



International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

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To cite this article:

Izgi, U., & Basar, S. (2015). The views of pre-service teachers about the use of concept cartoons in science courses. *International Journal of Contemporary Educational Research*, 2(2), 61-68.

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The Views of Pre-Service Teachers about the Use of Concept Cartoons in Science Courses

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Abstract

The content of the science course include facts, concepts, principles and generalizations, theories and natural laws. Concepts refer to similar objects, human beings, events, views and processes. Concept learning is the basis for cognitive development. In recent years the following topics related to the science course have frequently been studied: conceptual development, teaching of concepts, concept maps, misconceptions, and conceptual change and concept cartoons. Concept cartoons were developed by Brenda Keogh and Stuart Naylor in the 1990s. Concept cartoons are visual teaching tools which allow for discussion of a scientific event through caricatures and which provides different perspectives about the event at hand. The aim of the study is to reveal the views of the pre-service science teachers about the use of concept cartoons in science teaching. The participants were senior pre-service teachers attending the science teaching division of Hacettepe University during the academic year of 2014-2015 and they all took the courses of special teaching methods I and special teaching methods II. The data of the study were collected through semi-structured interviews in which five open-ended items were asked to the participants. The data obtained were analyzed through content analysis method. Based on the findings of the study the effects of the use of the concept cartoons in science course on the teaching process were discussed based on the views of the pre-service teachers. Several suggestions were developed concerning the improvement of the efficacy of concept caricatures.

Key words: Science education, pre-service teachers, concept cartoons

Introduction

In recent years it is widely agreed that traditional education cannot produce graduates with the desired qualification as a result of the advanced technology and accumulated knowledge. Therefore, those educational approaches which support active learners and learning by doing and which emphasize the higher thinking skills of individuals have begun to be used. In parallel to these developments the constructivist educational approach was introduced in Turkey in 2004. This approach argues that new knowledge can be based on previous learning and that learners should be active participants in teaching and learning process. It was employed in revision of the educational programs.

The teaching and learning process of the science course is regarded as significant. Because only through science knowledge individuals could make sense of environmental changes and developments and provide a logical framework for them. The science education program in Turkey was last developed in 2013. The ultimate goal of the program is to produce individuals who are science literate. Several qualities can be covered by the science literate. However, it mainly refers to those individuals who search for the changes in his environment, have higher levels of thinking and skills of scientific processes, are active participants of their learning, could make connections between their learning and daily life and are responsible for their learning. Various teaching and learning techniques are employed to make the individuals active in the teaching and learning process and to allow for them to acquire the desired knowledge and skills. One of such techniques is the concept cartoons.

Concept cartoons were developed by Brenda Keogh and Stuart Naylor in the 1900s and are based on the constructivist approach. These cartoons are designed to probe the views of the students about a science concept. In such cartoons the elements of humor are not used. Instead, these cartoons include different characters arguing about the answer to a question or debating alternate explanations of scientific phenomena. If there is a debate

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about alternate explanations of scientific phenomena, one of the arguments represents scientifically correct view and the others represent scientifically incorrect, but are held by students (Akamca and Hamurcu, 2009). Concept cartoons encourage students to think about a science concept and allow for them to actively take part in the learning process as well as provide a connection with the evaluation of learning (Keogh and Naylor, 2009). Students easily become interested in these cartoons which can be used as a teaching material.

Research suggests that concept cartoons are used as creative and complementary teaching tools in science education. The use of concept cartoons has become widely employed teaching and learning approach which may be used in different domains of learning (Dalacosta, Kamariotaki Paparrigopoulou, Palyvos and Spyrellis, 2009). In addition to be used for students, concept cartoons can also be used to improve the pre-service teachers' perspective regarding the teaching strategies that can be employed in science education. Because concept cartoons highlight the student misconceptions and reveal how they are active in questioning of their own ideas. Concept cartoons have been used as a complementary assessment technique in assisting pre-service teachers to control their science education perspective (Keogh and Naylor, 2000). Related studies show that concept cartoons are used to evaluate the comprehension levels of pre-service teachers about science concepts and topics in science and technology education (Chin and Teou, 2008; cited in: Dalacosta, Kamariotaki Paparrigopoulou, Palyvos and Spyrellis, 2009). On the other hand, it is argued that concept cartoons contribute to improve students' skills of problem-solving, critical thinking and producing scientific ideas and that these cartoons make the topic at hand much more interesting (Keogh and Naylor, 1999).

Statement of the problem

The research question which the study tries to answer is as follows: What are the views of the pre-service science teachers who took the courses of special teaching methods I and special teaching methods II about the use of concept cartoons in science education?

Based on this research questions during the interviews the participants of the study were asked to answer the following five open-ended questions:

1. Do you think that the use of concept cartoons in science education contribute to student learning? Why?
2. At which stages can concept cartoons be used in science course? Please give details of this use.
3. Do you think that concept cartoons are much more influential in determining and reducing student misconceptions in science course in contrast to other techniques such as concept maps, conceptual change sheets, etc? Why?
4. How can the efficacy of concept cartoons be improved?
5. What are the limitations in using concept cartoons in science course?

Method

The study is designed as a case study. Case studies can be carried out using either quantitative or qualitative approach. Regardless of the approach adopted the goal of case studies is to describe a situation. In other words, case studies examine the related factors such as environment, individuals, events and processes about a situation using a holistic approach and focus on the effects of these factors on the case at hand. Given that each case has its own peculiarities the results of the case studies cannot be generalized. On the other hand, these studies may provide necessary examples for other case studies which are carried out in similar situations (Şimşek and Yıldırım, 2006). In the study the data were collected through structured interviews, part of qualitative research technique.

Participants

A total of 53 senior pre-service science teachers participated in the study. They were attending Hacettepe University during the academic year of 2014-2015. They took the courses of special teaching methods I and special teaching methods II in which they were studied and informed about concept cartoons.

Data collection tools

The data of the study were collected through structured interviews in which participants were asked to answer five open-ended questions. The items were reviewed by a measurement-evaluation specialist and a field

specialist in terms of content and coverage validity. Furthermore, the items were reviewed by a group of pre-service teachers who did not participated in the study in terms of understandability. Based on the feedbacks these items were finalized.

In scientific research validity and reliability are two significant points (Şimşek ve Yıldırım, 2000). In the study necessary analyses for validity and reliability were made. In terms of internal validity of the study it can be stated that the findings of the study were found to be significant in the framework of the study context and that these findings were interpreted based on this specific context. Consistency and significance of the findings were continuously checked. The concepts revealed were found to have common peculiarities. The findings obtained were found to be related to the conceptual and theoretical framework followed. As stated earlier, the generalization of the case study results is not so strong and therefore, their external validity is weak. However, the results could be extended to those case studies carried out in similar situations (Şimşek and Yıldırım, 2000). The findings of the present study could be tested in other case studies. In regard to its external reliability necessary explanations were provided about the data collection process, data processing process, the interpretation of the findings and the conclusions. The findings are related to the data obtained. It is stated that concerning internal reliability researcher should describe the research approach adopted and controls made at different phases of the study in a clear manner (Şimşek and Yıldırım, 2000). In regard to the internal reliability of the current study it can be stated that the research questions were explicitly given and explained. Therefore, the data obtained supported the findings of the study.

Data analysis

Miles and Huberman (1994) argue that the process of data analysis is made up of three components: data reduction, data display and drawing conclusion and verification. During the data reduction researchers review and code the data they collected. In the coding process significant concepts and themes are used to choose those data which are significant.

The data then are displayed through graphics, tables and figures. For Miles and Huberman visualization of the data is very important in that it makes explicit the interrelations between concepts and between themes and it allows for reaching conclusions based on these concepts and themes.

In the final phase of the process, drawing conclusion and verification, the concepts, themes and relationships emerged are interpreted, contrasted and confirmed. Thus, the findings obtained become significant and valid.

The data collected were analysed following the data analysis process outlined by Miles and Huberman (1994). In the data analysis process the content analysis was employed and the frequency of the statements by the participants was found. In the discussion of these findings direct quotations were given to support the findings. Each quotation is followed by a code in brackets indicating the related pre-service teacher and the number given, such as (PSTX).

Results

The findings obtained in the study are discussed in this section and are given in the following tables.

In regard to the first item asked in the structured interviews, “Do you think that the use of concept cartoons in science education contribute to student learning? Why?”, Table 1 shows the views of the pre-service teachers about the contributions of concept cartoons in the teaching and learning process together with frequencies.

The answer of the participants to the question “Do you think that the use of concept cartoons in science education contribute to student learning? Why?” was positive and they all stated that the use of concept cartoons in science education contributes to student learning. Concerning the reasons for this contribution they mostly stated that concept cartoons provide long-lasting learning, avoid misconceptions and improve higher thinking skills of individuals. The following statement shows these ideas: “*Concept cartoons will allow children to learn and have fun in course. Moreover, these cartoons provide them with an opportunity to express their new ideas.*” (PST 31); “*Concept cartoons reduce students’ misconceptions and provide them with an opportunity to think critically. In addition, these concepts may provide an environment for productive discussions and for view exchange among students. If concept cartoons are used as an activity based on argumentation the higher thinking skills of students may be improved*” (PST 12); “*I think concept cartoons will contribute to the student learning. Through concept cartoons students learn with fun and with examples from daily life, making their learning long-lasting and significant.*” (PST 26).

Table 1: Views of the participants about the contributions of concept cartoons in the teaching and learning process and frequency

Views	f
Yes, I do. Because	
Cartoons test the previous knowledge of the students	2
Cartoons make it easy to teach concepts	3
Cartoons provide effective teaching	3
Cartoons provides active student participation	7
Cartoons provide long-lasting learning	17
Cartoons provide feedback	4
Cartoons provide an opportunity to make connections with daily life.	4
Cartoons allow for courses to be smooth	3
Cartoons foster the learning process	2
Cartoons reduces misconceptions of students	12
Cartoons avoid the formation of misconceptions.	1
Cartoons improve higher thinking skills.	11
Cartoons improve communication skills.	1
Cartoons direct students to make search.	1
Cartoons provide an environment eligible for discussion.	7
Cartoons enrich the learning environment.	1

In regard to the second item asked in the structured interviews, “At which stages can concept cartoons be used in science course?”, Table 2 shows the views of the pre-service teachers about the use of concept cartoons at different stages of science course together with frequencies.

Table 2: Views of the participants about the use of concept cartoons at different stages of science course

Views	f
a . Introduction	34
a.1. Getting attention	21
a.2. Improving motivation	21
a.3. Measuring readiness of students	7
b. Lecture	34
b.1. Concept teaching	5
b.2. Expansion of topics	5
b.3. Briefing	3
b.4. Repetition of topics studied	2
b.5. Correction of misconceptions	9
c. End of course	35
c.1. Inspection of incomplete knowledge	1
c.2. Measuring and evaluating the achievement of the goals of the course	17

In response to the question “At which stages can concept cartoons be used in science course?” the participants stated that concept cartoons can be used at introduction (34 participants), lecture stages (34 participants) as well as at the end of the course (35 participants). Their views are as follows:

“Concept cartoons can be used at the introduction part to improve student motivation. Using the cartoons at this stage will improve student attention and help them to focus on the course.” (PST 27); *“For me concept cartoons can be used at any stage of the course. If these are used at the introduction part they will improve student attention; if it is used at the evaluation part it may indicate at which level the course goals are achieved.”* (PST 2); *“Concept cartoons can be used at the introduction stage to make it possible to have better understanding of science concept and to allow for students to think about it and the cartoons can be used at the end of the course to consolidate student learning.”* (PST 7).

In regard to the third item asked in the structured interviews, “Do you think that concept cartoons are much more influential in determining and reducing student misconceptions in science course in contrast to other techniques such as concept maps, conceptual change sheets, etc? Why?”, Table 2 shows the views of the pre-service teachers about the effects of the use of concept cartoons on student misconceptions with frequencies.

Table 3: Views of the participants about the use of concept cartoons in reducing student misconceptions

Views	f
a. No	9
a.1. Concept maps are much better for this aim.	1
a.2. Conceptua change sheets are much better for this aim.	4
a.3. Each method is significant and has its own specific usage.	9
b. Yes	29
b.1. Concept cartoons are better than concept maps in reducing student misconceptions	2
b.2. Concept cartoons are better than concept change sheet in reducing student misconceptions	2
c. Undecided	3

In response to the question “Do you think that concept cartoons are much more influential in determining and reducing student misconceptions in science course in contrast to other techniques such as concept maps, conceptual change sheets, etc.? Why?”, nine participants argued that in reducing student misconceptions concept cartoons are not more influential than other methods. One of these participants claimed that concept maps are the best method of reducing student misconceptions and four considered conceptual change sheets to be the best method of reducing student misconceptions. Nine other participants stated that each method has its own use and significance in this regard. The number of the participants who regarded concept cartoons as the best method of reducing student misconceptions is twenty-nine. Three participants did not provide an answer to this question.

The statements of the participants concerning the use of concept caricatures and other methods in reducing misconcepts are as follows: “*For me concept maps should be used to teach more general topics at the beginning or end of the course, but concept cartoons should used for the concepts which are significant and can be confused. I think concept cartoons are much more special method.*” (PST 14); “*I think that concept cartoons are not superior than other methods in reducing misconceptions. All methods may facilitate learning and teaching as long as teacher is aware of which method should be used where.*” (PST 19), “*I think that it is not possible to argue any method is superior than the others. Each has its own usage. However, I myself prefer to use concept cartoons in reducing student misconceptions.*” (PST 9).

In regard to the fourth item asked in the structured interviews, “How can the efficacy of concept cartoons be improved?”, Table 4 shows the views of the pre-service teachers about the ways to improve efficiency of concept cartoons.

Table 4: Views of the pre-service teachers about the ways to improve efficiency of concept cartoons

Views	f
About teachers and student teachers	
They may be taught about concept cartoons.	9
The ministry may deal with it.	1
A course on concept cartoons may be covered in teacher training programs.	2
More cocnept cartoons may be used in courses	5
Collaborations may be developed with professional cartoonists.	1
About concept cartoons	
Cartoons may include more characters.	2
Cartoons may involve humor.	3
Cartoons may include more misconceptions.	4
Cartoons may include empty blank speech bubbles to be filled by students	3
Characters may be named or numbered	1
Cartoons may use shorter sentences	7
Cartoons may include more vivid colors	2
Cartoons may be developed for different age groups.	9
Cartoons may include those questions to ask students to think or discuss about	7
Cartoons may include topics and characters from daily life.	2
Cartoons may be about topics and gains	12
About teaching process	
Cartoons may be combined with such techniques as argumentation	3
About student	
Students may prepare concept cartoons	2
Students may be offered a course on concept cartoons.	1

The answers to the question of “How can the efficacy of concept cartoons be improved?” showed that the participants suggested four different ways to improve the efficacy of concept cartoons. More specifically, nine participants argued that teachers and student teachers may be taught about the use of concept cartoons. There were also twelve participants who suggested that concept cartoons should be about topics and gains. The combination of concept cartoons with other techniques such as argumentation was suggested by three participants. In order to improve the efficacy of the concept cartoons two participants argued that students should be involved in the development process of concept caricatures.

The views of the participants are exemplified as follows: “*Teachers should be informed about concept cartoons which may be involved in in-service activities. Concept cartoons should involve those pictures and dialogues in pertinent to the topic at hand.*” (PST 34), “*Concept cartoons should be more than drawings and focus on the targeted topic or concept. Cartoons should make active student involvement possible and provide a discussion environment. Cartoons should also be clear and easy to understand and should be about the gains.*” (PST 38); “*The topics at hand should be given in a simplified form. Each cartoon should deal with a single topic. Interesting visuals should be employed instead of those which are unnecessary. Any expression which may cause misconception should be avoided. Cartoons should be consistent with the topics to be studied.*” (PST 39).

Table 5 shows the views of the participants about the limitations in using concept cartoons in science courses.

Table 5: Views of the participants about the limitations in using concept cartoons in science courses

Views	f
1. There is no limitation in using concept cartoons.	2
2. There are some limitations	14
2.1. Cartoons may not be used for each phase of the course.	1
2.2. Use of cartoons may take longer time.	2
2.3. Cartoons may be ineffective in explaining the concepts.	1
2.4. Concept cartoons may lead to distraction.	3
2.5. Students may focus on characters instead of topic.	1
2.6. For each topic cartoons may not be developed.	7
2.7. Cartoons may not allow to teach topic as a whole.	5
2.8. Cartoons may make it difficult to manage the class for teacher.	1
3. Undecided	2

In response to the question of “What are the limitations in using concept cartoons in science course?” sixteen participants argued that there is no such limitation. The number of the participants who thought that there are some limitations was fourteen. These participants argued that cartoons may not use at every step of the course and that the use of concept cartoons make take longer time and lead to insufficient explanation of concepts, to distraction and to focus on characters instead of the topic. They also stated that cartoons may not be developed for each topic and may lead to difficulties in the management of classroom. Two participants did not give any comment on the limitations about the use of concept cartoons.

The following statements exemplify the views of the participants about the limitations about the use of concept cartoons: “*I think there is no limitation in using concept cartoons. Teachers may easily prepare and use them in the course. It is economic and does not lead to extracurricular assignment.*”; “*I think there is no limitation in using concept cartoons. Because concept cartoons aim to provide the key concepts in the course and to integrate the previous and future learning. I think cartoons serve for these goals.*” (PST 40), “*Cartoons may not be used at each and every step of lecturing. It is not possible to have full understanding of any topic using concept cartoons. Therefore, cartoons may not be used for each topic to be studied.*” (PST 5).

Discussion and Conclusion

The findings of the current study are mostly consistent with the previous findings. All of the participants stated that concept cartoons positively affect the learning process. Concerning the reasons for this contribution they mostly stated that concept cartoons provide long-lasting learning, avoid misconceptions and improve higher thinking skills of individuals. Similarly, Keogh and Naylor (1999) found that both pre-service teachers and students had positive views about the use of concept cartoons. Also in the study of Şaşmaz Ören and Meriç (2014), the most important finding from students' journals is that students have used a large number of positive

sentences for this technique. Students have developed a positive attitude towards Science courses. İzgi and Kaptan (2010) found that 20.1% of the pre-service teachers regarded the science and technology course as the best eligible course for the use of concept cartoons. It was also found that 15% of the participants considered concept cartoons as an enjoyable method and that 13.44% of them regarded concept cartoons as an effective method in determining and reducing students' misconceptions. Düzgün (2013) also concluded that the pre-service teachers considered concept cartoons as a useful, visual, interesting and multi-purpose tool.

In response to the question "At which stages can concept cartoons be used in science course?" the participants stated that concept cartoons can be used at introduction (34 participants), lecture stages (34 participants) as well as at the end of the course (35 participants). İzgi and Kaptan (2010) concluded that 25.3% of the pre-service teachers regarded it as proper for the evaluation of student learning.

In response to the question "Do you think that concept cartoons are much more influential in determining and reducing student misconceptions in science course in contrast to other techniques such as concept maps, conceptual change sheets, etc.? Why?", nine participants argued that in reducing student misconceptions concept cartoons are not more influential than other methods. One of these participants claimed that concept maps are the best method of reducing student misconceptions and four considered conceptual change sheets to be the best method of reducing student misconceptions. Nine other participants stated that each method has its own use and significance in this regard. The number of the participants who regarded concept cartoons as the best method of reducing student misconceptions is twenty-nine. Three participants did not provide an answer to this question. Ekici, Ekici and Aydın (2007), analyzed the role of concept cartoons in determining and reducing student misconceptions about photosynthesis based on student views. They concluded that concept cartoons are not effective only in determining the student misconceptions about photosynthesis, but also in reducing these misconceptions.

The answers to the question of "How can the efficacy of concept cartoons be improved?" showed that the participants suggested four different ways to improve the efficacy of concept cartoons. More specifically, nine participants argued that teachers and student teachers may be taught about the use of concept cartoons. There were also twelve participants who suggested that concept cartoons should be about topics and gains. The combination of concept cartoons with other techniques such as argumentation was suggested by three participants. In order to improve the efficacy of the concept cartoons two participants argued that students should be involved in the development process of concept caricatures.

In response to the question of "What are the limitations in using concept cartoons in science course?" sixteen participants argued that there is no such limitation. The number of the participants who thought that there are some limitations was fourteen. These participants argued that cartoons may not use at every step of the course and that the use of concept cartoons make take longer time and lead to insufficient explanation of concepts, to distraction and to focus on characters instead of the topic. They also stated that cartoons may not be developed for each topic and may lead to difficulties in the management of classroom. Two participants did not give any comment on the limitations about the use of concept cartoons. In the study by İzgi and Kaptan (2010) the pre-service teachers participated in the study reported that cartoons may facilitate discussions in class through characters with speech bubbles and may be used to determine and reduce misconceptions at every step during the course. They also stated that cartoons may reduce the negative attitudes of the students towards science courses due to the elimination of conceptual confusion. In addition, they argued that concept cartoons improve student attention towards the science and technology course and therefore, can be used in the science and technology courses.

Based on the findings of the study about the use of concept cartoons based on the views of the pre-service teachers and previous findings the following points are suggested:

- In order to improve the efficacy of concept cartoons pre-service teachers should be fully informed about these cartoons and in-service teachers should be informed about them through in-service training activities.
- Written teaching materials, especially textbooks, should contain more information about the technique of concept cartoons.
- The limitations of the use of concept cartoons in other courses should be identified in order to minimize them.

References

- Akamca, Özyılmaz G. ve Hamurcu, H. (2009). Analojiler, kavram karikatürleri ve tahmin-gözlem-açıklama teknikleriyle desteklenmiş fen ve teknoloji eğitimi. *E-journal of New World Sciences Academy*, volume: 4, number: 4, article number: 1C0089.
- Dalacosta, K.; Kamariotaki Paparrigopoulou, M.; Palyvos, J.A. ve Spyrellis, N. (2009). Multimedia application with animated cartoons for teaching science in elementary education. *Computers & Education* 52, 741–748.
- Düzgün, E. M. (2013). *Sınıf öğretmeni adaylarının fen ve teknoloji dersinde kullanılan kavram karikatürlerine yönelik görüşleri*. Yayınlanmamış Yüksek lisans tezi. Afyon Kocatepe Üniversitesi, Sosyal Bilimler Enstitüsü, Afyon.
- Ekici, F., Ekici, E., & Aydın, F. (2007). Utility of Concept Cartoons in Diagnosing and Overcoming Misconceptions Related to Photosynthesis. *International of Journal of Environmental & Science Education*, 2(4), 111-124.
- İzgi, Ü. ve Kaptan, F. (2010). Fen ve teknoloji öğretiminde öğretmen adaylarının kavram karikatürlerini kullanımı üzerine bir çalışma. *Uluslararası Öğretmen Yetiştirme Politikaları ve Sorunları Sempozyumu II*, Hacettepe Üniversitesi, Ankara.
- Keogh, B. ve Naylor, S. (1999). Concept cartoons, teaching and learning in science: an evaluation. *International Journal Of Science Education*.21(4). 431- 446.
- Keogh, B. ve Naylor, S. (2000). Teaching & learning in science using concept cartoons: why Dennis wants to stay in at playtime. *Australian Primary & Junior Science Journal*; August, vol. 16, issue 3, p10, 5p, 2bw.
- Keogh, B. ve Naylor, S. (2009). Active assessment. *Mathematics Teaching*, 215,35–37, September.
- Miles, M. B. Ve Huberman, M. (1994). *Qualitative data analysis: an expanded sourcebook* (2. baskı). Thousand Oaks, CA: Sage.
- Sasmaz Oren, F. & Meric, G. (2014). Seventh grade students' perceptions of using concept cartoons in science and technology course. *International Journal of Education in Mathematics, Science and Technology*, 2(2), 116-137.
- Şimşek, H. ve Yıldırım, A. (2006). *Nitel araştırma yöntemleri*. Ankara: Seçkin Yayıncılık.