20 females and 13 males) in their final year of study in a faculty of education located in the Black Sea Region of Turkey. Seven participants had never kept a journal before this study; ten had tried personal journal keeping but had not sustained the effort after one or two entries. The remaining sixteen had experience keeping journals regularly for some time before the study.

**Table 1** The STSE course content

| Week | Topic |
|---|---|
| 1 | Historical Development of Science |
| 2 | Nature of science and the scientific method |
| 3 | Types of scientific knowledge |
| 4 | Scientific Knowledge, Technological Knowledge and Technological Literacy |
| 5 | The Effects of Technology |
| 6 | Atom and Atomic Models |
| 7 | Fission, Fusion, Atomic Bomb and Nuclear Energy |
| 8 | Universe |
| 9 | Solar System |

The study was carried out within the scope of a course on Science, Technology, Society and Environment (STSE). One of the researchers was the course instructor. The study was held once a week for two hours. As seen in Table 1, the course aimed to improve students' awareness of the relationship between science, technology, environment, and society by addressing the nature of science and technology and examining some socio-scientific issues through which underlying science concepts were also explored. At the beginning of the semester, the pre-service teachers were informed about the purpose of a learning journal and how to prepare one.

### 2.2 Implementation Process

The participants were asked to produce a learning journal entry each week at the end of the class in which they were to write what they had learned. They were also encouraged to add their reflections on their learning. The journal entries were collected at the end of each class. In the following class meetings, the journal entries were returned to each participant with written feedback, and a short discussion was held, with a few anonymous journal entries being read aloud.

The study continued for nine consecutive weeks of the semester. Information about keeping learning journals was presented at the beginning of the course. Then for every week of the system, they read their own and their classmates' journal entries and had a small discussion about the content of the journals and their relationship to the course objectives.

### 2.3 Data collection

The study data was from the elementary pre-service teachers' journals for nine weeks. It consisted of nine learning journals of 33 pre-service elementary teachers.

### 2.4 Data Analysis

Qualitative methods analyzed the data. Deductive content analysis (Kyngäs & Kaakinen, 2020) was utilized to determine the levels of reflection of the pre-service teachers' journals according to a rubric developed by Kember, McKay, Sinclair, & Wong (2008), which describes four hierarchical categories of levels of reflection presented in Figure 1 was adapted for this study while inductive content analysis was applied to determine the characteristics of the content of the reflections. In addition, the word counts of each journal were calculated.

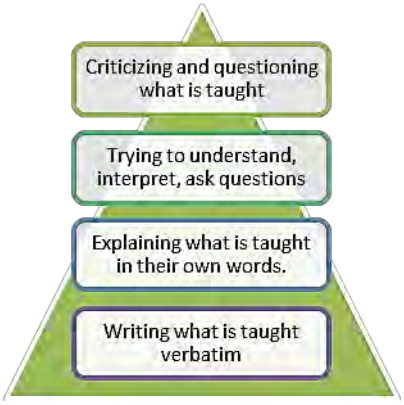


**Figure 1** Analysis rubric for the reflective journals

The journals were analyzed using qualitative data analysis software to determine the content of the reflections and the level of reflection. In the first phase of the analysis, the journals were coded by one of the researchers. To establish the reliability of the coding, a second researcher coded 30% of the journals separately, and it was determined that there was a high consistency between the two encodings. Next, in the second stage of the analysis, the codes obtained from the first stage were sorted into categories. This process was done separately by two researchers, and when the results were compared, a similarity of 90% was achieved. Finally, the researchers discussed the differences in the coding, and a consensus was reached for all codes and categories.

The journals were subjected to a second analysis to determine the length of the writings. In this stage, the number of words used in each of the participant's journal entries was counted, and then the relationship between the word counts and levels of reflection was computed by a software program.

## 3. RESULT AND DISCUSSION

The study's findings are presented in three sections: the levels of reflection in the pre-service teachers' journals, the content of the reflective journals, the relationship between the content, length, and the level of reflection.

### 3.1 Reflection levels in the journals

Considering the findings presented in Figure 2, the levels of reflection of the pre-service teachers varied from class to class. The highest number of journal entries (mode of the distribution) was identified with the level of "Explaining what was taught in their own words" when all journal entries were considered. In the 4th and 5th class meetings, in particular, the levels of reflection of the journals were higher than the mean of the other class meetings. They had more journal entries at the 3rd reflective level, "Trying to understand, interpret, ask questions." On the other hand, the proportion of items classified as "Writing what is taught verbatim" was significantly higher in the 3rd class meeting compared to other class meetings. Moreover, the percentage of those who reflected at the level of "Criticizing and questioning what is taught", which corresponds to the highest level of reflection, was zero for all class meetings except the 5th.

Moreover, as shown in Figure 3, the mean levels of reflection in the third and seventh class meetings were lower than in the other class meetings. In the fifth meeting, the mean reflection level increased significantly. On the other hand, it was determined that the pre-service teachers' level of reflections was above the mean (2.5 points) in only three of the nine class meetings (the 1st, 4th, and 5th).

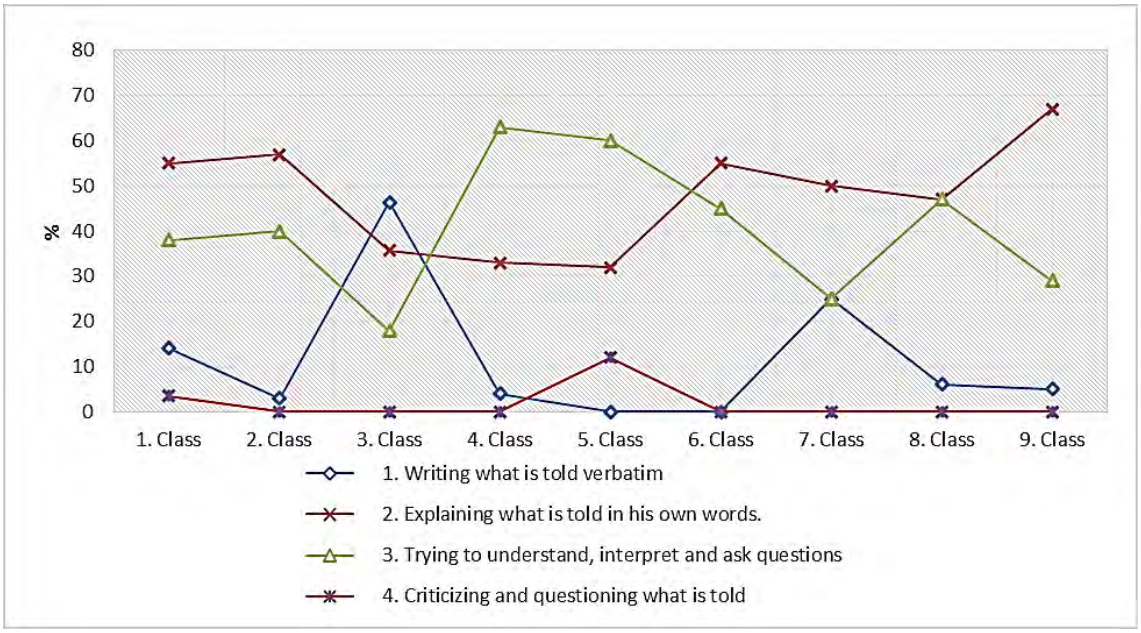


**Figure 2** Reflection level changes from one class meeting to another

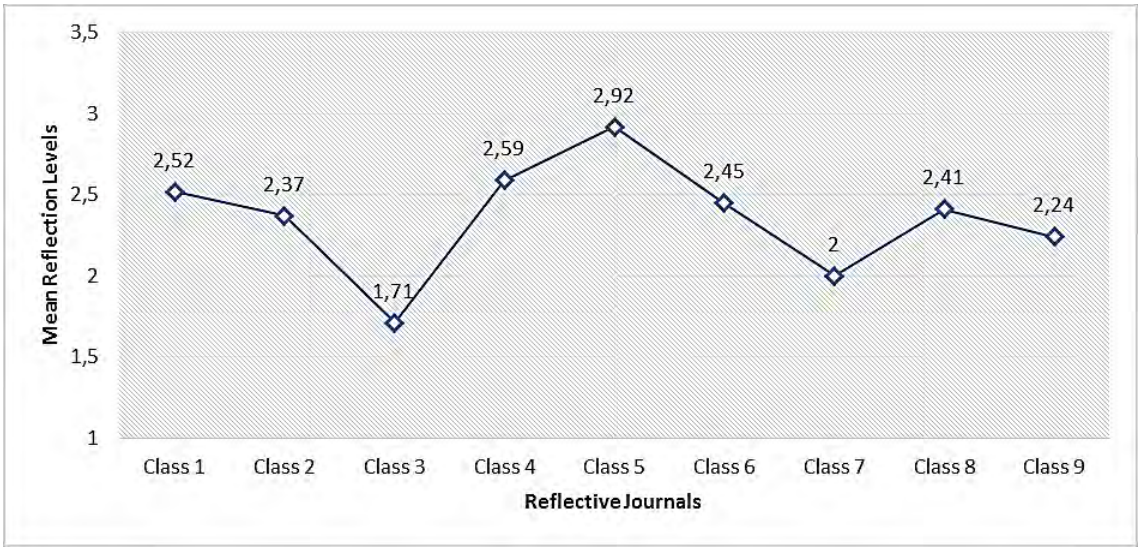


**Figure 3** The change in mean levels of reflection according to class meetings

### 3.2 Content of the journals

The analysis results regarding the reflective content of the journal entries are presented in Figure 4. In this regard, the pre-service teachers most frequently stated that they had learned new things in the classes. While the content of the journal entries varied from one class meeting to another, the expression "I learned new things" was most frequently cited in the journal entries for the fifth class. On the other hand, the highest frequency in the code "I changed my misconception/misunderstanding" was found most frequently in the second and third journal entries

As Figure 4 indicates, the third most cited phrase in all of the journal entries corresponded to the "class content statement," which includes noting what was taught in class, such as topics, concepts, principles, and so on. While expressions such as "I changed my misconception/misunderstanding" were emphasized in the 2nd and 3rd class meetings, in which science and scientific knowledge types were covered, it was seen that this expression was mentioned less frequently in the journal entries for the classes in which the harmful effects of technology, nuclear reactions, and the universe were taught**.** Furthermore, in addition to the above categories, a few journal entries also included expressions that comprised evaluations of the teaching method for the particular class meeting.

In terms of perceptions of the content, it was revealed that the participants expressed negative attitudes in the journal entries toward the class content relating to the topic of the nature of science, which was taught in the second-class meeting. However, they evidenced more positive attitudes toward the content in the ninth journal entry,

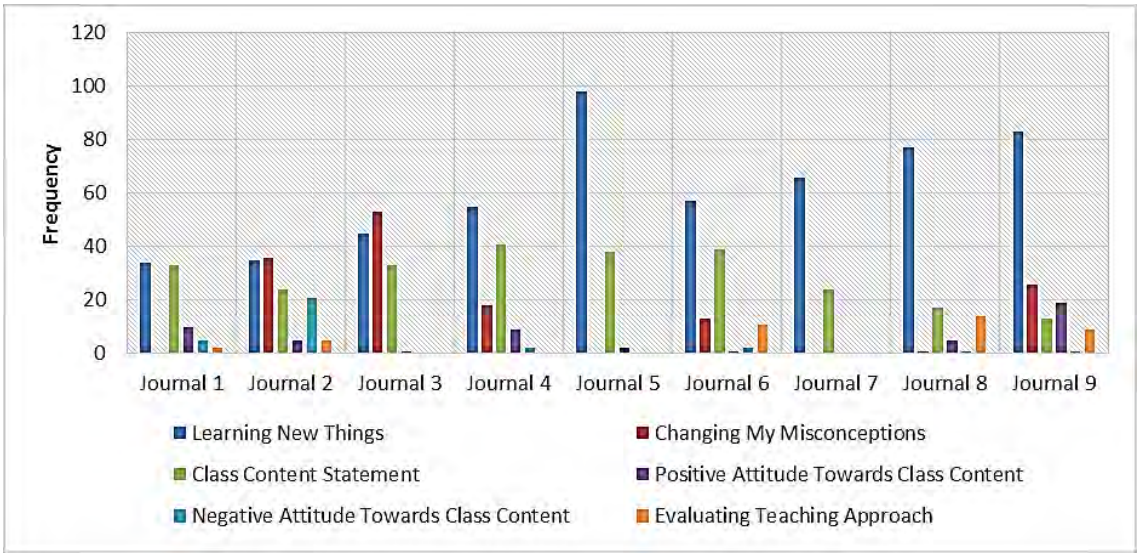


**Figure 4** The content of the reflective journals

corresponding to the solar system topic. Another point concerning these two journal entries and the associated class meetings was that the percentage of students who stated that they had gained new knowledge and corrected their misunderstandings about the topic was 35% and 35%, respectively, for the second journal entry. In contrast, the rate of students who stated that they had gained new knowledge was 83% for the ninth journal entry. Overall, no negative expressions about the class meetings were found in the journal entries where the participants indicated that they had learned new things. Moreover, as Figure 4 reveals, there were fewer instances of the pre-service teachers addressing the teaching method of a particular class and evaluating it. In this regard, the teaching approach was addressed primarily at the beginning and end of the course.

### 3.3 The relationship between journal entry length and level of reflection

The word count of a journal entry may be seen as an indicator of the richness of content and time spent writing it. As seen in Table 2, the mean word count found in the journal entries was 269, or approximately two short paragraphs – the length of an abstract for a research article. In this case, the journal entries with the highest word counts were written during the ninth, seventh, and fifth class meetings, respectively, and the entries containing the fewest words were written in the second-, third-, first-, and fourth-class meetings, respectively (see Table 2).

**Table 2** Mean of number of words in the journal entries and level of reflection per class

| Weeks | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | OMean |
|---|---|---|---|---|---|---|---|---|---|---|
| Means of Word Count | 241 | 194 | 231 | 241 | 301 | 288 | 323 | 276 | 325 | 269 |
| Level of Reflection | 2.52 | 2.37 | 1.71 | 2.59 | 2.92 | 2.45 | 2.00 | 2.41 | 2.24 | 2.36 |
| Correlation | | | | | | | | | | r= 0.05 |

**Table 3** Means of the words counts and reflection scores per individual

| Individual | Means of Word Counts | Number of Submitted Journal entries | Mean of Reflection Levels |
|---|---|---|---|
| 1 | 162 | 6 | 2.2 |
| 2 | 179 | 9 | 2.2 |
| 3 | 146 | 7 | 2.7 |
| … | … | … | … |
| 31 | 356 | 7 | 2.8 |
| 32 | 294 | 7 | 2.2 |
| 33 | 224 | 8 | 2.1 |
| Mean | 263 | 7.18 | 2.29 |
| r (Word count) | 1 | 0.012 | 0.429 |
| r (# of Journals) | | 1 | 0.333 |
| r (Reflection) | | | 1 |

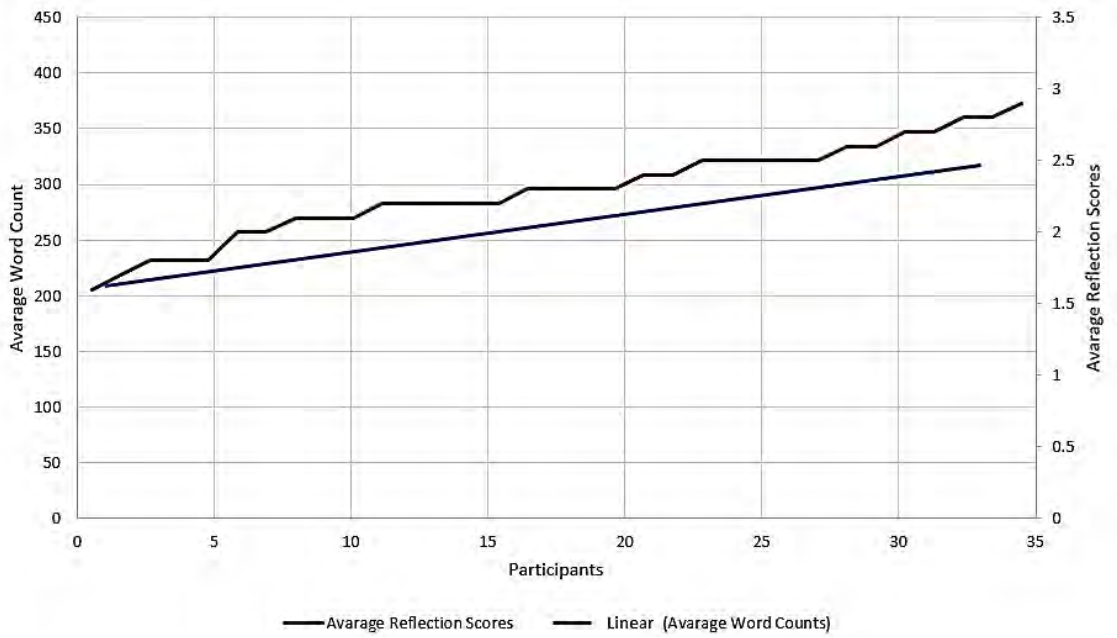


**Figure 5** Mean of the levels of reflection per individual and the linear trendline for the length of their journal entries over nine weeks

Table 2 also shows that the mean level of reflection was high in the 5th class meeting, which also yielded the journal entries with the highest word counts. However, there was an opposite trend in the 7th and 9th class meetings, where word counts were high, but the levels of reflection were lower than the mean scores. As such, it does not seem possible to infer a relationship between the level of reflection and the number of words used in the journal entries; in this respect, the correlation coefficient between the mean word counts in the journal entries, and the mean levels of reflection for each class meeting was very low ($r = 0.05$). That indicates no relationship between the length of the journal entry and the level of reflection.

On the other hand, the individual mean levels of reflection of the participants' journal entries and the associated word counts indicate a slightly positive relationship between the number of words in the journal entries and the average levels of reflection for each participant, as shown in Table 3.

Figure 5 was prepared by combining two datasets to demonstrate the relationship visually. As the figure reveals, the trendline of the mean of the word counts (the length of the journal entries) of the participants shows a fair correlation with the reflection scores, in order from lowest to highest; but there was no relationship between the number of journal entries submitted and either the word counts in the journal entries or the means of the levels of reflection.

### 3.4 Discussion

In this study, reflective journals from a group of pre-service teachers were examined regarding levels of reflection, content, and length of the journal entries. In addition, a relationship between these variables was sought. The following discussion and associated conclusions have been organized to address these issues individually.

When the journals were examined in terms of their levels of reflection, it was determined that they mainly demonstrated the second level of reflection, *explaining what is taught in one's own words*. Just a few instances, at the fourth level, *criticizing and questioning what is taught*. This may be explained by studies reporting that pre-service teachers rarely reflect at an advanced level because they have not kept reflective journals before (Cengiz & Karataş, 2016); Malthouse & Roffey-Barentsen, 2013). However, in this case, it cannot be said that the levels of reflection improved over time as the participants gained experience in journal writing (see Fig.3.). This situation is explained by the relationship between the level of reflection and the content covered in the class, as revealed by the results in Figure 1. This explanation is supported by Lee (2005) and Ross (1989).

As Yu & Chiu (2019) point out, different topics affect individuals' motivation for writing in different ways, and this causes the quality of reflection in their journals to vary. In this regard, Kizilcik, Temiz, Tan & Ingec (2007) determined that pre-service teachers were indecisive about the necessity of science education, while in another study, it was determined that pre-service elementary teachers' interest in science, technology, and social issues was at shallow level (Amirshokoohi, 2010). Considering that the participants in this study were also pre-service elementary teachers, it may be inferred that low motivation toward the class on their part may have negatively affected the quality of their writing.

Another reason that the pre-service teachers may not have reflected at the desired level is because they were only asked to provide written reflections. As Lee (2005) asserts, levels of reflection may be affected by the type of communication. Some participants may be better at a written reflection, while others perform better with verbal reflection. For this reason, Lee (2005) suggests offering participants a variety of options rather than limiting them to a single approach through which reflection will emerge.

A further explanation for the differences in levels of reflection may have been caused by the short time that the pre-service teachers had spent writing the journal entries. In this regard, they may have had insufficient time for writing due to their workload when they demonstrated low levels of reflection. Moreover, the decline in their levels of reflection in the final class meetings coincided with the period in which assignments and reports for other classes were due, also supporting this inference.

The fact that the word counts in the journals were similar to the mean reflection levels of the last few class meetings, as well as the weak relationship between the number of words and the stories of reflection, indicates that the participants tended to simply describe what was being said in the class rather than reflecting, which requires more thinking and is more time-consuming. On the other hand, it can be suggested that the context of the reflection might have affected the reflections; while this might be true, it should also be kept in mind that the context of this process was the same throughout the study (Boud & Walker, 1998).

When the journals of the pre-service teachers were examined in terms of content, it was revealed that the most frequently emphasized aspect was the knowledge they had just gained. In addition, they most often provided descriptions of the course content. In contrast, the journals' second most common type of content was statements to the effect that the pre-service teachers had corrected their misunderstandings.

In terms of attitudes toward the course content, although Hatton & Smith (1995) and Moon (2007) refer to emotions as an essential element of reflection, the pre-service teachers rarely mentioned either positive or negative views toward the content of the course. Similarly, they only infrequently referred to the teaching methods used. Although the content that the pre-service teachers reflected on was grouped under six different headings, three of these were rarely touched on in the journal entries, as stated previously. This situation indicates a lack of rich content in the journal entries. According to the Cengiz, 2020 supporting pre-service teachers with prompt questions during the journal writing process contributes to richer content and deeper reflection. With this in mind, it can be inferred that the unstructured nature of the journals, in this case, led to confusion about what to write. As O'Rourke (1998) indicates, simply telling students to keep a journal is not enough; instead, maintaining a journal should be explained. Within the scope of this study, the training provided for the pre-service teachers on how to write their journal entries may not have been sufficient.

Another factor affecting the content is that an environment of trust is necessary for students to feel comfortable evaluating themselves and their thoughts critically (Boud & Walker, 1998). In this case, it is possible that the pre-service teachers rarely mentioned their feelings and their views about the teaching of the class because they were aware that the journals would be read by the instructor (Boud, 2001); in addition, some of the pre-service teachers mentioned their concerns about their peers reading their journals (although anonymously). Savaşkan (2014) reached similar results in her study in which she examined the journal-keeping habits of pre-service teachers. On the other hand, Stephens & Winterbottom (2010) determined in their research that students did not reflect adequately on the learning process and argued that this might be related to the insufficient time given for writing. In this case, the time factor may have also affected the content.

In addition, there were fewer expressions about learning new information in the journal entries for the first three class meetings than in later entries. This situation can be explained by the fact that the pre-service teachers were getting familiar with the course in the earlier class meetings, and they had already had lessons that covered the nature and characteristics of science.

When the journal entries were examined in terms of the number of words they contained, it was determined that the entries written in the first, fifth, and ninth class meetings contained more words. In particular, the fifth and ninth journals corresponded to the class meetings in which the pre-service teachers commented most frequently that they had learned new things. On the contrary, the journal entries containing the fewest words correspond to the second-, third-, and fourth-class meetings, in which the pre-service teachers made the fewest remarks about having learned new things. On this basis, it can be concluded that the pre-service teachers generally wrote more after the class sessions in which they gained new knowledge.

In a study by Bainer & Cantrell (1993), pre-service teachers were divided into groups and enabled to teach classes that addressed different teaching areas (cognitive, higher-level cognitive, affective, and psychomotor skills). Afterward, they wrote reflective journal entries, and the word counts of their entries were examined. Their study showed that the number of words in the pre-service teachers' journals was independent of the different teaching areas. Although these findings are not consistent with the data obtained from this study at first glance, it should be taken into account that the pre-service teachers were the learners in this study, whereas they were teachers in Bainer & Cantrell (1993). As such, they had

comprehensive knowledge of the subject they were teaching. In this study, the pre-service teachers may have had a different level of prior knowledge on the topics; moreover, the issues, in this case, changed in each class meeting.

When the levels and content of the reflections by the pre-service teachers were evaluated together and linked to the related class meetings, it was determined that the reflection levels were highest after the fifth class, wherein the pre-service teachers reflected on their acquisition of new knowledge most frequently. From this, it can be concluded that the pre-service teachers reflected more effectively after the class meetings in which they felt they had learned more. In this sense, Williams, Woolliams, & Spiro (2012) contend that the subject to be reflected on should be sufficiently understood for reflection to take place.

On the other hand, in the third journal entry, where the pre-service teachers frequently included statements about correcting their misunderstandings, a lower level of reflection (writing what is taught verbatim) was identified. Although relationships between prior knowledge and new knowledge may provide an opportunity for advanced reflection, the pre-service teachers may not have been able to establish a good relationship between their new knowledge and prior knowledge within the given time; as Dyment & O'Connell (2010) point out, the time allocated for reflection may affect the reflection quality. In their view, sufficient time should be allocated to develop writing skills, especially for those who are new to the experience of reflective writing.

On the other hand, higher reflection levels were noted in the journal entries related to the class meetings in which socio-scientific issues that have greater prominence in society were taught. However, there was no exact overlap here, either. In other words, the level of reflection was not high in every class where socio-scientific issues were taught. Namely, the courses the pre-service teachers reflected at the highest level were the fifth and fourth, respectively. The topic of the fifth class meeting was "effects of technology," and the fourth lecture was on "scientific knowledge, technological knowledge, and technology literacy." When compared to the other topics covered, it was seen that these two subjects were more suitable for reflection. In this sense, the pre-service teachers produced higher quality reflections on issues for which they had less difficulty generating ideas. The number of words in the related journal entries also reflects this claim.

As seen in Table 2, in the 4th and 5th class meetings, the mean word counts per journal entry were above the general mean. The fact that levels of reflection are related to the content shows that reflection is not a skill on its own but a skill that manages the content (Yu & Chiu, 2019). Accordingly, the participants reflected well on the topics that were more recent trends related to their daily lives and consisted of new and exciting issues. Designing activities similar to Ausubel's (1978) advance organizers on topics that students are unfamiliar with may contribute to more in-depth thinking and even to considering a new subject at meta-levels. On the other hand, more research is needed to develop reflective thinking on more abstract topics and content, such as the nature of science.

The pre-service teachers' journal entries reflected at the lowest level were associated with the third and seventh-class meetings. The topics of these sessions were scientific knowledge types, fission, fusion, and atomic bombs, respectively. When compared to the issues for which the pre-service teachers' levels of reflection were higher, it was seen that they included theoretical knowledge and definitions rather than discussions and comments. As Figure 1 demonstrates, the percentage of "Writing what is taught verbatim" was higher than the other levels of reflection. Moreover, concerning the content of the related journal entries, the categories of "I learned new things" or "I changed my misconception/misunderstanding" were the most frequently mentioned. In other words, the levels of reflection remained low because the participants wrote more descriptive entries for the topics that contained new concepts and definitions. Therefore, it can be concluded that the topics' content and popularity (trendiness) affected their reflection levels (Yu & Chiu, 2019).

It was also revealed that, while the pre-service teachers demonstrated higher levels of reflection on more recent, popular, and society-wide topics and issues, more descriptive and lower levels of reflection were found concerning the more academic and theoretical topics and issues. In this respect, the pre-service teachers' lack of knowledge about science topics and concepts may have prevented them from reflecting more deeply on these subjects (Cengiz & Karataş, 2014). Considering Nguyen, Fernandez, Karsenti, & Charlin's (2014) conceptual model of reflection, underdeveloped conceptual frames, one of the core components of reflection, may yield undesirable reflection due to a lack of critical and iterative self-checks and views of change. In other words, there would be little or no comparison of previous schemata about the topic to view the self and the change of self that leads to assimilation rather than accommodation. Namely, the accommodation process of knowledge requires reinterpretation of the content and the self, leading to higher levels of reflection (Bodner, 1986).

However, considering the mean word counts in the journal entries, while the 3rd and 7th class meetings produced the lowest levels of reflection, they did not make the lowest word counts. The 7th class had the second highest mean word count (see Table 2). This situation may be misleading at first glance because descriptive writing requires less thinking than reflective writing, so more words may be written in a shorter time.

## CONCLUSION

Based on discussions, the following conclusions would be inferred:

1. Although the pre-service teachers rarely reflect at an advanced level, their reflections were at a more advanced level, where they felt they had learned more in class. It cannot be claimed that the level of reflections improved over time as the participants gained experience in keeping journals. This supports the idea that reflections are dependent on the content of the related class meeting.
2. When the journals were examined in terms of content, it was revealed that the most frequently emphasized aspect was the knowledge they had just gained. In addition, higher reflection levels were noted in the journal entries related to the class meetings in which socio-scientific issues that have greater prominence in society were taught.
3. Lastly, there was a weak relationship between the number of words and the levels of reflection. In other words, keeping a more extended journal does not guarantee a higher reflection level.

## SUGGESTIONS

Based on these findings and our discussion, we offer the following suggestions for improving journal writing for pre-service teacher education:

1. Journals may be assigned as homework in future studies to give more time for students to write them.
2. In accord with the current trend of online distance education and Web 2.0 tools, journal entries can be submitted via blogs or learning management systems so that prospective teachers can prepare them without time pressure. In this manner, they have the opportunity to share their knowledge with their peers.
3. More extensive training for keeping journals may be useful to enable greater reflection on learning.
4. In the first weeks of implementation, journal entries may not be scored to improve pre-service teachers' attitudes toward journal writing.
5. In addition to written feedback, it would be useful to provide verbal feedback on the journal entries.
6. Question prompts may be used in the journal-keeping process to increase reflection in pre-service teachers' journals and encourage them to think about specific issues.
7. It emerged that there was a strong tie between the class discussion content and the level and quality of reflection. However, further research should be conducted to elaborate and delineate the tie to contribute to our understanding of reflection and the teaching of reflective thinking.
8. As deduced from the data, expository organizers might be useful for students to reflect on the subject, especially when a new learning topic is unfamiliar. In this process, new knowledge should be linked to what the learner already knows to make the unfamiliar material more plausible to students. This also aligns with the accommodation process explained in the constructivist approach to learning (Fosnot & Perry, 1996).

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