



The Roles of Cartoons and Comics in Science Education

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1. INTRODUCTION



- Science teachers have faced the problem **how to promote students' interest**, so they have looked for **new methods and tools**, which would not only interest students, but also lead to desirable educational outcomes.
- In context of the development of science and technology (especially ICT) the traditional position of the teacher as the only authority has been overcome and **students' learning styles** have varied considerably as well.
- The need to **change educational methods** has been proved by the findings of surveys carried out in the international **PISA** research, etc.
- One of the possibilities, how to respond to the above mentioned facts, is to use **cartoons/comics** that are popular not only in entertainment, but also in edutainment. In recent decades, cartoons/comics have appeared in lessons worldwide.

1. INTRODUCTION



Cartoons/comics are used to achieve different **educational objectives**:

- development of reading skills
- enrichment of subject vocabulary
- development of problem-solving skills
- development of written expression skill
- development of idea formulation skill
- development of conflict resolution skills
- identification of attitude to science
- strengthening motivation
- acquisition of scientific knowledge
- detection and elimination of misconception

2. Cartoons/comics and Net Generation

- Popularity of cartoons/comics with the young generation is connected with their **higher visual literacy** (the Net Generation).
- The way of expression based on means of **visual communication and little text** suits them perfectly.
- In connection with frequent use of ICT the Net generation can **integrate images and text naturally**.
- Members of the Net Generation are able to **move between reality and virtual** environments quickly.
- But, they have significant **problems with reading long texts** and their **comprehension**.
- We need **well-crafted cartoons/comics** interesting and understandable.
- They do not like studying manuals and long instructions, they skip passages and try to finish the text quickly.
- We can use cartoons/comics for creation of manuals, etc.

2. Cartoons/comics and Net Generation

- Today's students are motivated by **daily life issues** set into a **meaningful context**.
- We use cartoons/comics containing images with **specific situations**.
- **Interactive cartoons/comics** simulate this kind of communication.
- The Net generation considers their peers more credible than teachers.
- Cartoons/comics - information is communicated by "image" peers.
- They refuse to read long texts and prefer visual stimuli.
- Students acquire abstract concepts better if they use cartoons/comics instead of conventional textbooks.

These requirements are fully met in **cartoons/comics** that contain **short messages** set in **meaningful contexts** created by **specific images**.

2. Cartoons/comics and Net Generation

- The Net Generation members **express themselves easily through images**. This can motivate active involvement of students in creation of cartoons/comics.
- This activity can lead to:
 - spontaneous acquisition of **scientific knowledge** and **skills of scientific communication**
 - study necessary **information** when creating texts inserted into "speech balloons"
 - **formulate** short **meaningful and scientifically correct statements**.
 - help them improve their **problem-solving tasks** that require the application of new knowledge in unusual situations and problems of working with information.

3 Classifications of educational science cartoon/comics

- A **cartoon** is a two-dimensional work of art that is not usually realistic or it is only partially realistic. Its purpose is usually caricature and humour used primarily for entertainment.
- Historically, cartoons evolved from a single image a "single-panel cartoon." This form has remained, especially as a satirical drawing in newspapers and magazines.
- Cartoons contain an image component and often a text component, usually inscribed in a speech balloon that comes out of character's mouth. The text can also be written in a box inside the panel or under the panel frame.

3 Classifications of educational science cartoon/comics

- **Combining two or more cartoons in a series**, connected by the same idea or story, forms **comics**. The term comics came from the English word "comic-strip" which can be translated as a strip of comic images.
- An image is called a **panel**. Images, possibly with accompanying text, are organized one after another, **creating a story**. There are also **comics without text**.
- If the comic is short, which means it contains **2-5 panels arranged** in a strip, it is called a **strip**.
- We are going to pay attention only to cartoons/comics with **science content that** are going to be referred to as **science cartoons/comics** (hereafter **SCC**).
- Many SCC can be used in science education, and they are referred to as **educational SCC** (hereafter **ESCC**). If we want to use ESCC in teaching systematically, they must be created intentionally.
- Several experts and companies in the world have already started creating ECCS.

3.1 Educational science cartoons

The simplest ESCC are **educational science cartoons**, which take the form of a **single panel**. They do not differ from traditional illustrations much, but their characteristic features are satire, irony and humour. Their basic characteristic is the fact that the main information medium is an image and text may be absent or only accompanies this image:

3.1 Educational science cartoons






Educational science cartoon. Constellation.

3.2 Sciencetoons

- P. K. Srivastava also uses only one panel when creating "sciencetoons", which has continuous text on one side, explaining depicted science issues simply and briefly. There is accompanying text under the picture, related to the situation shown.
- This kind of ESCC serves as motivation to study or as an incentive to stimulate discussion about the depicted issues. The combination of figurative representation and description of a phenomenon usually leads to better understanding and remembering.

3.2 Sciencetoon

	SCIENTOON	
<p>BROWNIAN MOVEMENT</p> <p>The zig zag movement of the suspended particles in a fluid medium is called Brownian Movement.</p>	 <p>"This is not your Lab and remember Professor! You are a human being and not a particle to follow <i>Brownian Movement</i> on the road."</p>	

Sciencetoon. Brownian movement

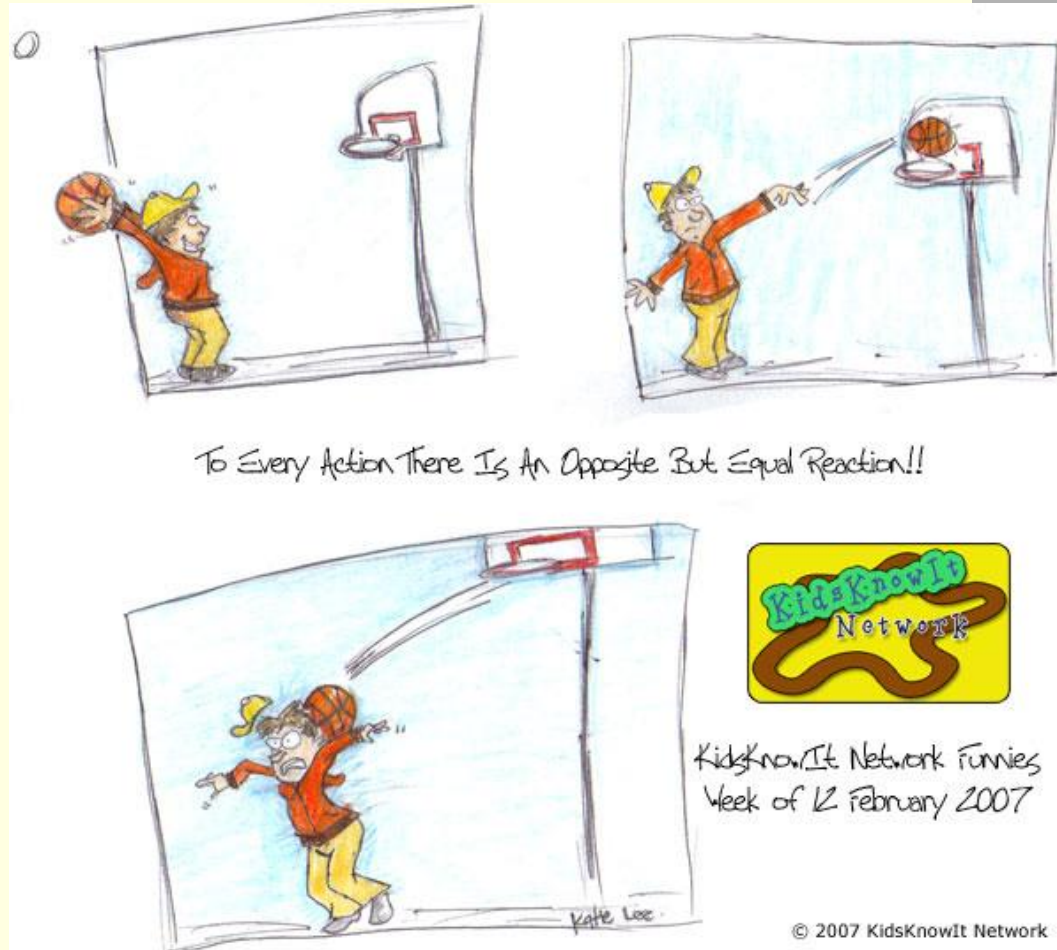
3.3 Concept cartoons

B. Keogh and S. Naylor and their Millgate House Education publishing produce and supply the educational market with "concept cartoons", which use one panel that contains mostly a group of characters discussing a certain issue. Individual characters suggest various problem solutions in their speech balloons. The authors specialize in **overcoming misconceptions**.

3.4 Comic strips

Several panels connected in a "**comic strip**" create a story that motivates students and brings them explanations of natural phenomena in a humorous form:

3.4 Comic strips



Comic strip. Action-reaction

4. Principles of creation of educational science cartoons/comics

Based on research using ESCC, formulated the following principles for the creation of ESCC, which we have modified as follows:

1. When creating ESCC a **minimum of text** should be used to make it clear and accessible to students of all ages and different levels of literacy.
2. Scientific knowledge should be used in connection with the issues of **everyday life** so that students can interlink phenomena and professional terms with events around them and can develop skills of professionally correct and reasonable argumentation.
3. ESCC should present **alternative views** on observed issues that could help to **identify possible misunderstanding** and should teach students how to distinguish between the alternatives.

4. Principles of creation of educational science cartoons/comics

4. ESCC should include **all scientifically acceptable views** on observed issues.
 5. Presented alternative views on observed issues must be presented to students **equally**, so that students could not be affected by the form of presentation.
- Today it is possible to **create our own ESCC** that would meet learning objectives and requirements of teachers and students fully.
 - Nowadays, there are **free programmes** available on the Internet for creation of your own ESCC.
 - It is advisable to **involve students in the creation of ESCC** who can not only acquire scientific knowledge and skills, but also develop interdisciplinary relations, because students apply knowledge and skills from Czech language, Art, ICT and very often English language.

5. Benefits and risks of educational science cartoons/comics

- ESCC similarly to any other teaching method has **benefits and risks**.
- A great benefit is considered a **strong motivational incentive** of ESCC, which may be weakened by excessive and improper implementation of ESCC in teaching/learning.
- It is also necessary to consider the content selection for ESCC creation carefully, because you cannot transform any topic into the ESCC form.

5. Benefits and risks of educational science cartoons/comics

Benefits	Risks
Great motivating potential	Excessive usage, inappropriate choice of content and inappropriate usage in lessons reduces motivational effects
Short concise texts suitable for the current Net generation that refuses to read long texts	Shortening and simplifying of texts may result in ambiguous and scientifically inaccurate statements. If students do not create ESCC themselves and are not forced to seek and process information, skills for working with text and reading literacy are not developed.

5. Benefits and risks of educational science cartoons/comics

Benefits	Risks
Putting subject matters into meaningful contexts	Fixation of a phenomenon and its solution in a given situation associated with the phenomenon in ESCC. Students can mismatch a particular situation shown in ESCC with the observed phenomenon or concept and they will not be able to match it with other conditions. Therefore, ESCC should include various alternative presentations of issues to avoid misconceptions.
Visualization of issues - images representing issues to be solved	
Identifying and removing misconceptions	

5. Benefits and risks of educational science cartoons/comics

Benefits	Risks
Interdisciplinary approach - using science knowledge and skills, mother language, art, ITC and very often English	Students can consider requirement for interdisciplinary skills an obstacle. However, it can be solved by appropriate guidance and help of the teacher and the choice of an adequate level of ESCC assignment.

5. Benefits and risks of educational science cartoons/comics

Benefits	Risks
A significant part of informal education, whether in the form of printed materials, or interactive materials on the website	Wrong processing of ESCC (text simplification leading to confusion and errors) without feedback of acquired outcome can lead to fixation of incorrect explanations and misconceptions. Prevention is respecting principles of ESCC creation and presenting alternative views on issues, which can help to identify possible misunderstanding and teach students to distinguish between the alternatives. It is necessary to combine ESCC with other teaching methods and tools.
Support of constructivist teaching approach - students acquire knowledge of natural phenomena based on gradual inquiry enabled by depicted situations, they do not accept only complete knowledge	

6. Conclusions

- ESCC are **very popular with students**.
- ESCC use in science teaching/learning **does not mean solving all the problems** currently faced by science teachers.
- ESCC should increase students' interest in scientific issues and appropriate implementation in lessons can help to detect and correct some misconceptions, deepen understanding of natural phenomena and increase the competence of students in problem solving and communication.
- ESCC is a big issue, **not very well-known**, so it should **be included in the continuous professional development of science teachers**.

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Thank you for your attention.



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