

Determination of Misconceptions in Disaster Education with Concept Cartoons: The Case of Flood and Overflow

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ABSTRACT

As there are many concepts in the content of each course, concepts are also extensively included in the secondary school geography course, and sometimes misconceptions occur in students. The aim of this study was to determine the misconceptions about the concepts of "flood" and "overflow," which are included within the scope of the subject of natural disasters of the secondary school geography course, through learning activities based on concept cartoons. The study group consisted of 50 secondary school students selected from among 10th-grade secondary school students in the city center of Çankırı province through convenient sampling during the first semester of the 2017-2018 academic year. The study was designed in the screening design. An attempt to determine students' misconceptions and confusions was made through the concept cartoons method. As a result of the study, it was found out that cartoons were an effective technique in revealing the misconceptions about the concepts of "flood" and "overflow."

Keywords: disaster education, concept errors, concept cartoons, flood, overflow

INTRODUCTION

The constructivist learning approach that forms the basis of the Geography Course Curriculum emphasizes that the individual does not start with an empty mind while starting to get information, that he/she activates ready mind structures associated with the subject or concept he/she has just learned, that he/she is inclined to choose and learn the issues which can be connected with what he/she knows and that he/she effectively restructures the new information he/she has learned in his/her mind (Taşkın, 2014). Do we expect students, who listen to the teacher under all conditions, read when they are asked to read, write when they are asked to write, speak when they are asked to speak, are devoid of critical thinking, do not question and are directed to memorization? Or do we expect students, who know their own mind, question, think critically, investigate the information not by getting it as it is, share what they know, and make new information inferences (Akınoğlu, 2004). The information gained by students in the educational environment in the school depends on their preliminary information they had before they came to this environment and what the educational environment provides to them. Therefore, students' preliminary information and, if any, their misconceptions should be seriously revealed, and the instruction should be planned by taking these into account (Benson, Wittrock & Baur, 1993; cited by Özmen 2005). Although constructivism is a concept which was mentioned throughout the 20th century, it has become more actual at the end of this century. This is mainly due to a significant increase in the studies on the brain during the 1990s. The results obtained in the field of neurophysiology closely concerned educators, and it was attempted to take these results as a basis in the regulation of learning and teaching processes, in other words, in the regulation of teaching (Taşkın, 2014). With all these reasons, the Geography Course Curriculum has a student-centered and spiral structure, and

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the teacher should take advantage of in-school and out-of-school events to emphasize the place of geography in life and how students' perspectives will change during lecturing. Teachers should often make students encounter with real-life problems and contradictory situations and ensure that they can use the knowledge and skills they have acquired to solve the problems they face (MEB [The Ministry of National Education], 2005).

There are many concepts in the content of each course. It is known that students have difficulty in understanding some concepts no matter at what level from primary school to university, that they have misconceptions as a result of misunderstandings, and that the permanence of these concepts cannot be achieved as a result of rote-learning based education (Karaer, 2007). Misconceptions are wrong information that individuals acquire through their experiences in order to understand the world they live in and to explain the events around them (Guralnik, 1986: cited by Koray, Akyaz & Köksal, 2007). It is possible to define misconception as a significant difference between the way a person understands a concept and the jointly accepted scientific meaning of it (Marioni, 1989; Riche, 2000; Stepan, 1996: cited by Aydoğan, Güneş, & Gülçiçek, 2003; Tery, Jones, & Hurford, 1985). It has been revealed with the studies that misconceptions are generally less logical, less precise and less common than the accepted scientific theories, are also owned by students with formal education on the subject, are not specific to a certain age group and are common in different age groups, and are resistant to replacement with traditional teaching (Hewson & Hewson, 1984, cited by: Koray, Akyaz & Köksal). Since misconceptions are permanent, it is difficult to eliminate them by traditional teaching methods, and they also prevent students from developing correct concepts (Lawson & Thomson, 1988: cited by Kaptan & Korkmaz 2001). The misunderstandings and misconceptions of students affect their subsequent learning and are resistant to change (Ayas & Demirbaş, 1997; Hewson & Hewson, 1983: cited by Çalık & Ayas, 2003; Nakhleh, 1992; Pardo & Partoles, 1995; Zoller, 1990).

Many disciplines are used while explaining the subjects in geography. Therefore, it is inevitable that many concepts and terms are mentioned in geography courses. It is a fact that the fact that geography is an interdisciplinary science gives conceptual richness to this science. The fact that students encounter many concepts in the courses will increase their willingness to memorization. It is known that memorization, which would mean an inability to learn concepts, is a significant cause of misconceptions (Alim, 2008). In particular, the comprehension level of concepts is one of the most important factors that should be provided in geography education. Each new concept learned will facilitate the understanding of another concept, and students will learn creative thinking and gain skills by making different inferences in the concepts. The students who understand the concepts at this level will not have any problems in understanding similar concepts and will reach generalizations (Akbulut, 2004). It is of great importance to reveal the students' comprehension levels of basic geographical concepts and to determine their opinions and misconceptions about these concepts in terms of effective geography teaching. Many researchers stated that students bring different views from what they learn in the school and from scientific facts to the classes where they receive education (Cin, 1999; Driver, 1989: cited by Akbaş & Uzunöz, 2011). In the teaching of concepts, many tools such as concept maps, semantic analysis tables, concept puzzles, concept networks, v diagrams, diagnostic tree, structured grid, and conceptual change text, are used to prevent it. In recent years, a new application called concept cartoons has become widespread in the field of education (Tokcan & Alkan, 2013).

Concept cartoons were first used by the Institute of Physics in London in metro stations to increase public interest in science. An attempt to explain the importance and strength of physics in our lives was made by asking every passenger, young or old, the question of "What do you think?" through cartoons (Keogh, Naylor & Wilson, 1998: cited by Baba, 2012). Cartoons can be used as an effective material in teaching in that they improve discussion and critical thinking skills (Cho & Reich, 2008: cited by Sidekli, Er, Yavaşer & Aydın, 2014). Cartoons are the most important and most appropriate visual learning materials in terms of usability because visual learning involves an approach that appeals to students' visual intelligence. This proves that cartoons are very suitable materials in terms of instructiveness (Özşahin, 2009). The researchers define concept cartoons as the "illustration of the discussion made by three or more characters." In this discussion, each character defends a different idea. One of the ideas presented in the discussion represents the scientifically accepted way of thinking, while the others represent the ways of thinking that are not scientifically accurate but are the unique ways of thinking formed by students (Long & Marson, 2003; Kabapınar, 2005: cited by Cengizhan, 2011). The primary purpose of the application of concept cartoons is to initiate a discussion about a concept, situation or event and to motivate to investigate as well (Yıldız, 2008). Although conceptual cartoons are aimed at collecting information about students' comprehension of the concepts, the evaluation of comprehension is not the primary purpose. The primary purpose of conceptual

cartoons is to help education and training (Keogh and Naylor, 1999: cited by Tokcan & Alkan, 2013). Concept cartoons are based on the constructivist learning approach which argues that information is interpreted and created by the individual (Morris, Merritt, Fairclough, Birrell & Howitt, 2007: cited by Cengizhan, 2011). These cartoons are mainly the pictures in the style of cartoons containing daily events, which put forward an alternative perspective on scientific issues and invite characters to discuss with each other (Keogh et al. 1998: Uğurel & Morali, 2006: cited by Özşahin, 2009). The science of geography is quite prone to the use of visual materials. Therefore, cartoons with geographical meaning and quality are frequently encountered in daily life. This has made the use of cartoon a requirement in Geography (Özşahin, 2009).

Due to all these reasons, the studies carried out to teach concepts and to resolve the misconceptions in geography teaching are highly important in terms of providing meaningful learning and the visualization of information through concretization. For example, a study was carried out to determine students' levels of understanding of 47 basic concepts included in the "A Spatial Synthesis; Turkey" learning domain of the 9th-grade geography course. In the study, it was concluded that students had no information about many concepts or did not have the ability to express the information they had adequately and that they had many concept confusions and misconceptions (Geçit, 2010). In a similar study, Akbaş & Uzunöz (2005) stated that recent studies on the determination of students' misconceptions and comprehension levels of the geography course were quite common, but the studies carried out to eliminate students' misconceptions were quite inadequate. When the literature is reviewed in this context, the studies indicating that the concepts of flood and overflow are confused will be encountered (Uşkay & Aksu, 2002, Alaz, 2005). It is thought that this study will contribute to the literature of geography teaching in terms of the determination of misconceptions, the elimination of misconceptions and the use of concept cartoons.

The aim of this study was to determine the effect of concept cartoons on concept teaching in disaster education. In the study, it was attempted to determine and eliminate 10th-grade secondary school students' misconceptions about the concepts of "flood" and "overflow" mentioned in the geography course. Based on this reason, the sub-problems of the study are as follows:

1. What are the misconceptions about the concepts of "flood" and "overflow" determined as a result of the application of concept cartoons?
2. What are the opinions of students about concept cartoons in order to identify the misconceptions about "flood and overflow"?

METHOD

The study group consisted of a total of 50 secondary school students in a school selected from among Çankırı Central Secondary Education Institutions through convenient sampling during the second semester of the 2017-2018 academic year. In the evaluation of the data obtained from the application, personal details of the students were hidden and sorted by random numbering. When it was required to quote from students' answers, students' names were not used, and the randomly assigned numbers were used.

During the study process, the literature was first reviewed, and the studies indicating that the concepts of "Flood and Overflow" are confused (Alaz, 2005; Uşkay & Aksu, 2002) were found. Then, the relevant concept cartoons were prepared (**Appendix 1**). The necessary arrangements were made by taking expert opinions (1 domain expert and 1 field specialist in education) about the cartoons, and the cartoon was put into final form by a graphic designer.

The discussion environment was created by applying these cartoons to the study group, and students' answers were noted. In this way, an attempt to determine the misconceptions in their minds was made. Students' opinions about the application were taken through the semi-structured form. The content validity of the form was ensured by expert opinion, and the results were subjected to content analysis and presented in tables.

RESULTS

In this section of the study, the answer to the question of what the misconceptions about the concepts of "flood" and "overflow" determined as a result of the application of concept cartoons are was first sought. The misconceptions determined were respectively presented in tables according to their frequencies (**Table 1**).

Table 1. Students' misconceptions about the concepts of "Flood and Overflow"

Students' misconceptions	Students	f
Flood occurs in the stream bed.	5,7,9,17,20,34,43,45,49,50	10
flood is a disaster	8,13,18,38,39,41,47	7
Flood is caused by the destruction of dams.	1,5,11,24,25,29	6
Flood certainly leads to overflow.	3,19,25,26,35,40	6
Flood and overflow do not affect each other.	4,6,18,19,48	5
Overflow results from precipitation.	2,12,33,46,50	5
Flood is caused by overflow of the stream.	4,11,22	3
Flood is seen in all forms of the earth.	21,14	2
Flood and flooding is the same thing.	10,15	2
Overflow have destructive power.	27,16	2
Overflow occur in the summer.	32	1
Flood takes longer than overflow	6	1
Total	50	50

As it is seen in **Table 1**, the students in the study group mostly have the misconceptions that flood occurs in a stream bed ($f=10$). S43 who had a misconception that flood occurs only in a stream bed stated that "Flood occurs only in a stream bed." The next misconceptions are listed respectively according to their frequencies as follows: The students in the study group have the misconceptions that the flood event is a disaster ($f=7$). S38 who had a misconception that flood event is a disaster stated that "Each flood is a disaster." With respect to students' misconceptions that the flood event occurs with the collapse of dams ($f=6$), S29 stated that "Flood occurs with the collapse of the dam wall." The study group had the misconceptions that flood certainly leads to overflow ($f=6$). S25 stated that "Every flood event leads to overflow, as well." Students think that flood and overflow do not affect each other ($f=5$). S18 who had the misconception that flood and overflow are independent of each other stated that "Flood and overflow are two different events and they do not affect each other." Some of the students in the study group believe that overflow results from precipitation ($f=5$). S33 stated that overflow occurs after raining. Furthermore, S11, one of the students who had the misconceptions that flood occurs when the river floods ($f=3$), stated that "If the river floods, then the flood event occurs." S21, one of the students thinking that floods are observed in all landforms ($f=2$), expressed thoughts by stating that "There is no specific place limitation for the formation of the flood." Among the students who had a misconception that flood and rainwash are the same events ($f=2$), S10 stated that "There is no difference between flood and rainwash." S27's statement that "Overflow is more destructive than flood" can be shown as an example of students' thought that overflow has more destructive power ($f=2$). S32, one of the students in the study group thinking that overflows occur during the summer ($f=1$), stated that "Overflows occur only during the summer under the effect of summer precipitation." Furthermore, S6 believing that flood lasts longer than overflow explained the reason for this misconception by stating that "The flood and overflow have the same duration."

In the second sub-problem of the study, the answer to the question of what the views of students about the concept cartoons are to determine their misconceptions about the concepts of "flood" and "overflow"? was sought. The results of this section of the study are presented in tables (**Table 2**).

Table 2. The opinions of students about concept cartoons

Code	Student	f
Brings a different perspective	1,2,3,6,8,9,11,13,15,16,17,19,20,21,23,25,29,30,31,32,33,35,36,38,39,40,42,43,44,45,49,50	32
Instructive	2,3,4,5,6,7,8,10,12,13,16,17,19,20,21,23,25,27,28,32,33,35,38,41,42,44,45,47,48,49,50	31
Overcome false notion	2,5,4,8,9,11,13,14,15,18,19,20,23,25,28,29,45	17
Improves friendship relationships	5,6,10,21,38,40,45,50,	8
Provides persistency	18,19,25,30	4
Gives the ability to interpret	2,8,19	3
Provides visuality	45,46	2
Gain the ability to discuss	2,18	2
Gives curiosity	10	1
Entertaining	39	1

In **Table 2**, students' opinions about concept cartoons are sorted by their frequencies. The following students' views were included to increase the intelligibility of these results. The students in the study group stated that concept cartoons give different perspectives ($f=32$). With respect to it, S2 stated that "I have observed a lot of different ideas." Students considered that concept cartoons were instructive ($f=31$). With respect to this code, S7 stated that "There were the things that I didn't know and I have learned them." The students in the study group found cartoons effective in eliminating their misconceptions ($f=17$). With respect to the elimination of misconceptions by concept cartoons, S1 stated that "They have eliminated my misconceptions because I have observed my wrong and accurate information and found the right." Concept cartoons were found to be effective in developing friendship relations ($f=8$). In this regard, S46 stated that "I studied with one of my friends with whom I have not talked too much so far in the same group, and I have become closely acquainted with him." Some of the students in the study group thought that the information they learned in this way would be permanent ($f=4$). With respect to this code, S1 stated that "I will not forget, because I've distinguished right and wrong. I will not forget easily." Similarly, there were also students stating that concept cartoons gave the ability to make interpretation ($f=3$). For example, S30 indicated that "I have interpreted by seeing different ideas." There were also students who found the concept cartoons technique effective in terms of visuality ($f=2$). For example, S38 indicated that "They were the representation of the ideas in my mind." The students in the study group stated that the technique gave the discussion skills ($f=2$). Regarding the fact that concept cartoons provided discussion skills, S49 stated that "I discussed with my friends who advocated different ideas and we exchanged our ideas." Among the students in the study group, S50 who found the application appealing stated that "I was always curious about the next step in the application." S41 who found concept cartoons used in the application amusing indicated that "I have never had so much fun in the geography course."

CONCLUSION AND DISCUSSION

Concept cartoons are suitable for use in students to reveal misconceptions. As a result of the study, it was observed that students had misconceptions about the concepts of "flood" and "overflow."

The concepts of flood and overflow are often used synonymously. It is thought that these misconceptions are caused by the wrong use of the concepts of flood and overflow in daily life, in the visual and written media and among people. It has been determined that they cannot distinguish the concepts of flood and overflow or they use them in the same meaning. Although these events are closely connected within cause and effect relationships, there are some differences between them. The flood may also occur in many regions of the world without a relationship with a stream due to excessive precipitation, snow melting, excess water released from dams, the rise of groundwater and many more reasons. On the other hand, the overflow is a state in which a stream causes great damages to the living and non-living environment and cultural environment as a result of its overflow from its bed depending on the above reasons and its spread over plain and pit areas and settlements around it (Şahin & Sipahioğlu, 2002).

The misconceptions of the students and their explanations are as follows:

With the statement of “Flood occurs in a stream bed,” it was observed that students described the rising of water occurring in stream beds and on the surface as a flood. The flood may occur without a relationship with a stream (Şahin & Sipahioğlu, 2002). In other words, the flood is the muddy water stream with a high destructive power which occurs due to rain shower and has no regular and stable stream bed. It easily occurs following the melting of snow after precipitation in sloping lands. Floods may lead to disaster in mountainous regions where natural meadow cover is destroyed and forests are wasted (Güney, 1994).

With the statement of “Floods are disasters,” students used the concepts of natural event and disaster synonymously. The events that do not cause the loss of life and property in the natural environment are not disasters. For example, the avalanche is also not a disaster as long as it does not cause the loss of life and property. In general, the flood becomes a disaster after it turns into an overflow (Şahin, 2006).

In the statement of “Flood occurs with the collapse of dams,” it was considered that the flood event was only due to the collapse of dams. In the statement of “Flood occurs with the overflow of the stream,” it was perceived that the flood depends on the overflow of the stream. However, the flood may occur in many regions of the world due to excessive precipitation, snow melting, overflowing of lakes and seas, excess water released from dams, the rise of groundwater and many more reasons (Şahin & Sipahioğlu, 2002).

In the misconception that “Floods certainly lead to overflow,” the fact that floods may occur outside of the stream beds was overlooked. For example, the areas located at lower levels compared to slopes are the places suitable for flooding due to the accumulation of water passing from the slopes down to the surface flow (Şahin & Sipahioğlu, 2002). Therefore, the flood does not certainly lead to overflow if it occurs outside the stream beds. Students think that “Flood and overflow do not affect each other.” However, the overflow may also occur after a flood event (Balci & Öztan, 1987; Görcelioğlu, 2003; Turoğlu, 2005, 2007, 2011).

With respect to the misconception that “Overflow results from precipitation,” it can be said that excessive and heavy precipitation is important in the formation of overflow but does not occur only due to precipitation. In particular, events, such as the narrowing of the stream section with construction, disposal of rubble, industry and household waste and the laying of sewerage system to the stream bed, illegal reception of sand gravel activities in stream beds, and the narrowing of bed capacity caused by trees and shrubs growing naturally in stream beds, in the stream beds passing through the settlements are also among the reasons for the formation of overflow.

The correct explanation of the idea that “Floods are observed in all landforms” is that flood occurs on sloping areas (Güney, 1994). It is not observed in landforms where the slope is less.

Students’ thought that “Flood and rainwash are same” is also a false notion. Rainwash is rain and snow water flowing down the slope by covering the surface of the slopes in a network of thin vessels such as yarn, not in a particular bed. Although there is a formation due to slopes in rainwash, there is no absolute dependence on the slope in flood.

In the statement of “Overflows occur during the summer,” it was perceived as a condition which is specific only to the summer months. However, overflows also occur during winter and spring (Şahin & Doğanay, 1999).

When the idea of “Flood lasts longer than overflow” is examined, it is considered that flood occurs within a few hours while overflow may go on for one or several days and sometimes even for days (Balci & Öztan, 1987; Görcelioğlu, 2003; Turoğlu, 2005, 2007, 2011).

Overflow is the overflowing of water from the bed and its spread to the environment during the flood tide of streams. Overflows lead to human and animal losses. The areas where overflow occurs are mostly the plains (İzbırak, 1996).

As it is seen, flood and overflow are interconnected events. Overflow occurs as a result of a flood event. In general, flood becomes a disaster after it turns into an overflow. However, each flood does not lead to overflow. For the occurrence of overflows, there should be low areas where the water around the stream bed where the flood occurs can overflow and spread. These low areas may be agricultural lands or settlement units (Şahin, 2006). The event that a stream with an increasing water body and velocity forms a flow size to the extent that could lead to the emergence of social and economic problems by causing damage to cities, towns, and settlements, and agricultural and tourism areas around it for various reasons is called the flood. However, rainwash may also occur outside the stream beds. For example, the areas located at lower levels compared to slopes are the places suitable for flooding due to the accumulation of water passing from the slopes down to the surface flow (Şahin & Sipahioğlu, 2002).

Students' views about the concept cartoons used to determine misconceptions in disaster education are quite positive. It was concluded that students could gain different perspectives and could learn the subject permanently by eliminating their misconceptions with this method. Furthermore, it can be said that it improves friendship relations, gives interpretation and discussion skills since it paves the way for group studies and discussion environments. One of the results of the study is that visuality was found to be attractive, which made the course amusing. When it is intended to determine the place of these results in the literature, many studies with similar results appear. For example, in the study of Baba (2012) regarding the fact that the concept cartoons technique is effective in developing different perspectives, it was concluded that students turned towards group discussion and investigation to decide which character had an accurate perspective about the problem presented to them and that this process improved students' critical thinking and reasoning skills, participation in group study, ability to see and respect different thoughts, ability to express thoughts and create group decisions. Taşkın (2014) stated that students wanted the course to be covered with concept cartoons and that it was catchy and amusing. Similarly, in the study carried out by Özşahin (2009), the usability of cartoons in the geography course was supported by students' views. As a result of the study of Cengizhan (2011), it was indicated that concept cartoons contributed to the development of students' thinking and problem-solving skills, promoted the creation of a discussion environment, provided convenience in reflecting different ideas and perspectives, were effective in terms of determining the missing points in the evaluation of the course, and were guiding on knowledge creation. Furthermore, in the study of Sidekli, Er, Yavaşer, and Aydın (2014), it was concluded that the use of cartoons had an effect on students' academic achievement. There are also similar study results reporting that concept cartoons have an effect on students' academic achievement. Baba (2012) concluded that concept cartoons increased the academic achievement of students. According to the results of the study carried out by Taşkın (2014), it was stated that the concept cartoons technique could be used in improving the success and developing a positive attitude in the primary school science and technology course. In another study in which it was determined that Geography teaching supported by concept cartoons was more effective compared to Geography teaching performed by traditional methods (Tokcan & Alkan, 2013), it was concluded that the teaching supported by concept cartoons was more effective compared to the teaching which is traditional or only based on the program.

Suggestions

Based on the results of the study, the following suggestions can be made:

- Concept cartoons are an effective method which can be used to reveal the misconceptions of students on many issues. Therefore, their use in the curriculum, course books, and teaching environments can be made widespread.
- The visuals in concept cartoons can be selected in accordance with the students' interests and levels.
- An incident that has occurred in the immediate vicinity can be selected as the subject of the cartoon.
- Concept cartoons can also be used in the determination and elimination of misconceptions in other geography subjects.

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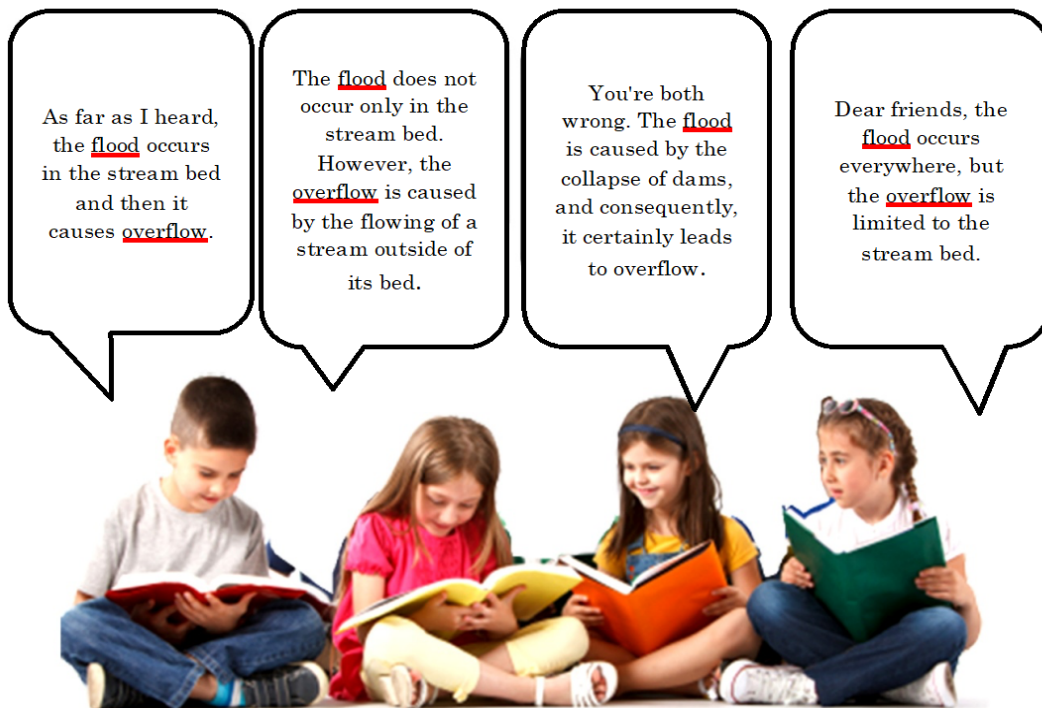
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APPENDIX 1

Concept Cartoon Examples

Name-Surname:

Write down with which of the following characters discussing the concepts of FLOOD and OVERFLOW you agree and explain why you agree.



I Agree with 1 because.....

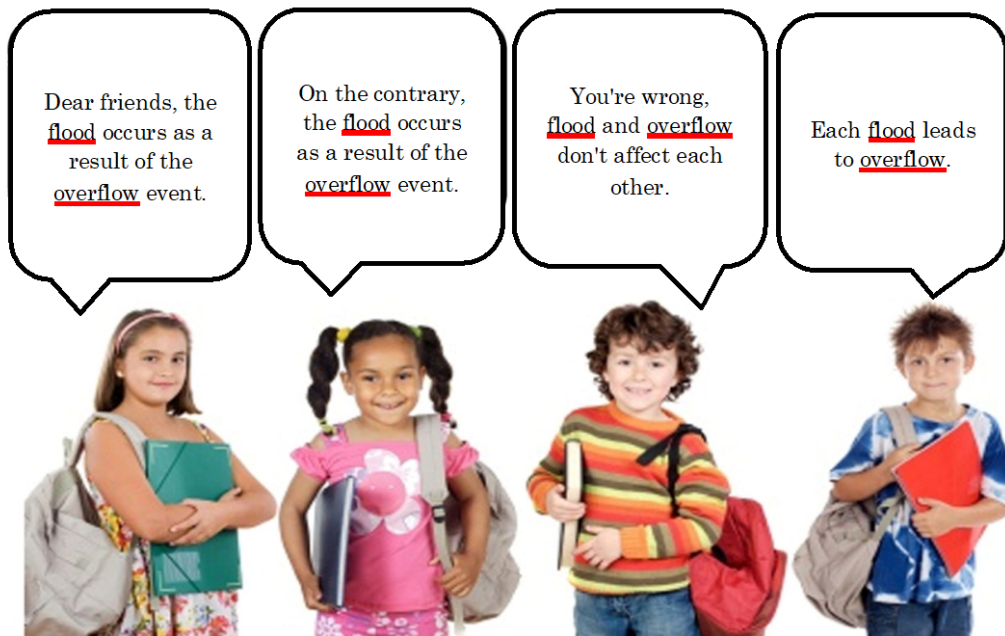
I Agree with 2 because.....

I Agree with 3 because.....

I Agree with 4 because.....

Name-Surname:

Write down with which of the following characters discussing the concepts of FLOOD and OVERFLOW you agree and explain why you agree.



I Agree with 1 because.....

I Agree with 2 because.....

I Agree with 3 because.....

I Agree with 4 because.....

Name-Surname:

Write down with which of the following characters discussing the concepts of FLOOD and OVERFLOW you agree and explain why you agree.



I Agree with 1 because.....

I Agree with 2 because.....

I Agree with 3 because.....

I Agree with 4 because.....

Name-Surname:

Write down with which of the following characters discussing the concepts of FLOOD and OVERFLOW you agree and explain why you agree.



I Agree with 1 because.....

I Agree with 2 because.....

I Agree with 3 because.....

I Agree with 4 because.....

