

Technology Innovation in Technical Teacher Education

David Vanecek

Masaryk Institute of Advanced Studies, Department of Engineering Education,
Czech Technical University in Prague, Czech Republic

vanecek@muvs.cvut.cz

Dana Dobrovska¹, Pavel Andres²

Abstract - This paper is aimed at the new aspects of the illustrative method. How do you teach difficult technical parts with clarity? Are you using modern technology for teaching difficult technical parts? It deals with current ways of improving illustration by using animation in explaining technical areas that otherwise, due to their complicated nature, would not allow sufficient explanation by the verbal-pictorial method. The paper presents technological possibilities of the solution to animation. Selected animations will be presented to the conference community.

The Dept. of Engineering Pedagogy, Masaryk Institute of Advanced Studies (MIAS), CTU in Prague prepares students for the profession of technical teacher in the bachelor study program "Technical Teacher Education".

Index Terms - Didactic methods, Animation, Blended learning, Teaching aid.

1. Introduction

The didactic methods represent an effective application of a teaching theory. They form a dynamic system of scientifically proven demands and rules that reflect the fundamental nature of the teaching process (teachers' activity – instruction, student's activity – learning). The didactic methods determine the content, organisation and the realisation of the educational process [2].

Selected Didactic Methods:

- Didactic Method of Scientific Approach
- Didactic Method of Initiative and Awareness
- Didactic Method of Consistency and Perseverance
- Didactic Method of Illustration
- Didactic Method of Adequacy
- Didactic Method of Combining Theory and Practice

The didactic methods are applied in specialised instruction, and they are interrelated. The didactic methods are also related to other didactic categories, such as the goals of instruction, content of instruction, organisation of instruction, conditions and results of instruction. Due to changes in the society, the selected methods are subject to consideration and revision. For further analysis, allow me to select the illustrative method.

2. Applying the pedagogical illustrative method using animation

2.1 Didactic Method of Illustration

Didactic Method of illustration: This method is based on incorporating illustrative means in the cognitive process. Illustration is utilised in creation of new technical images, in comprehension of the subject's nature, in demonstrating the specialised instruction's goals and in making them concrete. Historically, the illustrative method is connected with the personality of J. A. Komenský (1592 – 1670), who broadened the contemporary horizons of education by his learnings (not only in his written work [3]). His interpretation of the illustrative method became legendary: "Let it therefore be the Golden Rule for the teachers to show everything to all the senses, to as many as possible. Visible things to the sight, smellable things to the smell, testable things to the taste, and touchable things to the touch, and if anything can be shown to more senses at the same time, let it be so." This principle has been supported by research in psychology. The research ascertained that of what we read we remember 10 %, of what we hear we remember 20 %, of what we hear and see at the same time we remember 50 %, of what we say (self-presentation) we remember 70 %, and finally of what we practise we remember 90 % [6].

The current concept of didactics may distinguish between material illustration on the one hand, and verbal-pictorial illustration on the other hand.

Material Illustration: A system of images and terms is created on the basis of immediate perception of real materials such as natural articles, museum displays, drawings, photographs, etc.

Verbal-Pictorial Illustration: A system based on verbal description of the subject phenomenon, such as an example of situations and events. The teacher's spoken word is very effective especially when corresponding with the student's experience [4].

Due to progress in technology, it is necessary to distinguish yet another type of illustration arising from utilisation of recent didactic and computer technologies. Allow me to take the liberty to name this new type of illustration "illustration by media" (such as video, animation, hyper-media

¹ dobrovska@muvs.cvut.cz

² andres@muvs.cvut.cz

programmes, etc.). Below, we will focus on illustration by technical animation.

2.2 Animation

Animation: In the special didactics, animation is focused on a concrete student group. The most fundamental functions that animation fulfills can be categorized into the following:

- rehearsing the subject
- comprehending the subject nature
- simulation – real situation (such as physical phenomena)
- illustration

The teacher chooses what didactic function to utilise. The scenario and realisation of the animation will be closely tied to the didactic function of animation. The choice of a particular type of animation suitable for the instruction in the specialised technical field is of great didactic interest.

Verbal-pictorial illustration proves insufficient in explaining particularly abstruse areas of natural science. In such cases, animation will be used to facilitate comprehension of the particular subject's nature.

The previously formulated hypothesis can be demonstrated in the example of heat treatment of material – hardening (a theme group for both the SPŠ and SOU school programmes majoring in engineering).

Problem Situation: Most secondary technical school textbooks (in the Czech Republic) deal with heat treatment. They describe hardening as to what temperatures are reached to heat-treat the material as well as the final results. However, the theme of hardening is only part of a larger topical area generally dealing with various types of heat treatment.

Consequence: A high percentage of college students, even in senior years, still confuse the term of hardening with annealing and/or tempering (various types of heat treatment).

Applicable Solution: Animation will be used in explaining the process of hardening. The teacher will use animation in a way that will allow the student to see the material being inserted in the furnace, the material being heated in the furnace while changing its colour and subsequently, the material being taken out of the furnace and cooled in the quenching bath. Simultaneously, the student will be able to monitor the entire process in a diagram showing the correlation of the temperature changes and the percentage of Carbon present in the material (in bainitic hardening, eutectoid steel). All viewed on one screen. The teacher might further this method didactically.

Conclusion: Verbal-pictorial illustration is replaced by animation illustration. The creation of this new learning experience is managed in several directions; the general direction walks the student along the steps necessary to complete hardening (such as the heat treatment, cooling in the quenching bath, etc.) while the more specific direction focuses on the changes in the material microstructure taking

place in the process. The process is furthermore technically depicted (interpreted) in a diagram. The student is given an opportunity to gradually watch the ongoing process in a dynamic diagram. This will facilitate his/her understanding of the process. The diagram is not presented as a mere fact but rather as an action.

2.3 Using Animation

Blended learning is an educational process in which the traditional learning is augmented with computer learning: e-learning. In both types of instruction, blended learning and in the e-learning, there arises the necessity to support illustration through animation. In the e-learning type of instruction, it is necessary to design a very precise scenario of the entire course while incorporating animation. In the blended learning type of instruction, the most recent computer technology is utilised as a means of aiding the traditional learning. The teacher is recommended to didactically use animation during his/her lesson.

2.4 Technological Possibilities of Solution to Animation

In the present, the FLASH Professional programme is used in animation production. This programme combines sophisticated graphics with an interactive access to information. Browsing the internet, one can come across FLASH very frequently (such as in interactive and banners). The programme makes it possible to produce animation cartoons, clips as well as interactive games involving the viewer in the action by letting him/her to participate in the key decisions. The FLASH is more than entertainment for designers and artists. Thanks to its programming language, the programme allows the creation of truly interactive environment and controls [5]. Other technological possibilities of solution to animation: animation GIF, dynamic HTML, Java applet, Shockwave, Wink, 3-D Web graphics, Interactive animation.

3. Conclusion

The illustrative method is of special importance to technicians. A positive approach of technical college students, as well as that of young people, to computer technology in general, opens an ever greater opportunity to use animation in the instruction in the specialised fields. Given the relatively demanding nature of animation creating, and the busy nature of the teaching profession, it seems unlikely that the teachers themselves would create their own animation in the foreseeable future. Instead, the animations will be produced by specialised e-teams for the sole purpose of e-learning and blended learning course.

Finally, perhaps a word of caution for us teachers. Please remember that animation while being a useful means of teaching should not be confused with the actual goal of teaching.

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