

Role of concept cartoons in chemistry learning

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Abstract

Cartoons are valuable aids that prompt interest and foster genuine student engagement in the classroom. Cartoons are part of a much larger effort to introduce rare and amusing activities to boost learning and student participation. Concept cartoons are visual tools composed of three or more characters' proposing ideas, discussing or thinking on a subject, an incident or a concept in daily life. Concept Cartoons were first developed in the 1990s by Keogh and Naylor. Concept cartoons engage students in focused discussion, by making students talk about the concepts presented by the cartoon characters. Many concepts in chemistry are abstract and often difficult to grasp especially for novice learners and concept cartoons can play a very good role here to overcome the difficulties in learning. Concept cartoons in chemistry can grab attention of students more easily, generate participation by giving rise to vibrant class discussions and allows teachers to gain important insights into their pupils' understanding.

One of the most widespread forms of instructional media which is also abundantly and easily found is cartoon or illustration humour. Cartoon materials are readily available in newspapers, magazines and comics, which attract the attention of children (Hill 1990). Ideas transmitted through cartoon are easily understood through the action of the cartoon character. Not only children, all levels of society widely read and accept cartoon and comics (Johnson 1985). Cartoons and comics have utility in teaching-learning too, well beyond the generally accepted use of them in mass media. They use minimal text to make the ideas available to learners by visual appeal, and, hence are especially useful with groups of learners who have limited literacy skills.

Cartoons have a significant role in education to introduce remarkable and amusing activities for enhancing learning and student participation. They are used along with other innovative avenues to learning chemistry which include plays, poems, puzzles, games, songs, proverbs, famous quotations, biographies, and even literary references. Cartoons are valuable aids that instigate interest and foster genuine student engagement in the classroom. A simple image can often change the tone and the dynamics of a group by imparting a little humour. New ideas, concepts and attitudes can be introduced with the help of cartoons. In some cases, it can even make an important point more directly and painlessly than assigned readings or lectures ever could. Cartoons have been employed in a variety of ways for educational purposes. These include the development of reading skills (Demetrulias 1982) and vocabulary (Goldstein 1986); problem solving (Jones 1987) and thinking skills (De Fren 1988); enhancing motivation (Heintzmann 1989); resolving conflict (Naylor and McMurdo 1990); eliciting tacit scientific knowledge (Gutierrez and Ogborn 1992) and making

scientific ideas accessible (Peacock 1995). This idea is not new to chemical educators as there are many studies related with concept cartoons in chemistry.

Tracing the use of cartoons in chemistry

Science concepts are often abstract and difficult to grasp, especially for children. And when teachers try to explain them in as simple a manner as possible, they run the danger of oversimplifying these concepts. It is also common for pupils to develop misconceptions about these concepts. How then can we help our pupils to fully comprehend complex science topics? Over the years, visual stereotypes of chemistry have been used within the different categories of cartoons to make humorous points and provoke readers. This gives us a historical glimpse of how chemistry was generally viewed and brings up issues around the public image and understanding of chemistry.

That imagery is influenced by societal attitudes and perceptions of the day. However, the images created in turn also strongly reinforce those perceptions. There are both negative and positive stereotypes that can be identified, and those can certainly change over time. In at least one case, this has been intentionally done to portray chemistry in a positive light. This is the case with use of concept cartoons.

What are concept cartoons?

Concept cartoons were first developed in the 1990s by Keogh and Naylor as a result of endeavour to enlighten the relationship between constructivist approach and epistemology and classroom applications (Keogh and Naylor, 1999). These cartoons combine visual elements with the texts written in the form of dialogues (Keogh and Naylor, 1999).

Concept cartoons are interest-arousing and surprising drawings in the form of a cartoon in which each cartoon character defends different viewpoints concerning a happening in daily life (Keogh & Naylor, 1999a; Martinez, 2004). Concept cartoons are visual tools composed of three or more characters' proposing ideas, discussing or thinking on a subject, an incident or a concept in daily life. Concept cartoons show different specialties from ordinary cartoons. While cartoons are used to make people laugh, concept cartoons are used to entertain students and make them inquire their knowledge (Keogh & Naylor, 1996b).

Concept cartoons as strategic instructional devices

Many first-rate teachers instinctively incorporate a touch of humour into their lectures without explicitly realizing the exact benefits. Over the years, there have been numerous studies examining and attempting to define the role of humour with respect to both student

motivation and learning. When used appropriately humour is widely accepted and has become a regular part of an educator's arsenal. It is especially effective for "dread courses", including chemistry.

Concept cartoons have the following advantages as instructional-aids.

Grabs attention

Kids and adults alike like cartoons. They usually associate cartoons with fun and humour. Concept cartoons thus provide an appealing and non-threatening way to represent ideas. Pupils are more likely to be enthusiastic towards the activity to come and will then be more focused and receptive to learning.

Generates participation

In cartoons, the ideas have to be presented succinctly. These ideas can be so thought-provoking that pupils are drawn into "participating" in the dialogue by "becoming" one of the characters, giving rise to vibrant class discussions. The lesson thus becomes more interactive and student-centred as pupils are actively involved in their learning.

Develops skills

During discussion of the concept cartoons, pupils have to verbalize their ideas and thoughts. They are motivated to take a stand on the different ideas presented. If they disagree, they may present and defend their points of view. This process allows teachers to gain important insights into their pupils' understanding. Participating in such discussion also lets pupils hone their communication skills.

In literature there are studies on using concept cartoons (Ingeç, Güzel&Karakaya, 2008) in different stages of the lesson and for different purposes, which were developed as an alternative strategy in order to clarify the relationship between the constructivist learning model and its epistemology and classroom practices. As seen in the studies of Keogh & Naylor (1999) and Kabapinar (2005), concept cartoons can be used for learning teaching purposes during instruction.

1. At the beginning of new units/ lessons

The concept cartoons appear to be an effective stimulus for a form of argumentation in primary science (Naylor, Downing & Keogh, 2001). Children respond positively to them, engage in focused discussion and put forward and defend alternative viewpoints. The process of argumentation appears to be purposeful, frequently leading to scientific investigation and enquiry as a way of resolving the argument. By making the learners' ideas explicit the cartoons support the teacher in the elicitation process. This knowledge can then be used to inform the subsequent teaching, extending the range of restructuring strategies.

2. To enhance student motivation

Keogh and Naylor (1999) found that concept cartoon approach in teaching science enhances motivation, provides a purpose for practical work, minimizes classroom management problems by the focused discussion that keeps the pupils on task, enables finding out students' ideas prior to teaching, and provides a manageable way to plan and carry out the teaching according to students' ideas. Thereby researchers think that teaching via concept cartoon is effective in remedying misconceptions. Similar findings were also reported by other researchers (Keogh & Naylor, 1997a; 1997b; Keogh, Naylor, & Wilson, 1998). Concept cartoons help the students to question their thoughts, solve the problem they encounter in their everyday lives, broaden their horizons and provide different perspectives for the events (Dabell, 2004). Concept cartoons could provide intensive stimulations to arouse students' existing knowledge and past experience. Therefore, concept cartoon can incite students' discussion and induce their participation in argumentation (Keogh & Naylor, 1999).

3. During the classroom discussion

Additionally, teachers can benefit from the concept cartoons for such purposes as creating a discussion atmosphere (Naylor, Keogh & Downing, 2001; Balim, Inel, Evrekli&Kesercioglu, 2008) and helping students ask their own questions (Long &Marson, 2003). According to Kabapinar (2009), concept cartoons can encourage students to develop scientific ideas and question within the learning-teaching process. Moreover, they can be used for revealing students' preliminary information (Inel, Balim&Evrekli, 2009) and detecting any misconceptions and/or eliminating them (Ugurel&Morali, 2006; Akdeniz&Atasoy, 2006; Ingeç, Yildiz&Ünlü, 2006; Durmaz, 2007; Ekici, Ekici&Aydin, 2007; Yildiz, 2008; Özyilmaz-Akamca, Ellez&Hamurcu, 2009). Also, according to Birisçi, Metin& Karakas (2010), concept cartoons ensure that the instruction process becomes more exciting and interesting.

4. To identify learners' alternative conceptions

They were primarily intended as a teaching and learning aid and are frequently used as a surveying method to identify learners' alternative conceptions. Cartoon style drawings show different characters arguing about the answer to a question or debating alternate explanations of scientific phenomena. Each cartoon is designed to probe students' ideas about a science concept they have been exploring or investigating. The student must consider the question and explain why each character's response is reasonable or unreasonable. One character's response is aligned with the scientific point of view and the others are drawn from

children's typical confusions or misunderstandings. Rather than looking for a right answer, the teacher needs to look at the student's reasoning. Concept cartoons can be used to stimulate discussion before, during, or at the conclusion of an investigation.

Concept cartoons can reveal the students' misconceptions, make high participation class discussions possible on the causes of them, make students enthusiastic about learning, consequently can eliminate existent misconceptions.

5. Concept Cartoons as Assessment Tools

While being used for different purposes in learning-teaching settings, concept cartoons can also be used as an alternative assessment-evaluation tool (Keogh, Naylor, de Boo & Feasey, 1999; Naylor & Keogh, 2007; Ingeç, 2008; Song, Heo, Krumeraker & Tippins, 2008; Sasmaz-Ören, 2009). According to Stephenson and Warwick (2002), concept cartoons can be utilized generally for formative assessment and, in this case, students can find out where their learning comes from, by looking back. Moreover, these tools provide opportunities for feedback in the classroom against alternative ideas throughout the learning process and give information regarding how student ideas have changed (Dabell, 2008). In this respect, making use of concept cartoons for assessment purposes and student self-evaluation is said to be essential for encouraging students to be responsible for their learning and for following-up changes in their development. As is already known, concept cartoons were first presented by Keogh and Naylor as an alternative assessment tool within the context of learning-teaching approaches based on constructivism (Korkmaz, 2004). At this point, considering the aim of concept cartoons and the benefits for students, it is thought that studies regarding the utilization of these visual tools for assessment purposes are significant in terms of literature. Furthermore, although it is stated in literature that concept cartoons can be used as an assessment and evaluation tool, it can be implied that there aren't enough studies regarding using them for assessment purposes and developing a scoring key in line with this purpose.

Effective use of concept cartoons

If the cartoons are to be used as media of instruction, the most important factor to be considered is the involvement of students. The use of graphs, posters, charts, and cartoons in classrooms results in pupil growth only if there is active participation in their construction or use, as described (Harvill, 1947 in Eulie 1969). Active participation of students in the use of cartoons encompasses students a) thinking about the cartoons, b) discussing the meaning, and

c) if appropriate, drawing or creating their own cartoons. Cartoons drawn by the students will inspire them to think about certain issues and expressed a stance on the issue.

Kabapınar (2005) investigated the potential benefits of teaching via concept cartoons. In this two phased study, firstly, a number of case studies were conducted in different primary science classes (4th and 5th grades) to study concept cartoons' effectiveness. Students' ideas were determined both individually via written probes and during classroom interactions. The results indicated the concept cartoons as effective for finding out students' ideas without being affected by the ideas of others. In Second phase, a number of case studies with experimental designs were conducted to determine the effectiveness of concept cartoon teaching. Concept cartoon teaching was found effective in creating focused discussions where reasoning behind students' misconceptions could be uncovered, especially via teachers' thought-provoking questions; teaching via concept cartoons was effective in remedying the misconceptions. the study emphasised that the success of teaching does not only stem from the concept cartoons itself as a teaching material but it also stems from the quality of classroom interactions during the discussion and investigation phases of the teaching. Use of concept cartoons for 7th grade science classes have impacted students' enquiry learning skill perceptions by helping students to enquire new knowledge with their existing experiences (Balım, Inel & Evrekli, 2008). As mentioned earlier, concept cartoons are efficient tools to identify student misconceptions (Ingeç, Yıldız and Ünlü, 2006 cited in Ekici et al, 2007) and to remedy them (Saka, et al, 2006 cited in Ekici et al, 2007).

Conclusion

The use of cartoons as teaching and learning strategies began to regain attention among educationists because cartoons are able to:increase understanding, attention and interest, improve motivation towards learning, improve attitudes, increase productivity, creativity and divergent thinking, reduce anxiety and stress, increase active participation of students in the learning process and reduces boredom and behaviour disorders.

Eulie (1969) states that when cartoons are used in teaching, it can (a) create and maintain interest, (2) encourage students to think, and (3) help us to understand the issues. Concept cartoons can engage students in focused discussion when they talk about the concepts presented by the cartoon characters. This can provoke debate and argumentation among students, particularly if they have opposing ideas and do not agree with each other's viewpoints. Hence, the use of concept cartoons offers much promise in formative assessment as it allows teachers not only to obtain feedback about students' thinking but also to address

any misconceptions that their students may have. Furthermore, in the course of debating their ideas, students have the opportunity to engage in interactive, dialogic talk in a group setting where they articulate their thoughts, question each other, generate claims, propose explanations, and justify their reasoning.

Chemistry is very abstract in nature and learning in chemistry is unrelated to the everyday world they live in. Majority of secondary school students claim that chemistry is a very difficult subject to study. It is the duty of the teachers to make the learning meaning full and easy. For that teachers can use a variety of innovative teaching methods. Though the concept cartoon had been discovered by Keogh and Naylor in 1990, it is till to play due role in school chemistry education scenario in our country. So it will be worth enough to advocate the use of concept cartoons in school chemistry learning.

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