Application of the Project Method into the Teaching of the Aircraft Maintenance Vocational Subject

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***Abstract*—This article describes a project teaching method and its application into a teaching of an aircraft maintenance vocational subject. The first part of the article describes theoretical bases of this teaching method and used research methods. The used methods are basic research methods, project teaching method and questionnaire method. There is described a chosen subject in this part too. The project teaching method has been applied in this subject. The next part of the article is about a project method creation and its application in the teaching. The third part deals with a questionnaire. It is about a questionnaire creation and evaluation. The questionnaire was a source of data and information and it was a feedback for the authors too. An evaluation of all project method is mentioned in this part too. There is described a procedure of a project teaching method implementation at the end of the article. This procedure should be a support tool for teachers which want to applicate this teaching method into theirs teaching process. The main result of this work is a verification if the project teaching method can be used in such a specific subject like the aircraft maintenance vocational subject is.**

***Key words*—project teaching, project method, application of the project method, aircraft maintenance, procedure of the project teaching method implementation**

I. Introduction

The project teaching method is one of several teaching methods that are used during a teaching process at all types of schools or universities. There is an effort to replace the classic (frontal) teaching by other methods at last few decades. The project method is one of them. Students gain different abilities, skills and habits thanks to the using of the other teaching methods. It is difficult to gain these abilities, skills and habits during the classic teaching. Students evolve better and the teaching process is modernized thanks to the non-classic teaching methods. The other advantage is that the students or aircraft maintenance technicians will be well trained so it can increase the safety. Better training means better safety.

The reason of doing the research and writing this article is a verification, if the project teaching method can be applied to so specific subject like the chosen aircraft maintenance subject is. The second reason was an effort to applicate the modern teaching method into the university teaching and replacement of the frontal teaching (a lecture) by other method. As it is written above, the students gain new abilities, skills and habits that are hard to gain by the classic teaching thanks to the using the new method and the teaching process will be more attractive.

Two hypotheses have been defined in the beginning of the research. Their truthfulness has been verify by the questionnaire. The hypotheses are:

1. The project teaching method can be used at the aircraft maintenance vocational subject teaching.
2. Authors´ designed project teaching method is suitable for the aircraft maintenance vocational subject teaching.

II. Used Research Methods

Basic research methods (analysis, synthesis and deduction), project teaching method and questioning method via questionnaire have been used during the project teaching method application into the vocational subject.

A. Basic Research Methods

The analysis was the first of the used basic research methods. The principle of the method is that the whole thing is divided into parts. These parts are researched. The important and unimportant things are separated [1]. The method was used at theoretical part of the research.

The second used method was the synthesis. The synthesis is an opposite of the analysis. The parts are connected to one whole thing. New relationships or laws arise from the connecting [1]. The method was used in theoretical and also practical part of the research.

The last used method was the deduction. The new knowledge are created from the common known knowledge thanks to the deduction. It is a reasoning process that goes from the common known to the specific one [1]. This method was used at theoretical and also the practical part of the research.

B. Project Teaching Method

The project teaching method is one of the research teaching methods used at the teaching process. The basis of this method is the task that is defined in the beginning

of the research process. The students must solve this task. A solving process is managed by the students themselves mainly. The task or project can be solved by one student or a group of students can solve it. The solving process can be written at these four steps [2]:

1. *task assignment* – a researched area is defined and a suitable theme is chosen
2. *project plan creation* – each phase of the project, timetable, hypotheses, goals and outputs are defined, material and financial requirements are written down and responsible persons are chosen
3. *plan realization* – a work is in progress, an information and needed materials are collected and processed and project´s outputs are created and verified
4. *project ending* – the outputs are presented, whole project is evaluated and the outputs can be applied

C. Questioning Method via Questionnaire

The questionnaire survey is one of quantitative methods used at a research for gaining needed data and information. It is one part of the questioning methods. The interview or survey are other parts of the questioning methods. The information is gained in a written form via answers to given questions when using the questionnaire. There exist several question types e.g. open, closed and semi-closed questions. A respondent writes any answer when answering to the open question. He or she must choose from the written answers when answering to the closed question and answers to the semi-closed questions are combination of the previous two types. Every questionnaire should have the exact structure [3].

III. Chosen Subject Description

The subject that is taught at the Czech Technical University in Prague, Faculty of Transportation Sciences has been chosen for the project teaching method application. The study program is called the Technology in Transportation and Telecommunications (B 3710). The study field is called the Technology of Aviation Maintenance (3708R033). The chosen subject is the Aircraft Maintenance Technology. The subject is divided into three semesters and it is taught at fourth (summer), fifth (winter) and sixth (summer) semesters. The subject is obligatory. It is for the full-time study, it is taught 4 hours per week and it is ended by the classified credit [4]. The project method has been applied at the sixth semester. The chosen subject (Aircraft Maintenance Technology 3) syllabus must be according to the Commission Regulation (EU) No 1321/2014 and as amended [5]. The syllabus is:

1. Opening hour, Aircraft Weight and Balance
2. Towing, Taxiing, Lifting and Shoring
3. Parking, Mooring, Storage and Ground Power Equipment
4. Fueling and Defueling, De-icing, Anti-icing, Effect of Environmental Conditions on Aircraft Handling and Operation
5. Non-destructive Testing
6. Corrosion – Removal, Assessment and Re-protection
7. Maintenance Planning
8. Faults Finding and Removal
9. General Repair Methods, Fatigue, Corrosion
10. Modification Procedures
11. Abnormal Events

IV. Project Teaching Method Application

The project teaching has had to be created before its application. The first step was a task creation. The authors have created five tasks that have been based on the subject´s syllabus described above. The tasks were:

- design of a ground power equipment for a smaller airport
- design of an aircraft shoring
- design of an de-icing system
- design of the non-destructive testing for chosen aircraft
- creation of the troubleshooting diagrams

The second step was a decision, if the work was going to be individual or in a group. Eleven students had signed in the subject so it has been decided that the work was going to be at three groups with three student and one group with two students. Together, there was four groups.

The next step was to determinate the timetable. The timetable had four milestones. The first milestone was to show the project teaching to the students, division into the groups, choosing the task and inform about project requirements (e.g. final report content, 3 presentation days etc.). The second milestone was the presentation of the created project plans and timetables by each group. The third milestone was about presenting the work progress and the last milestone was about the project outputs and submitting the final reports. The project was five weeks long.

As it is mentioned above, the students presented their project progress or outputs during the three presentation days (second, third and fourth milestone). Although there were quality differences between the groups´ work and outputs, all groups fulfil the requirements and passed the project.

The students fulfilled the questionnaire at the last presentation day. The questionnaire has been created by the authors. It has been created and used to gain a feedback and other required data and information from the students. All gained data were used for the hypotheses verification. The questionnaire contained eleven closed (or semi-closed) and one open questions. The questionnaire was divided into three parts. The first part was about students´ knowledge about the project teaching method. The second part was about the project method realization and application. The students were asked about their satisfaction with the timetable, tasks, division into groups etc. The third part was about a project method long-term using. The students were asked about using the project method from the long-term point of view and its suitability for this subject.

There are shown the answers to the closed questions in the Table 1. The first answer was always a positive, the fifth was always negative. A dash means that the question had less than five answers. But the last answer was always negative. It is obvious from the table that the answers were positive or neutral in most cases. The twelfth question was the opened question and it was used for

writing other notes, ideas etc. to the authors. Approximately one half of the students used this opportunity.

TABLE I.
ANSWERS TO THE QUESTIONNAIRE QUESTIONS

question no.	answers 1.	2.	3.	4.	5.
1	5	5	1	0	-
2	6	5	0	0	0
3	8	2	1	-	-
4	3	6	2	0	0
5	8	2	1	0	-
6	5	3	1	2	0
7	8	1	2	0	-
8	7	3	1	0	0
9	3	6	1	1	0
10	5	5	1	0	-
11	4	4	3	0	0

A Frequency histogram has been created for each question. There is the frequency histogram for the question number 6 in the Figure 1. The questions asked about a students´ satisfaction with the timetable. As it is obvious from the Figure 1 that there were positive and also negative answers. So it can be assumed that the project could be longer than 5 weeks.

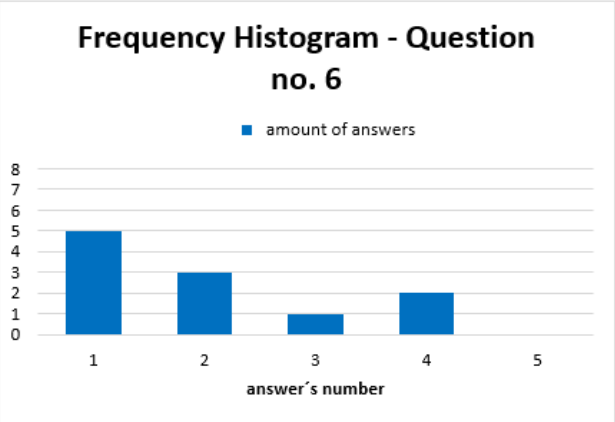

Figure 1. Frequency histogram for the question number 6

All data and information that have been gained from the questionnaire and also from the whole project teaching process by an observation have been evaluated and then the conclusion has been set. It is obvious from the results that the project teaching method is applicable at the aircraft maintenance subjects and the students confirmed its suitability.

The hypotheses are going to be evaluated now. The gained data confirmed the first hypothesis. The project teaching method can be successfully used at the aircraft maintenance subject teaching. The second hypothesis was disproved. Respectively, it could not be confirmed. It is obvious form the gained data and whole project teaching process that the authors´ created project teaching method had some problems and deficits. These problems and deficits have been analyzed, processed and the results were included into a Project Teaching Method Application Procedure that has been created by the authors. The procedure is described in the next paragraph.

V. PROJECT TEACHING METHOD APPLICATION PROCEDURE

The authors of this article have decided to create an easy procedure how to applicate the project teaching method into the teaching process. The decision has been based on the designed and applied project method, the feedback and all other information gained during the research. The procedure can be used for all types of schools or universities and it should be a support tool. The procedure is shown in the Figure 2. The procedure shows how a teacher should proceed during the project teaching method preparation.

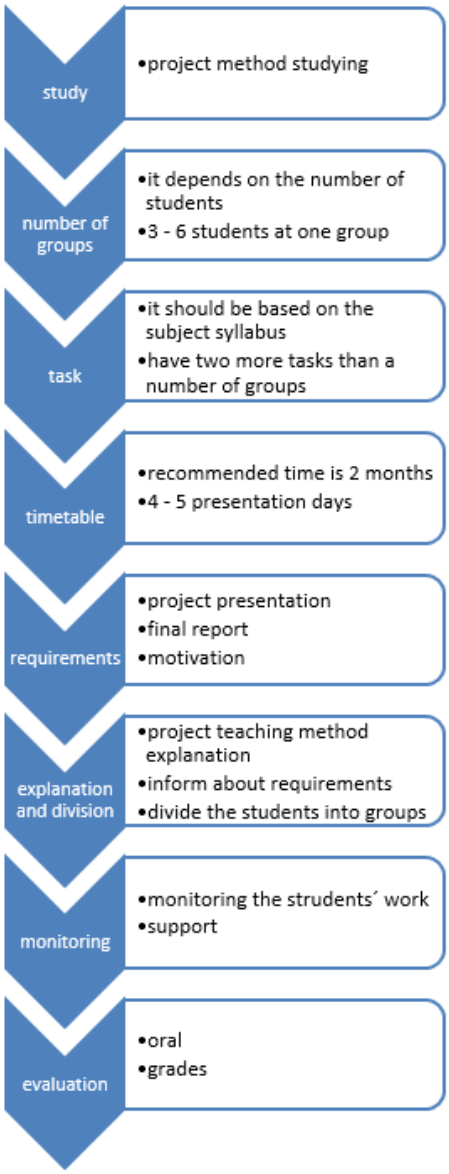

Figure 2. The Project Teaching Method Application Procedure scheme

VI. Conclusion

It can be written that the project teaching method is the modern and effective teaching method that can improve the aircraft maintenance technicians teaching and the safety too. The well trained technicians will work safer. The students also gain new abilities, skills and habits thanks to this method. The method has many advantages. The whole teaching process gets more attractive by its application and the students learn an independent work and creativity. The project teaching method has disadvantages too. For instance, it cannot be used as only one teaching method. It should be combined with other teaching methods during whole teaching process to reach optimal teaching results. The research verified that the project teaching method can be used at the aircraft maintenance vocational subjects.

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References

[1] I. Linderová, P. Scholz and M. Munduch, "Úvod do metodiky výzkumu," Jihlava: College of Polytechnics Jihlava, 2016, 69 p., ISBN 978-80-88064-23-7. Available from: http://www.vspj.cz/ISBN/Skripta%20-%20V%C5%A0PJ/%C3%9Avod%20do%20metodiky%20v%C3%BDzkumu%20-%20Linderov%C3%A1%2C%20Scholz%2C%20Munduch.pdf

[2] D. Vaněčřek et al., "Didaktika technických odborných předmětů," Prague: Czech Technical University in Prague, 2016, ISBN 978-80-01-05991-3.

[3] A. Giddens, "Sociologie," Prague: Argo, 1999, ISBN 80-720-3124-4.

[4] CTU in Prague, Faculty of Transportation Sciences [online], Prague, 2015, 2019 [cit. 2019-07-16]. Available from: https://www.fd.cvut.cz/

[5] EU, "Nařízení komise (EU) č. 1321/2014: o zachování letové způsobilosti letadel a leteckých výrobků, letadlových částí a zařízení a schvalování organizací a personálu zapojených do těchto úkolů," [online], EU: Úřední věstník Evropské unie, 2014, L 362, p. 194, [cit. 2019-07-16]. Available from: https://eur-lex.europa.eu/legal-content/CS/TXT/PDF/?uri=CELEX:32014R1321&from=CS