

**The guide of the results implementation and activities, set of
conclusions and recommendations in the Project
“Prefconstruction”**

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Introduction

As the first step in the Erasmus+ Project Prefconstruction was a document created, aiming to provide collection of three analyzes (PL, LT, LV) containing research, diagnosis and comparative analysis in the construction industry, especially in frame construction. Vocational education in the construction industry is struggling with a number of problems. They mainly concern the insufficient preparation of students from the practical side to practice. An important problem is also the didactic base, which in most cases does not reflect the real working environment. In order to overcome the shortages of the material base and increase the attractiveness of education, it is necessary to support cooperation between schools and employers. The analysis of the number of business entities operating in individual partner countries (Poland, Latvia and Lithuania) indicates a strong position of the construction sector. The number of entities appearing in the sectors indicated is the carrier of information about the potential employment opportunities in these sectors. The generated demand for work in the given regions almost completely reflects the economic structure of the analyzed areas. Due to the purpose of the diagnosis, the demand for work in terms of qualifications and occupations was carried out in terms of the employment opportunities of graduates of professions educated in a given region.

We would like to clarify the expected demand for specific skills and the situation of the construction industry in the countries in the report, which is one of the results of the project.

The main goal of the project is to enable access through a prepared diagnosis and corresponding training for practical solutions used in construction from conducting and implementation of construction of wooden skeleton houses, Latvian and Lithuanian experiences at school level and their application through knowledge transfer in Polish realities.

The overall benefit from this Erasmus+ K2 action project would be better understanding of knowledge in the field of frame building; gaining knowledge of project participants in the scope of complete prefabrication of house production; learning about innovative technological solutions used in construction; acquisition of the ability to use the use of renewable energy in wooden construction; getting to know the work culture and practices used in European vocational training institutions.

The principle of project is to exchange good practices and incorporate the effects of innovative ventures into the mainstreaming policy and practice.

Analysis of the building using prefabricated timber-frame houses in Poland, Lithuania and Latvia. Expert's opinions and contribution in project field

Poles are conservative in the approach to building, but this should change over time. With the development of this type of technology and its wider promotion, we will be more and more willing to use prefabricated houses. As it was mentioned before, despite the fact that timber-frame houses cannot currently compete with traditional ones in terms of popularity, there is a constant increase in interest in wooden construction. There are many unquestionable advantages of such technology. Firstly, construction is faster than in traditional technologies. Work time on the construction site is only about 6 months. Secondly, thanks to the wide application of natural material – wood, the buildings have a healthy microclimate. Companies producing modular wooden houses assure clients of low heating costs considering low heat transfer coefficients and air tightness of buildings. Nevertheless, due to the relatively short tradition of wooden frame and modular construction in Poland, there are some concerns about durability, fire resistance and comfort of use of such buildings. Finding a competent company specializing in timber-frame houses also turns out to be a challenge for investors.

Latvians school experts believe that wood carpentry construction should be taught in-depth in woodworking classes, as it has a perspective that would provide jobs for future professionals. But, unfortunately, in Kurzeme region, where our school is located, there is no company which is producing wood-frame houses. All companies are mainly located in Vidzeme region. This makes it difficult for our students to find both- internship placements and a job afterwards. But seeing as the demand for wood-frame houses is increasing due to lower cost, eco-factor and rapid construction, carpenters of this type might be in demand in the future. Liepaja also has a good location – it is a port city, where it is possible to export finished products directly to Scandinavia, where the demand for timber frame houses is known to be high, because Scandinavians value high quality, ecological houses with high energy efficiency. Currently, one of the largest companies in Liepaja, SIA "Dzelzsbetons MB," produces reinforced concrete panels, but not timber frame houses.

Like elsewhere in Europe, natural and eco-friendly wooden houses are raising merits in Lithuania, so the woodhouse industry is experiencing a stage of growth: new

enterprises are established, business is expanded not only in the Lithuanian market but in foreign markets as well. Five years ago people were thinking that wooden prefabricated house is more suitable for construct industrial, commercial, administrative buildings and business canters. Lithuania still has a tradition of building houses from blocks. Therefore, Lithuanian manufacturers successfully export panel frame houses to Scandinavia.

Everywhere in Western Europe, the Scandinavian countries, the US is opting for cheaper, faster and more convenient panel house technology. In addition, these homes are also easier to transport. Bricklaying is not very popular there. At that time masonry houses were more rooted in us since the Soviet era. However, in Lithuania also prefabricated frame houses are gaining market share. Nowadays Modern architectural tendencies, new building materials and the latest technologies provide more and more possibilities for production of panel houses. Currently there is a great interest in frame houses, because their thermal parameters are much better. There is really no need to fear such a house. However, there are people's perceptions that a frame house is unreliable and resistant, for example, to strong winds. Although it is a normal full house. Only from the Soviet era is the belief that only brick is solid and reliable. Representative from Skydmedis said his opinion about such statement "Inflammability of a timber- frame panel house". If it was not for this misconception, timber-frame panel houses would have significantly more supporters. Obviously, if the owner of the house was trying to save money by sacrificing quality and safety during the assemblage process, there will be a possibility of an accident occurring. A reason for the fire might be poorly insulated flues, improper installation of the power system, saving money on timber impregnation. Not following the instructions for installing flues, boilers or the power system may result in burning down not only a timber-frame building, but also a masonry house. A masonry house has the same precarious segments: the rafters, especially at the point where they meet the chimney, the wooden partitions, etc. If an accident occurs and a fire happens to break out, the owner of a timber-frame panel house will have suffered less damage than the person owning a masonry house because it is easier to replace the separate segments of a timber- frame panel house than to rebuild a section of a masonry building.

Conclusion of the Analysis

A lack of knowledge and experiencing at many persons professionally connected with wooden buildings (architects, building companies or also persons from

the building inspection), is causing problems both in the phase of the design as well as during construction. In order to popularize wooden frame and modular construction, there is a great need to familiarize students of vocational schools and construction students with these technologies. The first step is to prepare teachers and widen their knowledge about it by organizing trainings and meetings with specialists from this industry. Only a well-educated group of teachers can pass knowledge to students. Moreover, schools should be equipped with such study aids as wall and roof models of modular houses with cross-sections of component layers. It is much easier to understand how something works when you can see it. What should also change is school program. Teachers are obliged in the first place to realize it. If timber-frame houses are not included there, this topic will be still slightly overlooked. Finally, closer cooperation between schools and companies involving study visits and training programs for students would result in better preparation of future contractors and designers of wooden structures. To sum up, wooden frame and modular construction has a chance to become a competition for traditional construction, as it happened in the case of Scandinavian countries and Germany. However, changes are necessary in the education sector, national construction and commissioning requirements needs to be developed. There is also a need for reliable data on the number of wooden buildings made annually in individual technologies.

Teachers expectation from the training (compiled after a survey):

1. To get theoretical knowledges of wooden panel houses
2. To get knowledges about specific, main points what is important working with and building wooden panel houses
3. Requirements for specialists: producer, builder, architect, designer
4. To get practical skills working with wooden panel house in all stages
5. Main aspects of wooden panel house quality
6. To acquire what skills are important for workers who build prefabricated houses
7. What software programs used for producing prefabricated wooden house process are needed to know in order to be a professional worker
8. Constructional plans
9. Assembler team, requirements for it
10. Modern insulation-hermetization technologies. How to achieve quality in it.

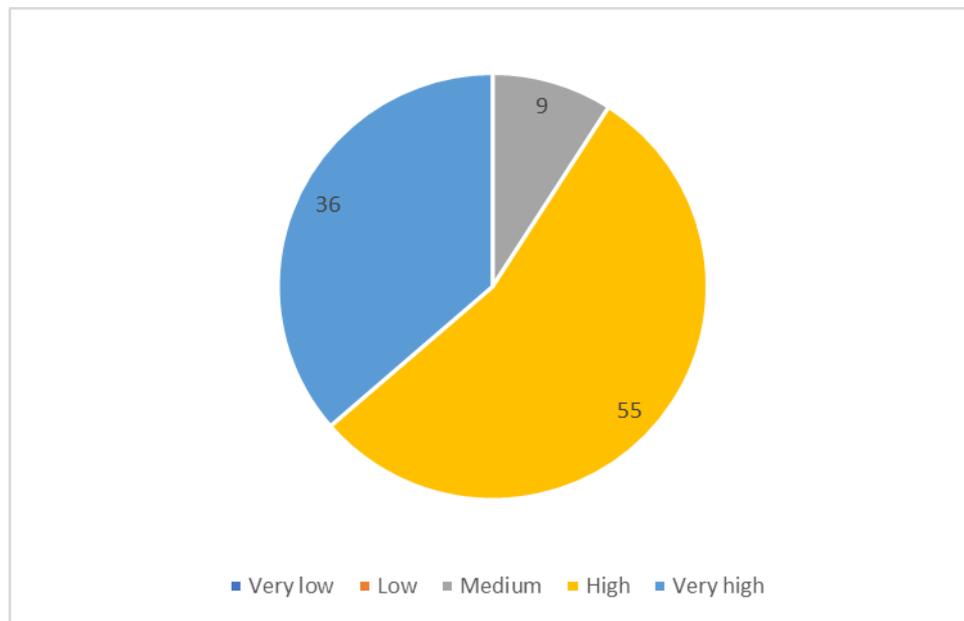
Online materials

A second evaluation questionnaire was created to analyze the effectiveness of education through the remote learning platform prepared as part of the project on-line platform:

<https://rck.org.pl/prefconstruction-online-course/>

The conclusions of this survey are as follows. When asked for a rating the level of own skills after the completion of the on-line training was provided by the respondents answers shown in the graph below. In general, virtually all project participants assessed the level of their skills in practical terms, high (55% of respondents) and very high (36% of the respondents), which proves positively about the level of prepared materials educational in the form of e-learning training, its effectiveness and adaptation to audience. It should be emphasized that none of the respondents, after completing the on- line did not rate his skills as low or very low. The participants of the study confirmed this sentence in responses to subsequent questions in which also emphasized several times that the level of materials prepared as part of the course online was very high. These materials will also be used by training participants in later work with students. And it turned out to be an effective learning material during the period after the training course, during the Covid-19 pandemic when the schools were working remotely, it came in handy.

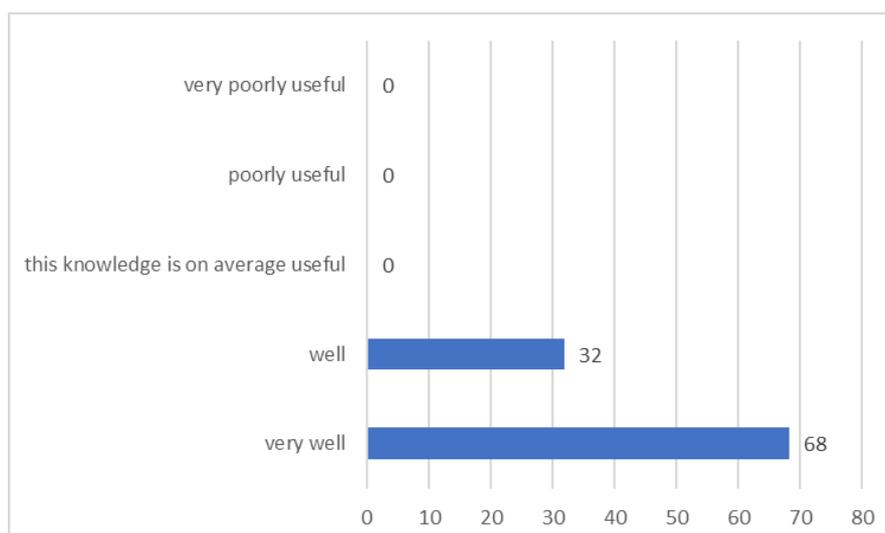
Graph 1.
How do you evaluate the level of yours today, AFTER THE END OF THE ON-LINE
TRAINING professional skills in practical terms? (% of respondents)



Source: own study based on surveys.

The results obtained above were confirmed by the respondents' answer to the question whether the course carried out under the remote learning project (on-line platforms) met their expectations. 100% of the teachers replied in the affirmative.

Graph 2.
The degree of usefulness of the knowledge acquired during the on-line course
(% of respondents)



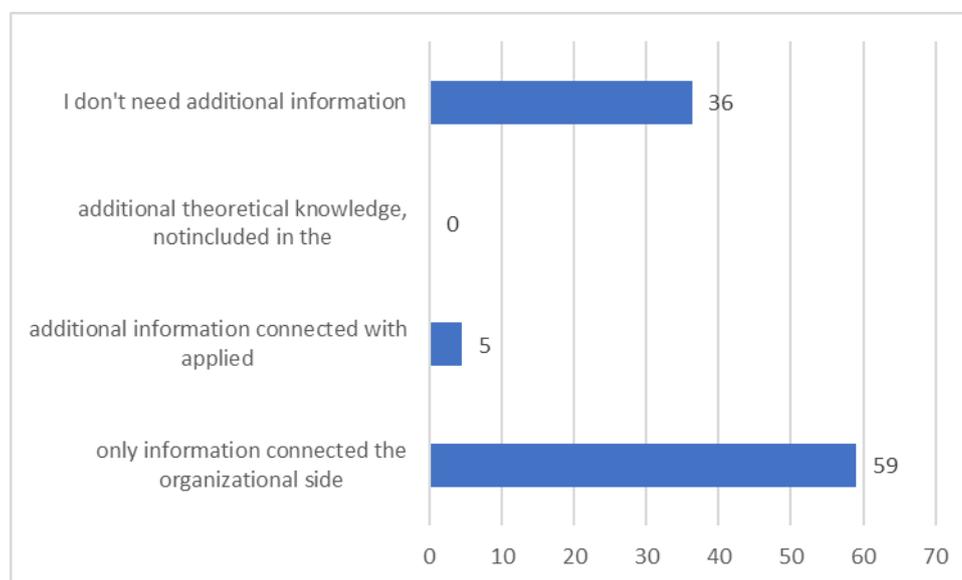
Source: own study based on surveys.

In the next question, the respondents had to define the degree of usefulness of the knowledge gained during the on-line course. As shown in the chart below, 68% of respondents found the knowledge very useful and 32% of the respondents found it very useful. None of the respondents decided that the knowledge they acquired during distance learning would not be useful in their further professional work. This is another element confirming once again the high quality of the materials presented to teachers on the on-line platform.

According to the respondents, the most important information needed after completing the on-line course, and before starting practical training, is information related to the organizational side of practical training. 59% of the respondents agreed. 36% of the respondents stated that they did not need any additional information after the end of distance learning and before starting the internship. The structure of the answers is presented in the chart below.

Graph 3.

Information needed after completing the on-line course and before starting practical training (% of respondents)



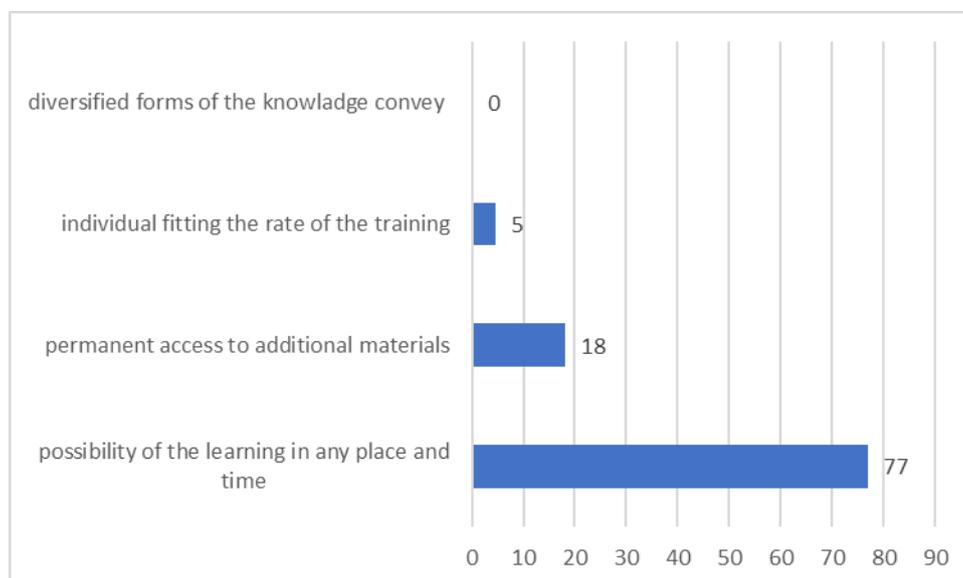
Source: own study based on surveys.

The possibility to study anywhere and anytime was recognized as the dominant advantage of the course. 77% of teachers agreed. The second advantage of this form of education was constant access to additional materials. Such an answer was given by

18% of the respondents. The individual adjustment of the training pace was also considered an advantage.

Graph 4.

The most important advantage of the e-learning course (% of respondents)

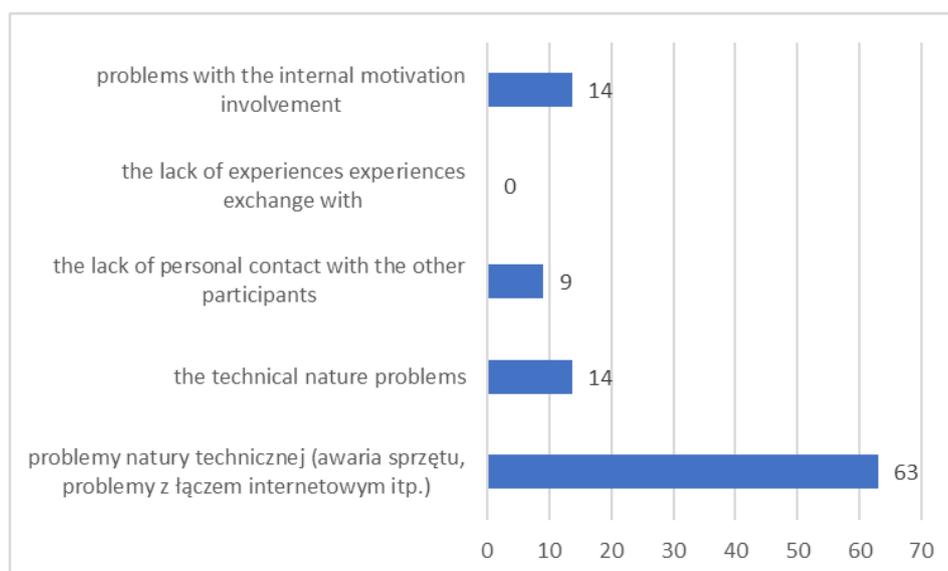


Source: own study based on surveys.

The next chart presents the most important barriers that the participants of the project had to face while implementing the on-line course.

Graph 5.

The biggest barrier encountered in the implementation of the on-line course (% of respondents)



Source: own study based on surveys.

The biggest barriers faced by the course participants were technical problems (hardware failure, internet connection problems, etc.). 63% answered yes respondents. Other problems that the participants of the project faced were the lack of "live" contact with other people from the group of participants of the course and the advantage of theoretical over practical knowledge. In both cases, 14% of respondents agreed. A small group of participants (9% of respondents) suffered from the inability to exchange experiences with other course participants. The structure of the answers is presented in the chart above. The last question of the questionnaire number 2 concerned the expectations of the course participants in the practical training scheduled for 20-27 January 2020. All the proposed aspects of the practical training were considered important and very important by the participants of the training. This is important because it proves the actual interest of the participants in practical training and high expectations as to their effects.

The teachers expectations from the practical training:

- improving professional competences (100% of respondents);
- broadening the knowledge about innovative practices applied in the construction industry (100% of respondents);
- practical verification of the knowledge acquired during the on-line course (100% of respondents);
- acquiring additional practical skills in relation to innovative practices used in the construction industry (100% of respondents);
- familiarization with the aspects of the work culture and practices applied in European institutions (100% of respondents);
- practical experience in a foreign institution (100% of respondents);

The third stage of the evaluation is the evaluation of the practical training carried out on 20-27 January in Białystok. Questionnaire number 3 was to analyze and evaluate the effectiveness of practical activities. Its aim was to show the degree of satisfaction of the project participants in terms of content and organization with the completed practical training. In the responses to the question about the assessment of the level of skills after the practical training, it can be seen that there is a continuous progress in the professional skills of the project participants. In particular, it is clearly shown in the teachers' opinions after the training.

Implementation of the training

As a result after the practical courses schools staff incorporation of course elements into school activities. Including specific content, solutions and techniques for building houses implemented in the technology of wooden skeleton in the theoretical and practical program of vocational subjects in the school curriculum.

1. Lithuania

The knowledge acquired during the practical training is applied:

- during practical and E-learning courses is passed to the students who are learning in the Furniture-maker training programme, during theoretical and practical lectures. A theoretical material which was developed in the project was used two times per week, during distance learning lessons with first and second year's students. Practical materials also was used and showed to the second and third year's students during distance learning, two times per week during spring months.
- in the study process for Decorator (building) training program second years' students in such modules: Manual plastering and painting of building surfaces; Plastering of building structures with hand tools; Facade insulation with thermal insulation panels; Installation of plasterboard; Manual woodworking; Roof repair works. As all lessons during spring was organized in distance learning, students had opportunities to read eLearning course, to do quizzes. Also gained information from practical course in Bialystok was provided to the students during practical lessons two times per week.
- in the study process for Decorator (building) training program third years' students. In such themes: building facade processing; floor preparation, concreting; Wall painting, wallpapering; Electrical installation;
- in the study process for Decorator (building) training program second and third years' students. In such modules: building facade processing; floor preparation, concreting; Wall painting, wallpapering; Electrical installation; Plastering of building structures with hand tools; Facade insulation with thermal insulation panels; Installation of plasterboard; Manual woodworking; Types of installation of roof windows; windows and doors with electronical elements;

2. Poland

- The teachers are planning to send their trainees to the company Danwood, so they are preparing them by extending the teaching content from the fundamentals of construction included in training programs in professions: building and finishing work technician;
- Implementation of practical training parts in the professional company Danwood;
- Including in the work plan for construction teachers: - educational content promoting the construction of houses realized in the prefconstruction technology in 2nd and 3rd year study programmes (practical in bricklaying, plasering technology
- Organizing training trips for students to the company Danwood

3. Latvia

The knowledge acquired during the practical training is applied in:

- purchasing materials for workshops;
- practically included and applied in the curriculum: Construction technology (tiling in the bathroom with water-resistant materials) 1st – 3rd year students. Construction processes and stages (step by step using the theoretical online materials for the first year students. Wooden frame constructions (using theoretical online materials and practical knowledge acquired in Danwood) for 1st and 4th year students;
- in the study process for electrical engineering courses in the module: auxiliary electrical works, construction of a modular house electrical system. In carpentry: types of installation of windows, roof windows, doors and innovative materials in material education;

In the project evaluation questionnaire, participants were also asked to provide examples of practical use of knowledge and skills acquired during the project from their experience. Examples of the practical use of knowledge provided by teachers are:

- knowledge is transferred to young people in the form of presentations, descriptions, etc. during theoretical classes in the professional work of teachers;
- materials included in the on-line course (films, presentations) are used during classes with students;
- knowledge is used when building your own home;

- knowledge is used for private use (home renovation and renovation, painting, wallpapering, etc.);

In general, all project participants emphasized that they will use the acquired knowledge and practical skills both in their professional and personal life. In the professional field, by passing it on to students during practical classes, using the materials posted on the on-line platform (films, presentations), and in private life by building and renovating own houses.

Conclusions

The aims of the Prefconstruction project implementation was achieved. Conclusions from the project implementation are following:

1. Expectations of the project participants as for the whole of the Project as well as the merits issues brought up in the course realization were met in the 100%;
2. Participants before the project beginning recognised as the crucial purposes: raising own professional competence in educating process, developing the abilities concerning the group work, introducing to culture aspects in the work and applied traineeship of European institutions and increasing correlation between the system of the vocational training and expectations of employer/entrepreneurs in the relationship to graduates of the vocational training schools.
3. The 95% of respondents as the most valuable project components accounted: possibility of getting to know innovative practices used in the construction industry and possibility to extending the knowledge about innovative practice used in the construction industry as a part of the construction prefabricate. Remaining project components were assessed not much lower what is concerning that the Project conception was prepared very well.
4. The merits level of the online training was evaluated also very high. All project participants after on-line training assessed the level of their professional skills in the practical perspective high (55% of respondents) and very high (36% of respondents) what is concerning positively about the level of prepared educational materials in the e-learning form, its effectiveness and fitting to the group of participants.
5. 68% of participant recognised the knowledge that they purchased during the on- line course very well useful and 32% participants well useful. Nobody of respondents acknowledged that the knowledge he/she purchased during the on-line course wouldnt help in the further work. It is the next element confirming the high quality of materials

introduced for teachers on the on-line platform. The online course is used by teachers until today in the work with pupils at school.

6. The biggest barriers of the on-line training according to 63% of participants was the technical nature problems (equipment failure, problems with the Internet connection etc.). Another problems are the lack of personal contact with the other participants from the on-line course and also more theoretical than practical knowledge. In both cases it recognised by the 14% of respondents.

7. Participants in the project recognised that both elements i.e. using the on-line platform as well as the practical training in Białystok was equally valuable – this 23 way answered 73% of participants. The 18% of respondents recognised that the practical training in Białystok was much more valuable.

8. According to respondents; the biggest barrier of the course implementation was English language used during the Project. It recognised the 64% of respondents. The 5% of respondents agreed that that problems with the computer hardware had also been a barrier during the on-line training. It is worthwhile to emphasizing that the 31% of teachers didn't recognise barriers of the project implementation.

9. All participants in the project emphasized that they would use the purchased knowledge and practical skills both in the working and personal life. In professional life – during lectures at schools, using materials from the on-line platform (films, presentations, etc.) and in the private life – during renovating their homes.

Very important is the fact that the knowledge, abilities and social competence purchased in the course are used in practice by teachers both in the working life in vocational schools with pupils as well as in personal life. Undoubtedly the high level of the course merits (both of prepared and presented materials on the on-line platform as well as rich scope of the practical training in Białystok) affected this situation. To sum up the Prefconstruction Project was appraised very high by all participants.

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