

## INNOVATIVE APPROACHES TO PRACTICAL TRAINING FOR TEACHERS OF TECHNICAL SUBJECTS

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**Abstract.** The paper is focused on practice of students in frame of training for future technical subject teachers, which is called “Clinical School of Technical Spare-Time and Creative Activity”. This clinical school is focused on enhancing the practical way of teaching students in the field of spare-time and creative activities. That means in the field where students are usually prepared mainly theoretically but not much practically. It is a very specific kind of practice which is focused on students of technical education pedagogy and it is realized in frame of technical activities carried out by the Jan Evangelista Purkyne University in Usti nad Labem for pupils of basic and high schools called “School of Technics”. Students are able to apply pedagogical competencies under supervision of experienced specialists in area of organization and managing spare-time activity. Pupils of basic and high schools are subsequently able to try non-traditional technologies. Activity is realized as a practice of students in conditions that are unavailable at basic and high schools due to lack of technical materials and also specialized human resources. The contribution gives essential information about the activity, its preparation and realization. As an example, there is a short description of one of the courses, completed during the activity “School of Technics”, called “Electronic Constructions”. Tuition, thanks to innovation of the practical training and the use of the project and problem teaching method, is more efficient and can better prepare students, both professionally as well as in terms of expected competencies of future teachers.

**Keywords:** technical education, students, clinical school.

### Introduction

Teachers’ training in the area of technical education is a very specific one given the complexity of the subject. Students in their training undertake a pedagogic practice, while applying the theoretical background obtained in their specific subjects, especially didactics.

One of the innovative approaches in the training is the project “Clinical school of Technical Spare-Time and Creative Activity”, where prospective teachers can try how to lead a group of pupils in their creative classes while using the technical background available at the university.

A clinical school of this type and in this specific field has a significant motivational impact on both the target groups - students of pedagogy for basic schools in the field of technical education and pupils themselves [1].

As a creative activity any activity is considered that an individual has chosen to do according to his own will and various reasons. An individual often chooses that kind of activity in which he excels and its results bring him satisfaction. There are numerous functions of the creative activity. According to Hájek [2] we consider as creative activity a target-oriented activity leading to satisfaction and development of individual needs, skills and interests. They have a significant impact on personal development and social orientation.

For many individuals success in creative activity is much more important than any other kind of success, given the fact it can compensate failures in other aspects of life. For creative activity development among pupils it is therefore important to build a whole range of opportunities to satisfy their needs.

The quantity of activities offered is not as important as the quality and variety to satisfy pupils. It is of utmost importance that the range of activities would not only satisfy them but also reflect the needs for social development of an individual.

Technical creative activity improves manual skills and abilities, enhancing technical thinking and use of it in the real world. This kind of creative activity should strengthen the pupils’ natural interest in technics. It also helps define their career orientation. Among technical creative activity we can include works with use of different materials, constructive works, building and unbuilding works, models, electronics, IT, audiovisual technics etc.

## Materials and methods

The aim of the project is organization and realization of a clinical school of technical spare-time and creative activity for students of pedagogy in a specific field of technical education. The clinical school is focused on strengthening of practical aspects in the training, i.e. the field students are trained theoretically, but in a practice insufficiently.

The target group of this practice is pedagogy (technical education) students and it runs as a series of regular classes at the university for pupils of basic and high schools under the name "School of Technics". The students are able under the supervision of pedagogy specialists to apply their competences in organization and management of creative activity. This project runs as a practice for students under conditions that are not possible to get at basic and high schools for technical and human resources reasons.

The clinical school project supports the efforts of the university to popularize technical and natural sciences education, it manages an interesting and effective practice for students in the field of technical spare-time and creative activity and also it creates an interest in studying technical related fields. The project runs in compliance with long-term efforts of the university to popularize science and technical education.

The project is a series of five one-day activities (courses), in which pupils are introduced practically and interactively with interesting fields of technics in a different manner. As a norm from each particular activity pupils are able to take the result home in form of a final product. Each course is supervised by university professors in their fields of expertise, who prepared students of pedagogy for organization and management of particular courses of the clinical school. Students themselves then manage the courses under supervision. After realization the analysis of performance of each student will be conducted. The clinical school consists of the following courses:

1. Funny metalworks

During the course traditional as well as non-traditional works with metal technologies are presented, such as casting tin, welding and soldering, forming, blacksmith works and cutting. Participants of the course are able not only to see these kinds of technologies that are not usually presented during their studies, but they can also use them in practice under supervision. Each technology is theoretically introduced to provide the basic connection between the technology and the used materials.

2. Rocket engineering

This activity is based on the course Technical creative and spare-time activity in the study program Pedagogy of technical subjects. The course introduces the basics of model engineering with the focus mainly on air and rocket engineering. In the theoretical part the principle of rocket launch and fly is explained. In the practical part the pupils are introduced with basic engineering methods and materials. The final product is a functional model of a rocket that will be launched at the end of the day.

3. Technical photography

The course begins with brief historical background, the contemporary photography is discussed as well as a transition from analogue to digital. In the practical part the course focuses on black-and-white photography from pushing the button to drying positives, the pupils also try less conventional procedures (photograms, Camera obscura).

4. Non-professional electronic constructions

The course focuses on practical application of electronic constructions. The pupils learn how to read simple electronic schemes; they will understand the transition from the scheme to the final product, which they will produce on their own. Part of the course is also to obtain skills with electric soldering iron that pupils use to produce printed circuit board. This board, the core of any electronic device, is then "made alive" and implemented into the final product.

5. Forgotten woodcraft techniques

During the course the pupils are introduced with different kinds of wood and its characteristics, traditional and also non-traditional technologies of woodcraft are presented. Practically and according to their skills the pupils can try various techniques such as inlays, they can eventually choose woodcut

or simple wooden sculpture. The final produces are polished with French polish, bee wax or Carnauba wax.

Firstly, the supervisors of courses and the students are introduced with the aim of the project and they are provided with essential information. In the course Didactics the students are informed more profoundly with the scope, preparations and time-frame of the whole project. Based on their interest they choose the particular course to manage. In groups the students are trained by their supervisors in the essentials of each course - the basic concept of a course, technologies used, technical limits and possible trouble-shooting. Basically all course realization is explained, but the students act as pupils and the supervisors as course managers [3].

Then the students take their time to do the necessary preparatory works and the supervisors to obtain materials and other mainly administrative needs. The next step is the advertisement of "School of technics" to wide public - online, by leaflets in public transport and with direct contact with nearby basic and high schools. On given dates the "School of technics" is realized as a series of five one-day activities, where pupils are practically introduced with interesting fields of technics in a non-conventional manner, different from traditional basic school methods.

The courses are realized by the students as the clinical school under the supervision of university professors. The way how the school is organized enables the pupils to undertake during the whole "School of technics" all particular activities. When the "School of technics" ends the SWOT analysis will be performed with each supervisor during the Didactics course. Given the numbers of students and pupils each course is realized by two to three students and practiced by six to eight pupils - with respect to specific technologies these numbers enable individual approach and at the same time respect to security measures. Capacity of the courses is set according to prospective demand by students and pupils.

### Course of non-professional electronic constructions

During this course the pupils are introduced with practical application of electronic constructions by using project methods. It was already mentioned, the pupils will learn how to read basic electronic schemes, they will understand the transition from the scheme to printed circuit board, which they will design and produce photochemically. Part of the course is also to obtain skills with electric soldering iron, which is used during the course [4]. The printed circuit board with electronic components, a core of any electronic device, is "made alive" by the pupils, they will put it into a proper box or the final product.

Among very popular products to make, especially by beginners with minimal level of experiences, there are various flashing gadgets. Therefore, the basic product to be produced during the course is a gadget with two flashing diodes that are connected in a stable multivibrator with two transistors (scheme on Fig. 1). LED diodes, connected with collectors of both transistors, flash in one-second intervals. As transistors universal Si-types can be used, e.g., BC108. Gadget is powered by 9V battery. The flashing times of diodes can be adjusted by changing the parameters R and C.

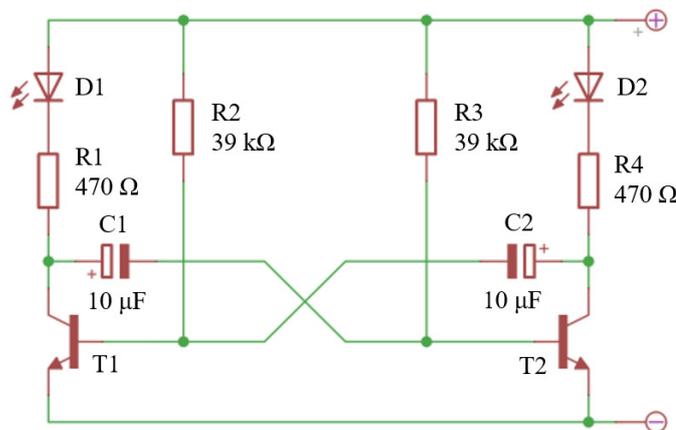


Fig. 1. Scheme of multivibrator

## Results and discussion

As the most important result the fact is considered that students by realization of a clinical school can practically apply their pedagogic competences specifically in organization and management of creative activity with the focus on particular field. The project is therefore realized as the clinical school for students with complete support and background, which is offered by an educational institution where are they prepared for their future career.

The practice organized that way fulfills not only didactic ambitions, but it represents an interesting opportunity for pupils from basic and high schools how to introduce the world of technics, try some technologies and make sure that it is indeed possible to produce quite sophisticated gadgets on their own as, for example, the mentioned electronic construction.

In the project a practice for the students of pedagogy was realized by using non-traditional approach in a way that they will be aware of the possibilities and limits in technical spare-time and creative activity. This field has a significant motivating potential and a natural interest in the world of technics can be initiated, which could eventually lead to a technical school to study as the first choice [5]. All means that are given to students to apply their competences in practice lead to more effective educational process and moreover the clinical school explained above offers a truly non-conventional motivating potential for all parties involved.

## Conclusions

Conclusions and specific results of the project in relation to innovative approaches are:

1. Organization of the activity "School of Technics" within the project "Clinical School of Spare-Time and Creative Activity".
2. Preparation of students for courses supervision within the clinical school as well as their practice in creative activity.
3. Preparation, training and supervision in realization of the courses by students and subsequent analysis and evaluation of the results.
4. Presentation of the results.

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