

Prospective Science Teachers' Attitudes and Views of Using Journal Writing in the "Methods of Teaching Science" Course

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Received 30 January 2013; accepted 4 August 2014

The aim of this study was to investigate the attitudes of prospective science teachers at Sultan Qaboos University towards and their views about using journal writing in the Methods of Teaching Science course. Twenty-six prospective science teachers were asked to write about each topic in the course in their journal to show their understanding of it. In addition, they were asked to reflect on that topic. Two research instruments were used to collect the data; a scale of attitudes towards using the journal in the course and a focus group discussion. The attitude scale consisted of 29 items and its reliability coefficient was calculated by internal consistency using Cronbach's Alpha, which gave a value of 0.91. The focus group discussion was conducted with eight prospective science teachers. Both instruments were applied at the end of the course. The results of the study showed that prospective science teachers have a positive attitude towards using journal writing in the "Methods of Teaching Science" course. They cited several advantages and benefits they gained from using the journal. They are also willing to use the tool when they become teachers of science in schools after graduation. However, they highlighted some points for improving the tool in future, such as giving them examples from previous works and more feedback from the instructor. Several recommendations are proposed to enhance the use of journal writing in "Methods of Teaching Science" courses.

Keywords: Journal writing, prospective science teachers, methods of teaching science course.

INTRODUCTION

Writing as a process can be used as a way of learning in every subject and it can make the classroom more student-centered (Gammill, 2006). Written communications help students become active learners and improve their academic achievement, because they can use language to facilitate and clarify their

understanding, and to communicate what they know and do not know (Kostos & Shin, 2010). Langer & Applebee (1987) also assert that writing can help students to (1) gain relevant knowledge and experience in preparing for new activities, (2) review and consolidate what is known or has been learned and (3) reformulate and extend ideas and experiences. According to Borasi & Rose (1989), psychologists have suggested powerful connections between writing and learning.

Writing can be done either in a traditional way using handwriting or electronically. One format that allows students to experience the benefits of writing is journal writing (Fahsl & McAndrews, 2012). Journal writing is defined as a teaching/learning exercise in which students express, in writing, their comprehension of,

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doi: 10.12973/eurasia.2014.1224a

State of the literature

- Writing as a process can be used as a way of learning in every subject and it can make the classroom more student-centered.
- Journal writing is defined as a teaching/learning exercise in which students express, in writing, their comprehension of, response to, or analysis of an event, experience, or concept.

Contribution of this paper to the literature

- Journal writing is an effective tool to be used with prospective science teachers, despite the fact that it takes time and effort, according to the points of view of those sampled for this study.
- The students' positive responses strengthened the instructor's belief about the value of journal writing to make it a permanent feature of the course.
- The results of the study were consistent with relevant literature in demonstrating that journal writing has many advantages when it is used with students

response to, or analysis of an event, experience, or concept (Martin, 2000, cited in Chabon, 2012).

According to many educators and previous studies, journal writing has many advantages and benefits, such as 1) Stimulating reflective thinking among students (Dianovsky & Wink, 2012; Dymont & O'Connell, 2011; Langer, 2002; Spalding & Wilson, 2002); 2) Being an effective teaching, learning and assessment tool (Chabon, 2012; Shin, 2006); 3) Improving students' learning and communication skills (Kostos & Shin, 2010; Talyor-Haslip, 2010; Harmelink, 1998); 4) providing a means for students to develop personally and professionally (Dymont & O'Connell, 2011; Rolfe, 2006); 5) Providing valuable feedback to students, showing growth and changes in their attitudes and knowledge over a term or a semester (Bolin, Khramtsova & Saarnio, 2005); 6) It can also be used to activate prior knowledge, engage the imagination, and practice writing skills (Fahsl & McAndrews, 2012), and 7) as a tool for self-awareness and empowerment (Blumenfeld, 2010).

The journal can be written in different shapes, sizes and forms. It can also be recorded in audio, video and word processing modes. The most important things are not the shapes or the type of medium, but rather how the concepts and knowledge are designed and structured. Langer (2002) listed the following three types of journal writing.

The first type of journal writing is an "unstructured journal", which allows students to produce their own format and design. Students tend to use a free-writing format, open to a range of content and structure. The

problem with this type is that it makes it difficult for the instructor to compare a specific journal with other formats used by students in the same class, and thus makes it difficult to assess how students are reflecting and learning in groups.

The second type of journal writing is the "structured journal", which carries an imposed form of constraint regarding the manner in which it is written. Its purpose is to benefit both the instructor and student. The instructor receives information in a specific format or range of formats. This allows the instructor to compare student responses and reflections and obtain feedback on specific lessons and discussions.

The third type of journal writing is what is called a "dialogue journal", which can be used methodologically to train students' expressions and reflections. It can be seen as a vehicle for communication. Staton *et al.* (1988) describe the dialogue journal as a method for encouraging the exchange and development of ideas between two or more writers.

Researchers have identified a number of concerns or difficulties with journal writing with students, especially those studying in higher education. The first concern is related to the training that students are provided with by their instructors. O'Connell & Dymont (2003) point out that an overarching reason for the poor quality of reflection in journals is that many instructors fail to provide adequate training to their students to help them write journals effectively. The second concern is that many educators do not actively confront the potential pitfalls of using journal writing as pedagogical method (Dymont & O'Connell, 2011). The third concern is related to the feedback that instructors give to students. English (2001) argues that instructors usually read personal revelations written by students, assigning a grade based on them and not allowing adequate time for feedback.

The purpose of the current study is to investigate prospective science teachers' attitudes towards using journal writing in the "Methods of Teaching Science" course. The study focuses on the following two research questions:

- *What are the prospective science teachers' attitudes towards using journal writing in the "Methods of Teaching Science" course?*
- *What are the prospective science teachers' views about using journal writing in the "Methods of Teaching Science" course?*

METHODS

The Participant

Twenty-six prospective science teachers participated in the study. These teachers were enrolled in the science education program at the College of Education (Sultan

Table 1. Type of attitudes in relation to the range of average mean

Range of Average Mean	Type of Attitudes
4.21 – 5.00	Strong positive attitude
3.41 – 4.20	Positive attitude
2.61 – 3.40	Neutral
1.81 – 2.60	Negative attitude
1.00 – 1.80	Strong negative attitude

Qaboos University), and in their fourth year. The main aim of the program is to prepare Omani science teachers in three science majors (biology, chemistry and physics) to teach grades 5-12. Two teaching-methods courses were offered to prospective science teachers in the third and fourth years of their study. Each course involves two contact hours for theory and another two contact hours to practice what students have been taught in the theory part in peer teaching settings (i.e. microteaching). Journal writing was introduced in the "Methods of Teaching Science (II)" course. Student teachers were asked after each topic to write about that topic in a form that suited each student and to reflect about the topic.

Journal Writing

The current study used the "unstructured" type of journal. The prospective science teachers were asked at the beginning of the course to have a classic, leather-bound book to be used as a journal. This book was used by the prospective science teachers to write, in any form or design they liked, about the topics they covered in the course. They were given the freedom to use any forms or types of journal writing including graphic organizers, story writing, role-playing techniques, question and answer methods and other forms. This approach aimed to develop creativity among the student teachers. They were also encouraged to use color in their writing to highlight parts of their writing.

The prospective science teachers were asked to reflect on each topic after they wrote about it. The reflection part is very important as it indicates how important the topic is, how the teachers can cover it in the classroom and what modifications to the teaching method could be suggested. Dymont & O'Connell (2011) argue that a written journal can serve as a vehicle for reflection before, during and after a learning experience.

The reflection part was not only used after each topic but also for the whole process of journal writing. The reason for this was to help the instructor of the Methods of Teaching Science course on how to improve the use of this tool in future.

The Attitude Scale

The main instrument used to gather data about using journal writing in the teaching methods course was the attitudes scale. The scale consisted of 29 items, divided into 17 positive items and 12 negative items. The items dealt with two domains. The first domain was the "importance and benefits of journal writing" and the second domain was "enjoyment and interest of using journal writing" as a tool in both the "Methods of Teaching Science (II)" course and in teaching science as a whole. The prospective teachers were asked to indicate the degree of their agreement using a five-point Likert scale: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree.

Specialists in science education at the College of Education in Sultan Qaboos University were asked to assess the items in the scale in terms of their clarity and suitability for the purposes of the study. The referees' comments and suggestions led to the rephrasing of some items. The reliability of the scale was assessed in terms of internal consistency using the Cronbach's Alpha reliability coefficient. The reliability value of the scale was 0.91, which indicated that the present scale was consistent and reliable for collecting the data needed for the current study. The scale was administered to the prospective science teachers at the end of the course (December 2012).

The positive items were given the values of: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree, whereas the negative items were given the opposite values: (5) strongly disagree, (4) disagree, (3) neutral, (2) agree, and (1) strongly agree.

To identify the types of attitudes among prospective science teachers towards using journal writing in the "Methods of Teaching Science" course, a scale of the average mean was used (Table 1).

FOCUS GROUP DISCUSSION

The aim of the focus group discussion was to investigate prospective science teachers' views on using journal writing in the "Methods of Teaching Science (II)" course. Regarding this type of research tool, Cohen, Manion & Morrison (2000) point out that the focus group is a growing tool in educational research

and it is a form of interview, though not in the sense of a conversation going backwards and forwards between interviewer and group; rather, the reliance is on the interaction within the group, who discuss the topic supplied by the researcher (Morgan, 1988). Five questions were discussed with a sample of eight prospective science teachers. These questions were:

- *What do prospective science teachers think about using journal writing in the “Methods of Teaching Science (II)” course?*
- *What are the advantages of using journal writing in the “Methods of Teaching Science (II)” course?*
- *What are the difficulties that prospective science teachers face when using journal writing in the “Methods of Teaching Science (II)” course?*
- *How can we improve the use of journal writing in the “Methods of Teaching Science (II)” course?*
- *Would you, as future science teachers, use journal writing with your students at school?*

The focus group was conducted at the end of the course to ensure that the prospective science teachers were fully aware of the reasons behind introducing such a tool to the course.

RESULTS AND DISCUSSION

Attitudes towards Journal Writing

To identify prospective science teachers' attitudes towards using journal writing in the “Methods of Teaching Science (II)” course, the average means and standard deviations of each item were calculated.

Table 2 shows that item number 12, “*At the beginning of the course, I found it difficult to write my journal*”, has the highest mean value (M=4.31) of all the items. This is due to the fact that these students had never faced such types of activities in any course during their study at Sultan Qaboos University, where a lot of thinking and creativity are required. The existing literature, according to Langer (2002), has found that students initially tend to find the use of journals uncomfortable or have difficulty understanding why it is required. However, these difficulties disappear as they continue to do the activity for each topic of the course. The item that has the second-highest mean value is number 2, “*Journal writing helps me to review the topics of the course*”, with a mean value of 4.27. This item indicates one of the important advantages of the journal. As students write in a form that suits them for each topic, they actually do some sort of revision of the topics. This process results in an increase in the revision done for the final exam and less anxiety among the prospective science teachers about passing the course. Items 5, “*Journal writing develops creative skills among students*” and 1, “*Journal writing helps the student to present his point of view without being confrontational*”, come third in order of highest mean values among other items

in the scale, with a value of 4.19. Again, these items reveal some advantages that prospective science teachers acquire from using journal writing. Developing creative skills among students is one of the emerging issues that science educators have highlighted. When such skills have been developed among teachers, these skills will be transferred to their school students (Al-Muqemmi, 2012). Some students are afraid or shy when presenting their work or in showing their understanding in front of their teachers or colleagues. They might think that if they make mistakes their teachers will punish them or that they will be laughed at or hear bad comments from their colleagues. Journal writing may help to overcome such problems (Doll *et al.*, 2008), as students can present or show their understanding of the topic in any form of writing they like. In journal writing, teachers can ‘hear’ their students in different forms (Blumenfeld, 2010).

The prospective science teachers had neutral attitudes towards some items, such as number 27, “*Journal writing facilitated my revision for the final exam of the course*”, with a mean value of 3.04. Prospective science teachers could not come up with a decision about their attitudes towards whether this technique or tool would facilitate their revision for the final exam. This may be due to that fact that journal writing is new for them and they have only been exposed to it for the first time in this course. The same reason could be used to explain the prospective science teachers' response to item number 26 “*I would like other instructors to use the idea of journal writing in their courses*”, which had a mean value of 3.19. It is important to apply the idea in other courses in order to enable students to have a fully clear picture about the tool and its advantages.

It seems that the instructor of the course did not give adequate feedback to students about their journal. For this reason, item number 11, “*The journal writing that I did during the course provided me with feedback about my work for the course*”, received the lowest mean value of all the items in the attitude scale (M=2.62). This relates to one of the concerns about journal writing stated by English (2001). A previous piece of research by Peyton & Reed (1990) has shown that the commentaries (i.e. content-based feedback) that typically accompany journal writing are beneficial for the effective development of language among students from primary to university level. Giving students adequate and constructive feedback for their journals is very important if we are to use the journal as an effective teaching and learning tool.

The overall mean of the scale is 3.64, which indicates that prospective science teachers generally have positive attitudes towards using the journal-writing tool as part of the “Methods of Teaching Science (II)” course. There are many reasons for these results. One of them is related to the benefits for prospective science

Table 2. Mean values and SD for each item of the scale

No	Item	Mean	SD	Type of Attitudes
1	Journal writing helps the student to present his point of view without being confrontational.	4.19	0.98	Positive
2	Journal writing helps me review the topics of the course.	4.27	0.96	Strong Positive
3	Journal writing saves time.	4.00	1.32	Positive
4	Journal writing helps with monitoring the progress of the course topics.	3.88	0.63	Positive
5	Journal writing develops creative skills among students.	4.19	1.06	Positive
6	I like writing a journal as part of other courses, in a similar way to what we did on the Methods of Teaching Science (II) course.	2.58	1.33	Neutral
7	Journal writing developed my writing skills.	4.04	1.32	Positive
8	Journal writing helps me to manipulate the course topics in different ways.	4.00	0.63	Positive
9	I enjoyed writing about the teaching methods course in my journal.	3.58	1.37	Positive
10	I will encourage my future school students to write journals.	3.81	1.39	Positive
11	The journal writing that I did during the course provided me with feedback about my work for the course.	2.54	1.30	Neutral
12	At the beginning of the course, I found it difficult to write my journal.	4.31	0.78	Strong positive
13	Journal writing developed my language skills.	3.62	0.85	Positive
14	Journal writing helps students share the ideas that they have about the course topics with other students.	3.62	1.06	Positive
15	I will use the idea of journal writing notes when addressing various topics in daily life.	3.65	1.38	Positive
16	Journal writing developed my ability to use colors in an attractive way.	3.42	1.30	Positive
17	The instructions that I was given at the beginning of the course did help me to write my journals.	3.58	1.63	Positive
18	Journal writing helps improving learning process.	3.96	0.79	Positive
19	I benefitted from the feedback that was provided by the instructor to improve my journal writing.	3.58	1.65	Positive
20	The use of illustrations in the journal will help the transfer of ideas to others.	4.12	1.03	Positive
21	Journal writing helped me to improve my reflective skills.	4.00	1.49	Positive
22	Journal writing made me love the Methods of Teaching Science (II) course.	3.00	1.26	Positive
23	I will encourage my colleagues in different disciplines to write journals for the courses they study.	3.46	1.27	Positive
24	Journal writing raised my motivation for reading more in the "Methods of Teaching Science (II)" course.	3.58	0.808	Positive
25	Journal writing develops students' higher-order thinking skills such as analysis, synthesis and evaluation.	3.73	0.919	Positive
26	I would like other instructors to use the idea of journal writing in their courses.	3.19	1.47	Neutral
27	Journal writing facilitated my revision for the final exam of the course.	3.04	1.46	Neutral
28	Journal writing can be employed in other aspects of teaching science such as the laboratory.	4.16	1.37	Positive
29	In general, I like writing journals.	3.46	1.36	Positive
	Scale total	3.64	1.30	Positive

teachers, including saving their time while revising the course topics. Secondly, it develops many skills such as reflectivity, creativity, writing and language skills. The third reason for why prospective science teachers are motivated to write good journals and to have positive attitudes could be due to the fact that they may receive good marks for the course if they write good journal. 15% of the marks for the course were assigned to the journal. Studies by Dymont & O'Connell (2010) and Creme

(2005) found that some students are motivated by their grades to write good journals.

Regarding the answers to the four questions that prospective science teachers were asked during the focus group discussion, their answers were very valuable in directing journal writing in the future. Prospective science teachers were very happy with the idea of journal writing. They see the idea a very interesting and helpful tool in understanding the topics of the

“Methods of Teaching Science (II)” course. They listed several advantages of using journal writing in the course, such as helping them to revise the course contents, developing their creative skills, enhancing their thinking skills (especially the higher order thinking skills), engaging their interest while they worked on it and finally the idea of reflection in the journal.

Some prospective teachers point out that journal writing is more suitable to female students than males. They thought that female students generally like spending their time doing their work in a fashionable way by applying different types of drawing and colors. This point may need more investigation in the future.

However, although there are so many advantages to using journal writing, the prospective science teachers highlighted some difficulties. The first difficulty is that journal writing requires more time from them compared to asking them to write an essay about the topic for example. This is in line with Langer’s (2002) study. Prospective teachers can be overloaded with work from other courses they are studying concurrently with the “Methods of Teaching Science (II)” course. In addition, at the beginning of the course they could not do it in a creative way as this was the first time this tool had been introduced to them. They acquired the necessary skills as they were continuously writing journal entries for each topic during the course. Thus, their work became more creative and critical.

Regarding how to improve journal writing in the “Methods of Teaching Science (II)” course, prospective science teachers highlighted several points, such as giving students opportunities in the lectures to write their journals and not only setting them as homework. The reason for this would be to receive instructor and peer or colleague feedback and comments immediately, when the ideas are still fresh in their minds. Secondly, they need continuous support from the instructor, some sort of constructive feedback. In line with this, the study

by Abbas & Gilmer (1997) promotes the role of instructors as active facilitators in the journal-writing process. Finally, because it was the first time they had used such tool, they felt they need examples, samples or templates from the instructors or examples from the work of previous students. This point is highlighted by Johns (1994), who points out that a template provided by the instructor will help in providing guidance on developing and utilizing the journals. Constantinou & Kuys (2010) are in agreement with Johns (1994) about the importance of providing students with formats and templates to write their journal, especially in the early phases of learning. However, there is an argument against this: if the instructors provide a template for everything in the journal then students’ creativity in the journal will be at risk.

The final question was about whether the idea of journal writing can be transferred and applied in a school setting. Prospective science teachers were very enthusiastic about the idea and said that they intended to use it with their school students in the future. Langer (2002) emphasizes the importance of taking material or ideas learned in the classroom and understanding their application in the workplace. Prospective science teachers are willing to take the idea of journal writing to schools and highlighted the importance of the necessity for the simplicity of the journal the first time and its gradual implementation by the teacher in the classroom.

TYPES OF REPRESENTATIONS

Prospective science teachers used different types of representations to show their understanding of the topic content. At the beginning, prospective science teachers used simple types of representations, such as drawing simple concept maps or just boxes with some words or items on them. However, when the prospective science teachers became more involved, their representations of

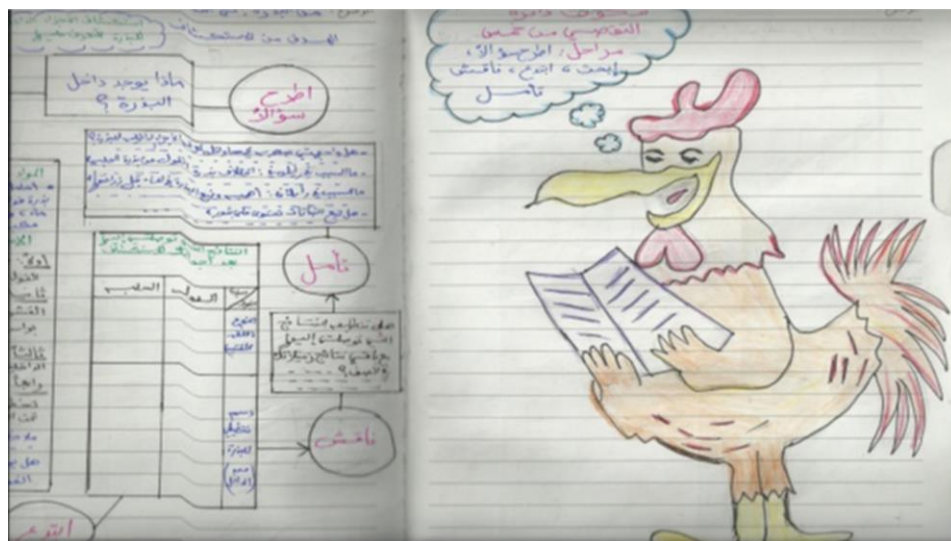


Figure 1. Student teacher (S1)’s representation of the inquiry cycle method of teaching science.

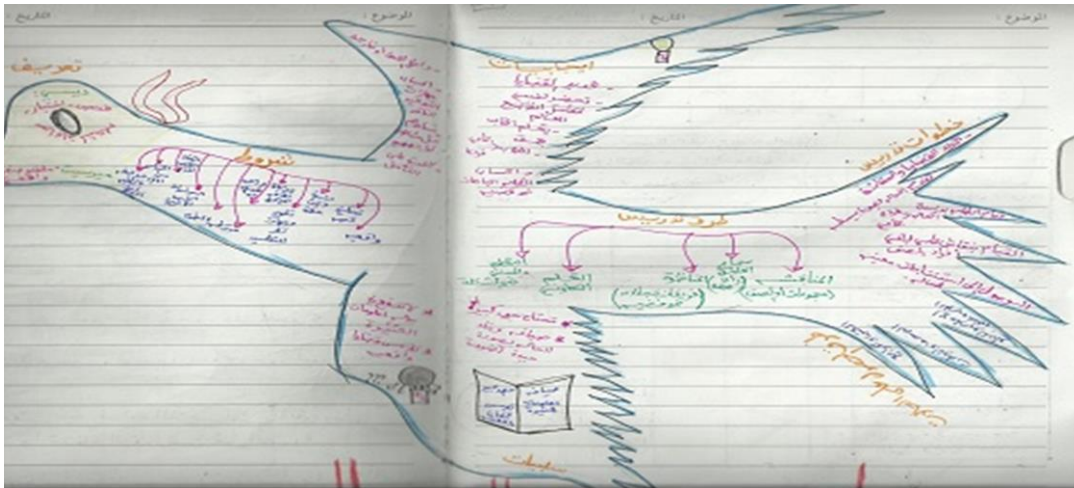


Figure 2. Student teacher (S2)'s representation of the 'case study' method of teaching science

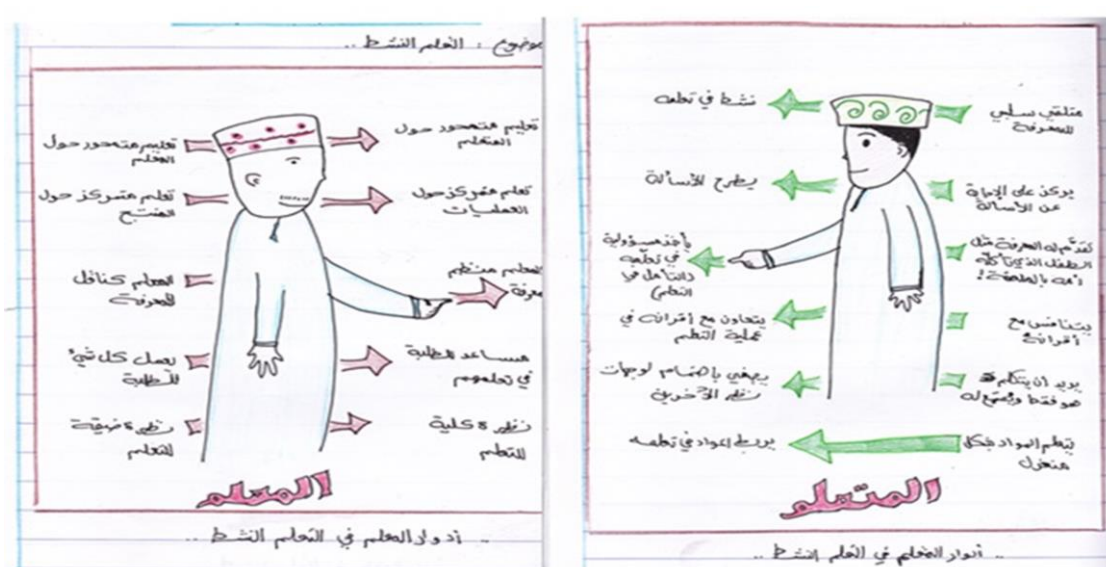


Figure 3. Student teacher (S3)'s representation of the role of teacher and student in active learning

the topics' content became more creative. For example, some prospective science teachers used concept cartoons, as in Figure 1. In this Figure, the student teacher (S1) used a cartoon to represent her understanding of the inquiry cycle. The cartoon is a picture of a hen asking about the components of the inquiry cycle and the answer to the inquiry was represented in boxes with examples from the Omani science curriculum about what is found in the seed of the plants.

In Figure 2, another prospective science teacher (S2) also used cartoons of a bird. In this cartoon, a student teacher represented her understanding of the 'case study' as a teaching method. She put the definition of the method in the head of the bird. Then, she distributed the rest of the content in the different parts of the body. The reader can fully understand the topic from the drawing that the prospective science teacher used to represent her understanding of the 'case study' method of teaching science. In Figure 3, another

prospective science teacher (S3) used a simple cartoon based on male Omani characters to represent the role of both the teacher and the student in an active learning environment. The drawing on the left side of the picture shows the role of the teacher whereas the drawing on the right side of the picture shows the role of the student. Here we can see the importance of connecting the teaching and learning of science with the prospective science teacher and society. In Figure 4, a student teacher (S4) used the symbol from the same topic that she studied in the "Methods of Teaching Science (II)" course. The topic was about accelerating learning and in this topic student teachers were taught about the two sides or parts (left and right) of the human brain and their roles in the learning process. She used the human brain to represent functions or responsibilities of each half of the brain in the learning process. This idea indicates that the student teacher thought creatively when she presented her writing in the journal. This topic was taught to students around the

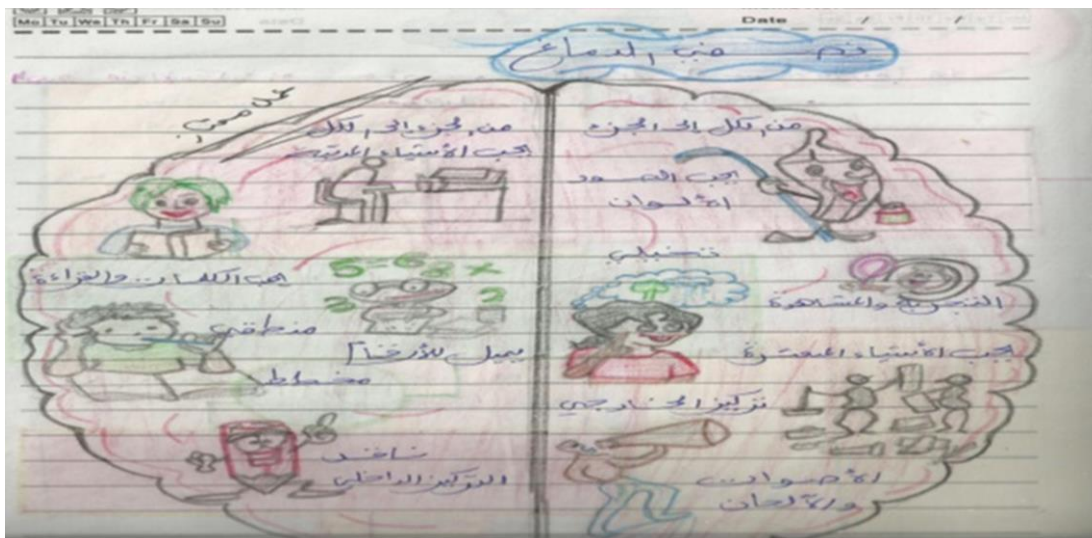


Figure 4. Student teacher (S4)'s representation of the functions of each half of the brain in the learning process

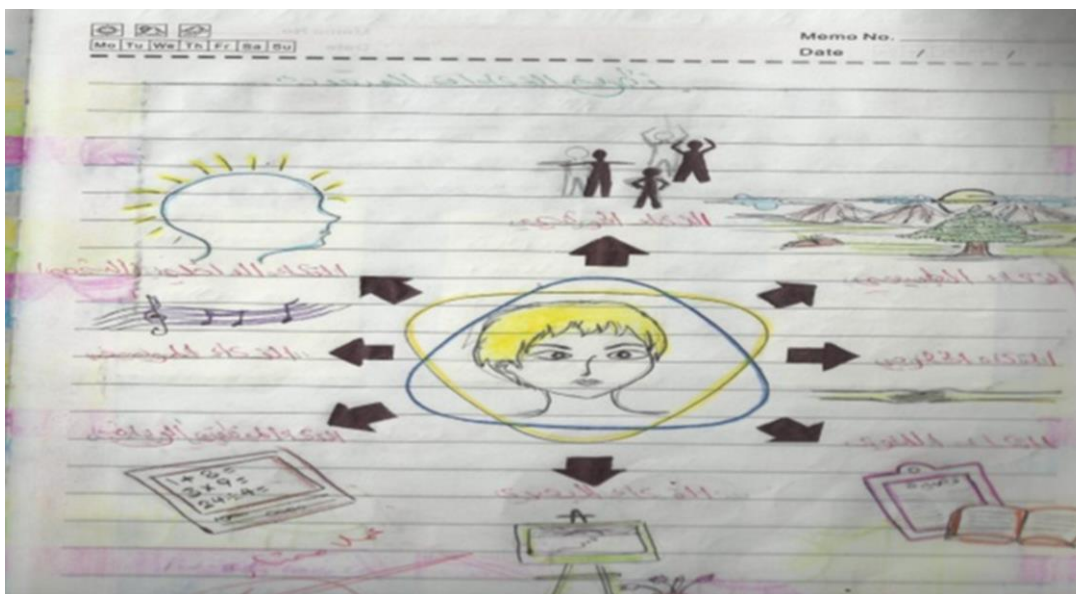


Figure 5. Student teacher (S5)'s representation of Multiple Intelligence

middle of the semester. Student teachers at this point had written on many topics in the course, which allowed them to acquire the skills to present their work in a creative manner.

In Figure 5, a student teacher (S5) used a creative drawing to represent the Gardner Multiple Intelligence Theory (MI). She drew the human body in the center of the diagram with the eight intelligences posted around it. Each type of intelligence was represented by a symbol that reflected its content. For example, linguistic intelligence was represented by a book whereas naturalist intelligence was represented by trees and mountains. This way of presenting the eight types of intelligences might help student teachers to easily connect, in their minds, what each type of intelligence entails.

Students' Reflections

Another aim of using the journal-writing tool in the “Methods of Teaching Science (II)” course was to train prospective science teachers to reflect on what they do, either on their practical life as students, or as teachers in the future, or on their daily life activities. The use of reflective journal writing can stimulate reflective thinking (Doll *et al.*, 2008; Splading & Wilson, 2002). Langer (2002) asserts that it is evident in the literature that the use of learning journals facilitates critical reflection, particularly as it assists students in conceptualizing abstract meaning and relating it to actual practice.

Prospective science teachers were asked to reflect upon what they wrote in their journal. At the beginning of this process, the reflection was simple and only focused on what benefits the topic (i.e. teaching method) gave them in their career. After that, and due to the feedback from the instructor and continuous writing in the journal, the reflection process became more in depth. Prospective teachers reflected on the topic from different angles, including the benefits they gained from the topic (the teaching method and approaches), the difficulties they faced when applying it in a real classroom and how they could improve it to overcome these difficulties. When discussing the process of reflection with prospective science teachers, they mentioned that they gained skills of reflection and now they practice such skills even in their daily lives.

IMPLICATION AND RECOMMENDATIONS

Journal writing is an effective tool to be used with prospective science teachers, despite the fact that it takes time and effort, according to the points of view of those sampled for this study. The students' positive responses strengthened the instructor's belief about the value of journal writing to make it a permanent feature of the course. The results of the study were consistent with relevant literature in demonstrating that journal writing has many advantages when it is used with students. In the current study, prospective science teachers found that using journal writing in the "Methods of Teaching Science (II)" course has several advantages, including helping them to organize their knowledge, revise for exams, and acquire creative and reflective skills. The results of this study show the importance of an instructor's feedback to student journals. If the instructor does not provide students with adequate guidance or facilitation on how to produce journals we cannot expect good journals that reflect students' understanding of the course content. Borasi & Rose (1989) assert that as teachers become readers of their students' stories in the journal, they can in turn become better teachers in more than one way. This idea can also be transferred to other courses and subjects at both university and school levels. Prospective science teachers were enthusiastic to use the tool with their school pupils when they graduate from the university and enter the world of work. They would start by doing this gradually and in a simple form. The current study recommends that university and school teachers use this tool with their students and conduct more research into the effects of such a tool on students' achievements and other educational variables, such as students' attitudes towards science, teaching science, or their motivation.

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