DEVELOPMENT OF STUDENT COMPETENCES BY CREATING AN INSTRUCTIONAL VIDEO: PRESENTATION OF A CASE

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In the era of information technologies, teachers need to acquire new skills and competences. Info-communication technology (ICT) is extensively used in education and the development of student competences to use ICT should be focused in the process of teacher training. This paper reports on a project of which the aim was to create an instructional video with a group of student teachers, whose majority belongs to the age group of 30-50. The project was planned with the involvement of the group; however, the students mostly expected the teacher to tell them what to do and were in general reluctant to take an active part in the project. The video was created with a significant participation of the teacher. The project was a success in terms of the motivation and raising the interest of the students, but failed to involve them to play an active role in the creation process. It is concluded that creation of an instructional video can be a valuable tool in the development of student teachers' competences, but the way it was implemented in the present case needs further revision.

Keywords: instructional video, project, teacher education

Approaches and opinions about teaching and learning have been considerably revised in the recent years. While competence has become a central concept, new ways of behaviour and thinking have also been occured. We can experience that we also need digital literacy in addition to literacy in the traditional sense (Tóth, 2012).

Research results proved that "practical skills and the teacher's competences can only be developed through consciously developed, implemented and analysed (reflected) activities." (Hajdú, 2006). A number of such competences are listed in the 2006 Decree of the Minister of Education of Hungary, about the teacher's competences to be acquired in a Master's level programme of teacher education. Those competences include

the ones related to digital literacy as well. These competences are considered as "basic competences" in the info-communication society (Cserhátiné, 2008), and are of key importance (Szabados, 2009). By taking advantage of the opportunities offered by the info-communication technologies, the teacher can efficiently direct the learning activities of the students. The aim of the development of ICT skills is "an even more efficient practice of the teacher's profession. The teacher's competences related to the information technologies are not separated from the description of other fields of the teacher's competences." (Kárpáti & Hunya, 2009). One area of ICT competences is represented by the ICT user's general competences, which is also called digital literacy. The other area is competence related to the educational use of the ICT devices (Lakatosné, 2011). This also proves the existence of one teaching competence, i.e. by the application of the new info-communication technologies, the teacher can create an efficient learning environment for the students, thus creating a variety of learning forms. The teacher will also be able to choose digital teaching materials, to find resources and contents that meet the aims of teaching and development, and also to systematize and edit them (Minister's Decree, 2006). The teachers should not only use their digital literacy skills, but they should also develop these competences in their students. This is a methodological and educational task (Ollé, 2012). In the life of the Z generation, the use of different ICT and Web 2.0 tools for learning is natural (Szabados, 2009). Teachers belonging to the Y generation have a closer relation with the Z generation students than teachers of the X generation, because the technologies of the Y generation are obvious for the Z generation (Szabados, 2009). In teacher education, digital pedagogy and classes with regular use of ICT tools are necessary so that the use of such tools be obvious for the student teachers in everyday life (Cserhátiné, 2008). ICT is also appropriate for overcoming differences and disadvantageous social situations. Instructional software can be excellent tools for individual teaching and learning at the individual's pace. Instructional software that integrates knowledge and helps understanding can have a high importance (Csapó, 2008).

By the application of info-communication technologies, multimedia contents can be easily used or even produced by the teacher. One type of such contents is video. The instructional video "consists of black and white or colour series of pictures, whose order and length is unchanged, and is appropriate for presenting movements, arranged in a didactic structure. It presents knowledge using the artistic and technical tools of film to promote learning, for realizing a specific educational goal and method." (Varga, 2008) Educational videos make it easier to present and understand different teaching topics, even if real demonstration is not possible during a class (Herczku, 2007). Instructional videos can be divided into several types, such as motivating videos, knowledge presenting videos, illustrative videos, demonstration videos and situation videos (Gesztesi, 1997). Instructional videos have the advantage of "dynamic and event-like presentation, realistic depiction, demonstration from many aspects, presentation from different points of view", and "special effects make it possible to present movements and phenomena that cannot be perceived or studied in reality; it can also show processes accelerated or slowed down." (Varga, 2008). As Varga says, educational films have several didactical functions, such as motivation, provision of facts, placing facts in a system, and summary. Video technology can help bridge the gap between the school's artificial environment and the outside world in a way that it brings "reality" into the classroom (Jurich,

1999). In a study published by the Corporation for Public Broadcasting, it was concluded that educational video:

- Reinforces reading and lecture material.
- Enhances student comprehension and discussion.
- Provides greater accommodation of diverse learning styles.
- Increases student motivation and enthusiasm.
- Promotes teacher effectiveness. (CBP, 2004)

A number of such advantages of using instructional videos have been demonstrated by authors representing different fields. Videos can strengthen the connection between the abstract concepts and principles learned in class and their concrete application (Jurich, 1999). In the context of language teaching, instructional videos can, for example, significantly improve students' knowledge about the culture of the target language (Herron et al, 2000). Another study proved that random access video contents in an e-learning system has a positive effect on both learning outcome and the learner satisfaction in e-learning (Zhang et al., 2006), and the positive effect of the inclusion of video clips on the motivation of the students was also confirmed by Simo et al. (2010).

Student competences can be developed by video creation. Holtzblatt & Tschakert (2011) described three groups of competences used in a student video project. First, functional competences include reporting, research, and leverage technology to develop. Second, personality competences, including professional demeanor, problem solving and decision making, interaction, leadership, communication, project management and leverage technology to develop. Third, business perspective competences, which were related to their profession. Production of a video can also improve the students' knowledge on the subject matter (Frenzel et al., 2013).

Writing a storyboard also has a potential of supporting students' learning processes. It facilitates critical and sequential thinking and thus providing contextual learning (Lillyman et al, 2011), and also offers an opportunity for systematizing and disseminating thought experiments (Jones, 2008). The use of digital storytelling methods in for 20 weeks in a senior high school resulted in a significant improvement of students' critical thinking and learning motivation in learning English (Yang & Wu, 2012).

In teacher education, video is extensively used for assessing student teachers' teaching or discussing cases. So et al. (2009) used a video database made of student's teaching videos and the student could use it collaboratively. In another research, pre-service teachers were engaged in video recorded role playing cases. The use of the videotaped cases in teacher training has a potential of improving motivation, learning, empathy and even the construction of professional identity (Koc, 2011). The use of video cases in teacher education was also recommended by Ozkan (2002), who highlighted situated cognition, cognitive flexibility and reflective practice, as major theories of using video cases. Another study by Towers (2007) highlights that video can direct attention to the learner in the analysis of classroom practices, focus on reflective practice, and provide a prompt for the imaginative rehearsal of action.

The use of ICT tools requires some basic knowledge and competences. However, an assessment of students' knowledge, applying for BA and BSc level programmes, suggests that the majority of what is prescribed in the National Curriculum in the field of informatics is not taught at secondary level (Kiss, 2011). Another study demonstrated that teachers and most often use ICT tools for planning the educational processes (Lakatosné, 2011).

Simon's (2012) results suggest that teachers use Web 2.0 tools for private purposes more than for their profession, but they are open to use them for teaching as well. Although the majority of the teachers in that research said that their knowledge on information technologies is "over average", the author urges the inclusion of up-to-date information technologies in the curriculum of teacher education courses.

Goals

Creation of an instructional video requires the application of a number of teacher's competences, and also has the potential of their development. This paper presents the first attempt in the Department of Education, Pollack Mihály Faculty of Engineering and Information Technologies, to include the creation of an instructional video in the learning process of student teachers. Goals at two levels were identified before the project. For the teacher trainer, the primary aim of the project was to develop the student teachers' competences. For the students, the goal of the project was to create an instructional video.

Methods

Participants

There were 12 students invited to take part in the project. All of them are students of the Teacher of Engineering MA programme of the University of Pécs, Pollack Mihály Faculty of Engineering and Information Technologies, Pécs, Hungary. All of them hold at least one BSc or MSc level (or equivalent) degree in engineering and before starting this MA programme, none of them had previous studies in education. All students are between 30 and 50 years of age except one younger and two older. This project was implemented as part of their eLearning course. None of the students had any previous experience with creating an instructional video. The project was led by a full-time teacher of the Department of Education, Pollack Mihály Faculty of Engineering and Information Sciences, University of Pécs, who has moviemaking skills.

Procedure. Preparatory session

Before starting the project, students were prepared to provide them with the information necessary for planning and implementing the project. The preparatory session covered two topics. Topic A was the project method which included the general procedure of projects in education. Topic B was the procedure of creating instructional videos.

For the explanation of the project method, Torgyik's (2007) description was followed, which was slightly modified as demanded by the particular needs of the topic. According to that description, first, the goals, the time frame and the evaluation criteria need to be clarified. Second, the tasks are planned in the group, including a clear identification of each task, together with the instruments needed and the persons involved. Also, a mind-map is created by the participants. Third, the tasks are carried out, as planned, and fourth, the final product is presented to the group. The product is then evaluated.

For the discussion of the video creation procedure, the scheme described by Elek et al. (1998) was used. The six steps described by them are as follows:

- Choosing a theme
- Analysis of goals and matters to be taught
- Selection of medium type
- Creation of medium (storyboards, production)
- Testing, evaluation
- Creation of final version

Besides, educational, psychological and technical knowledge is needed, as suggested by the authors.

Project implementation. After the preparatory session, the project was implemented by carrying out the following steps, following the plan outlined above.

Definition of project goals

The project goal was the creation of an instructional video. The theme of the video was a chemical experiment, which was determined by the teacher. The experiment was the "Chemical Garden", which is well-known in popular chemical literature and has been researched since the late 19th century (Thouvenel-Romans & Steinbock, 2003). In this experiment, spectacular colourful forms evolve of metal salts in sodium silicate solution.

The group decided that the aim of the instructional video is to demonstrate this phenomenon and provide explanation how it works. The group also decided that this video would be 3-5 minutes long. These properties, i.e. the quality of demonstration, the quality of explanation and the time frame, will serve as primary aspects of evaluation at the end of the project.

The planning phase

The aim of the planning phase was to organize the production of the video. To promote this activity, the mind mapping technique was used. Using the map, the following tasks were identified:

1. Writing narration text and storyboard.
2. Meeting with lab people, organizing time, place, materials, asking for staff assistance
3. Organizing instruments for shooting (camera, tripod, microphone, lamp, tape)
4. Shooting
5. Reading narration
6. Choosing background music, editing

In certain fields of knowledge, such as writing a storyboard, operating a camera, or editing a video, the students had little previous knowledge, so the teacher provided help in carrying out the related activities.

In a properly planned project, individuals and dates are assigned to each task. In this project, students turned out to be reluctant to take an active part in the implementation of the tasks and only two students volunteered, so the

teacher decided to guide the project in a way more active than usually in a project. Nevertheless, the students expressed their interest in the project.

Carrying out the tasks

1. Narration text and storyboard. One student was responsible for writing the narration text and storyboard. For this purpose, she collected information about the experiment and outlined the major parts of the video as follows:

- Introduction (a short interview with two experts)
- Presentation of tools and materials used for the experiment
- The two experts show the experiment: 1. they make the sodium silicate solution, 2. they drop the pieces of metal salt in the solution.
- The formation of the flower-like forms is shown, while the phenomenon is explained by the narrator.

Of these four points, the last three are referred to as the "experiment part" of the video. For writing the shooting script, the traditional double-coloumn format was used. In the left coloumn, shots with instructions for the camera operator were listed, while the right coloumn included the soundtrack. Although the student was able to describe the structure of the video, she needed considerable help in creating a usable shooting script. She had to learn the different types of shots (close-ups, long shots etc.) and some basic rules of how they are used. See the final shooting script in Appendix A. The student had to learn the following principles: close-ups are used for showing details, while long shots or mid-shots are used for showing the environment of the event being filmed. If possible, two shots of the same type should not follow each other.

2. Organizing the scene took only a few emails with a staff member of the Department of Environmental Engineering, Pollack Mihály Faculty of Engineering and Information Technologies, University of Pécs. Prior to using their laboratory, permission of the Head of the Department was obtained. Apart from one staff member, two B.Sc. students of Environmental Engineering acted in the video as assistants. Shooting was scheduled to 18 April 2012, 9.00 a.m.. The staff member and the two engineering students prepared all materials and lab equipment as needed for shooting.

3. Equipment for the shooting was provided by the Department of Education, Pollack Mihály Faculty of Engineering and Information Technologies, University of Pécs. The instruments were as follows: Sony HVR-A1E digital camera with a Sony VCT1170 RM tripod, and one "Balogh" type spot lamp. Permission to use these instruments was obtained from the Head of the Television Programme Maker course of the Pollack Faculty.

4. Shooting: All equipment was prepared and carried to the lab, as scheduled. The chemical materials and instruments were also prepared by the staff member and the engineering students. Apart from those previously assigned to take part in the shooting activities, one student of the Television Programme Maker course was invited to assist. Before any shooting activity, the persons involved had a discussion, which covered the following topics:

- Common reading and interpretation of the shooting script, discussion of the shooting procedure
- Assigning roles, such as Speaker, Student A, Student B, camera operator,
- Finding locations in the lab for shooting the two parts of the video, i.e. the introductory interview and the experiment. For both

situations, decisions were made about where to place the camera and the lamp and where the actors should stand.

After the discussion, shooting was started. The aim of shooting was the creation of video clips which were later used to complete the video in the editing process. The recording properties of each clip was determined by the shooting script, however, during the shooting process, new ideas arose, thus the final video was not exactly the same as what was written in the shooting script.

Figure 1. The initial position of the camera and the actors. (C: camera, L: lamp, S: Speaker, A and B: engineeringstudents)

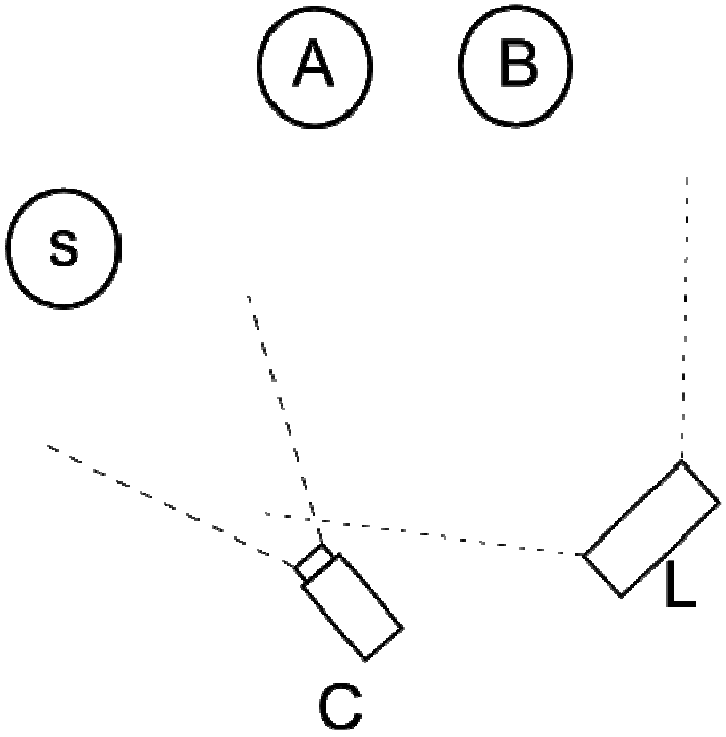

Figure 1 illustrates the arrangement for shooting the introduction part. One student was assigned to act as Speaker, but she felt unconfortable in front of the camera so the teacher acted as Speaker. The camera was operated by the Television student. The whole introduction part was shot without interruption, and the different shots prescribed in the storyboard were obtained by panning and zooming. Because of setting problems and mistakes, the shooting of the introduction part was repeated twice and the third version turned out to be usable.

Figure 2. *Camera positions for shooting the experiment. (C: camera, L: lamp, A and B: engineering students)*

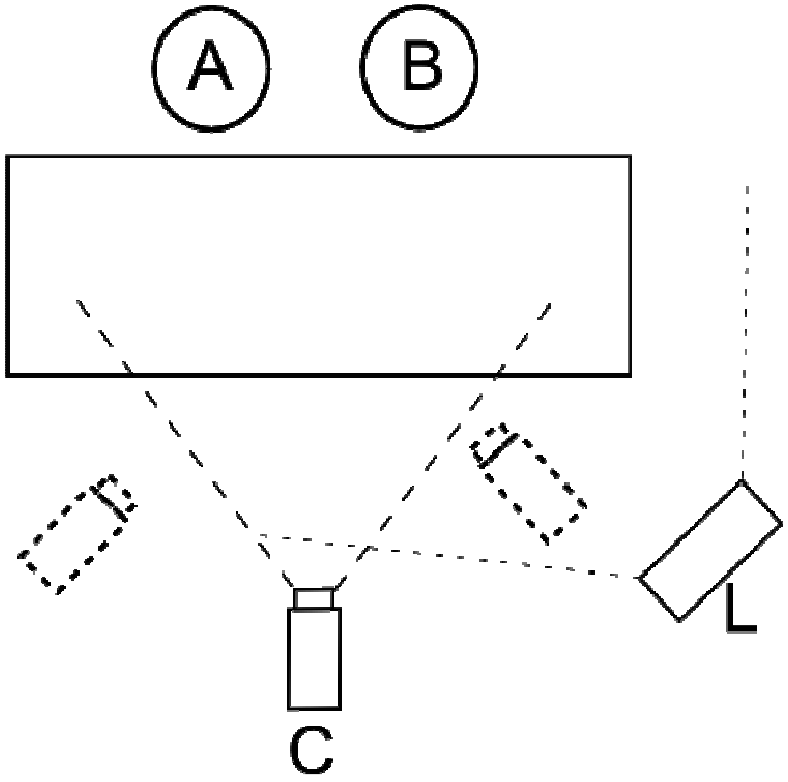

Figure 2 illustrates a general arrangement for shooting the experiment part. The dotted rectangles represent camera positions other than central.

For presenting the instruments and materials, first, wide angle shots from different positions were made to show all items used in the experiment. Then, close-ups were recorded to show the details of the instruments and the materials. For this purpose, several camera movement variations were used, including pans, tilts, and zoom-ins and zoom-outs.

For presenting the experiment, again, a wide angle shot was used as an establishing shot to show the context of the experiment, then, close-ups were recorded to show small details and movements. To make the visual appearance of the video more changeable, low angle shots of the engineering students were recorded. Several actions were recorded twice, first, using a long shot, and second, using a close up with zooming in. The purpose of this was that such changes direct the attention of the audience to the important details of the scene. This technique was especially used at the beginning of a series of events, after the establishing shot. Finally, when the experiment was ready, the colourful forms in the glass were recorded in several different ways, mainly close-ups and extreme close-ups, using pans and tilts.

Although shooting seemed a simple operation, it was mostly carried out by the television student, under the direction of the teacher. The student teachers understood the different types of shots, but did not feel that they were able to use it with self-confidence.

Shooting took approximately 3 hours and the length of the footage was approximately 30 minutes in total.

5. For reading the narration text, one student volunteered, but she made several mistakes and was reluctant to repeat reading so finally the teacher read the text. Editing took place in the Department of Education, where the Adobe Premiere video editing software was available for this purpose. The

main aim of the editing process was to realize the shooting script, however, many new ideas arose during both shooting and editing, so, again, the final video was slightly different from what was determined by the shooting script. One major change was the presentation of the materials. While the shooting script prescribed the creation of the solution first, and then the presentation of the materials (Shots 6-8), the final version of the video first presents all materials and then all the details of the experiment, which seemed more logical.

Background music licensed under Creative Commons was downloaded from the internet.

No student teacher had satisfactory skills to use any video editing software so finally, due to the limited time available, the editing process was completed by the teacher.

Testing and evaluation

Two aspects of the project results were evaluated by the group. First, the video itself was assessed, and second, the group work as a project was analyzed.

Before the evaluation of the completed video[1], the group collected the properties of the video that had been defined at the beginning of the project. The opinion of the group was that the video achieved the goals of the project because it was completed, its length is as determined, and it presents the chemical phenomenon in a spectacular way. However, several remarks were made in connection with improving the video. In particular, the following properties were mentioned:

- Poor sound quality (narration)
- Sometimes too quick movements of the camera, no time to observe thoroughly the materials
- When the camera pans and shows the materials from a close distance, the distance between the materials is too big and empty space is shown. Still images of the materials would be better.
- When the materials are presented, chemical symbols should be shown more clearly. They are on the watch glasses but are not visible.
- The male student's face is too dark.
- Difficult to understand the explanation. While the explanation of the phenomenon is being read, animation or drawings should be used instead of showing experiment and the glass with the colourful forms.

The group also discussed the project in terms of its members' cooperation and the organization of the activities. It was generally accepted that the teacher had a dominant role in managing the project and the video would not have been completed without the teacher's contribution. Students' reluctance to take an active part in the project may be attributed to the following factors:

- The project method was new to all students they only had experiences with tasks in which every little detail was determined by the teacher.
- The students had little or no knowledge or experience about script writing and video technology.
- The topic was too complex for this group to work with in a project.

[1] The completed video is available at: … youtube… (English subtitled version will be available)

Despite of all these difficulties, the students found the project very interesting and motivating, and the students expressed their interest in participating in another video project again. It was stated that the project method did not work in a proper way and the teacher highlighted that in a properly working project, the teacher only has a facilitator's role.

The teacher's aim of developing the students' competences was only realized to a limited extent. There were several occasions when students' creative and critical thinking were applied and developed. Also, the students learned facts and procedures about the creation of a video. Students' motivation and interest was also a success factor. However, most of the students took a passive role during the implementation of the project and this restricted the development of a wide range of competences.

Conclusions

Creation of an instructional video can be a good instrument for developing student teachers' competences. In this particular case, however, several difficulties arose and the project itself worked mainly only as a demonstrational tool, rather than an effective method of competence development.

The first main conclusion is that the teacher educator should make sure of the students' existing competences and skills. The lack of some basic competences needed for a project may significantly hinder the completion of the project. In this case, script writing and camera operation were lacking key competences, and significant external help was needed. Another important point was that the students in this project never had experiences with modern active learning techniques and expected the dominant role of the teacher.

Secondly, however simple the theme of the video seemed at first, it became too complex for the students. For a beginner group, creation of video clip with only a very few shots, demonstrating a simple phenomenon would be more appropriate.

Thirdly, properties of a video should be much clearly defined for the group, and thus goals can be formulated and implemented in a more sophisticated way. Beaundin & Quick (1996) developed a 17-item rating form, in which the evaluation criteria can also be used as a guideline for designing the video. For writing the storyboard, Limbert's list of the elements of digital storytelling suggested by can be followed, such as point of view, voice, the power of the soundtrack or pacing (Dreon et al, 2011).

Fourthly, to make students' video production more organized and conscious, the activities presented by Fedorov (2010) provide a good basis. Following that description, which includes composition of different types of script, dramatizing events, or using their imagination and visual expression skills, such a project can be better prepared.

Despite all difficulties we faced in this project, the results suggest that instructional video creation may have a significant role in the development of student teachers, but the way this particular project was planned and implemented needs further revision.

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Appendix A

CHEMICAL GARDEN

Shooting script

Actors: Speaker, Student "A", Student "B"

	Picture	Audio
	Title: "The Chemical Garden"	Music volume up
1.	Fade in. Chemical lab. Medium close-up of Speaker. Chemical tools in the background.	Music softer Speaker: One of the most spectacular chemical experiment is what we call the "chemical garden". We will show this experiment in the Department of Environmental Engineering, Pollack Mihály Faculty of Engineering and Information Technologies.
2.	Two shot of Student "A" and Student "B"	Speaker: What will we see in the experiment? "A": We'll drop metal salt pieces into glass water solution. Colourful forms will then evolve. Different metal salts give different colours.
3.	Close-up of Student "B"	Speaker: What preparation is needed for the experiment? "B": First, we'll make glass water solution of ion free water. We'll choose pea sized pieces of the metal salts. We'll also need a glass stick to push the salt pieces to the bottom of the glass.
4.	Camera pans Medium close-up of Speaker. Fade out.	Speaker: Let's see the experiment! Music volume down.
5.	Fade in. Mid shot. Experimental tools and materials on a laboratory desk.	Music volume up. (different music)
6.	Mid shot. Student "A" making the glass water solution.	Speaker: The glass water solution is made by diluting one unit sodium silicate with two units of ion free water. Tap water is not suitable for the experiment because the calcium and iron ions in tap water may make the solution turbid.

7.	Extreme close up. Student "A" pours the solution into a glass.	 The solution is poured into a glass.
8.	Medium close-up. Student „A" puts pieces of metal salts on watch glasses on the desk with tweezers.	We then prepare the metal salts.
7.	Close up. Pieces of the metal salts on watch glasses.	The iron chloride, the iron sulphate, the cobalt chloride and the chromium chloride.
8.	Two shot of "A" and "B". Student "A" takes a watch glass. Student "B" takes a piece of a metal salt with tweezers and places to the top of the glass.	We then carefully throw the pieces of metal salts into the water glass solution.
9.	Close-up The top of the glass. "B" puts the metal salt piece into the solution. "B" pushes the metal salt piece to the bottom of the glass.	Music
10.	Close–up. The bottom of the glass. The metal salt piece reaches the bottom.	Music.
11.	Low angle mid-shot. Student „A" concentrating on the experiment.	Music
12.	Close-up. The bottom of the glass. Several pieces of metal salts. Some colourful forms.	Music
13.	Low angle mid-shot. Student "B" putting another piece of a metal salt into the solution.	Music
14.	Close up. The glass, a number of colour forms have evolved.	Music softer. Speaker: The explanation of the phenomenon is that a thin precipitation membrane forms between the metal salts and the water glass.
15.	Close up, camera pans. The glass with the colour forms.	Speaker: This precipitation membrane is semi-permeable. Because the salt solution at the outer side of the membrane is less concentrated than at the inner side, a concentration equalization process begins.

16.	Close up The glass with the colour forms.	Speaker: Water diffuses into the more concentrated solution. Then, the increased osmotic pressure breaks through the membrane.
17.	Extreme close up One coloured formation.	Speaker: As a result, a small quantity of salt solution flows out.
18.	Close up The glass with the colour forms.	Speaker: A thin silicate membrane is formed again at the boundary of the salt solution flown out, and the process is going on. This is how the colourful "garden" is created. Music volume up.
19.	Mid shot Desk with the glass	Music
20	End title scrolling	Music
21	Fade out	Music volume down.