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Piloting the learning by developing action model pedagogy in Finland HEIs.

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PILOTING THE LEARNING BY DEVELOPING ACTION MODEL PEDAGOGY IN FINLAND HEIS

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Abstract

This article describes a study at Haaga-Helia University of Applied Sciences (Haaga-Helia) to understand how suitable the Learning by Developing (LbD) action model is as a teaching and learning method for computing students. The research also aims to obtain information about how the competence of calculation students in different competence areas develops during the study module selected for the research. In addition, we want to get information about the experiences of students, lecturers and customers about LbD pedagogy in general. The research result is also intended to be used in developing the LbD action model.

Keywords: Learning, teaching, Learning by Developing, computing, learning outcomes.

1 INTRODUCTION

The purpose of the research is to find out the perception of Haaga-Helia's computing students by implementing a study module that applies the principles of the Learning by Developing (LbD) action model, which includes real customer projects. The research aims to discover the development of students' competence during the study module through self-assessment. In addition, the research wants to find out what the student's broad learning experiences are like according to the LbD action model. The LbD action model was initially developed at Laurea by studying teaching and learning at universities of applied sciences [1]. The LbD action model has been used at Laurea since 2004 and has been perceived as a successful way to teach new things in higher education [2].

In the LbD action model, competence development is an entity that includes research, authenticity, partnership, experience and creativity [3]. Authenticity refers to a genuine work-life context that helps students develop work-life skills during their studies. The importance and value of lifelong learning are also part of the LbD pedagogy. [4].

In previous research cycles, the research subjects have been computing students from Laurea and RGU. This study has conducted similar research for Haaga-Helia's computing students. The study aims to determine whether the LbD action model is a good learning and teaching method for Haaga-Helia computing students' study modules involving genuine customer projects. Haaga-Helia's computer science students have been chosen as the research target, so the research results previously conducted for Laurea's computer science students can be compared. In this study, an important research topic, in addition to the student's own learning experiences, is how their skills in different areas develop using the LbD pedagogy in projects implemented in cooperation with working life. The research also examines the lecturers' experiences with the use of the LbD action model and its suitability for computing studies, as well as the experiences of customers participating in the study module on the use of the LbD action model in real customer projects.

2 METHODOLOGY

This research is part of a broader research strategy, which has been chosen as action research. Action research is well suited for development-oriented research, where the researcher is a part of the developed organisation and an operational agent. Action research is characterised by the researcher's participation in acquiring information, and the goal is to change practices in the future based on the information obtained [5]. In this process, the researcher has been personally involved in the first research cycle in the role of a teacher and has systematically and carefully examined his teaching practices using research methods. In other research cycles, the researcher has been involved in the role of an external observer and observer to identify the teaching practices of the participating teachers. [6]. Action research can involve only one teacher, a group of teachers with a common problem, or the entire school faculty and is well suited for educational research [7].

In action research, the investigated situation progresses in cycles, and new information about the investigated case is always obtained based on the analysis of the research data of each cycle. The researcher first maps a picture of the current state based on the information to be studied, based on which they start planning the target state. The researcher participates in the development process and develops it further, reflecting on the situation of other participants. The first research cycle was conducted at Laurea, Finland, in the fall of 2019, and the next in the United Kingdom, at Robert Gordon University (RGU). This research cycle was carried out in Haaga-Helia to determine whether the LbD approach is also suitable as a teaching method for the project study module for computer science students at another Finnish university of applied sciences, Haaga-Helia. Method triangulation is used as the primary research method in this study. In method triangulation, for example, several data collection methods are used to acquire research material, as has been done in this study. [8]. The data collection methods used in this study were a questionnaire for students and a thematic interview for lecturers and customers.

Narrative analysis has been used to analyse the research material in thematic interviews and students' free-form questions. The meanings of human activity and phenomena are built into different stories essential to study. In narrative research, the story can also be used in research conducted through interviews. Narrative means a story. In the narrative research strategy, we are interested in what stories are told about the research object or what kind of narrative the research object exists in culture or society. The basis of the strategy is seeing language and language use as primary in the production of meanings. In the case of entities based on individual meanings and interpretations, a narrative perspective helps to understand things on both a personal and collective level [9].

Narrative analysis is suitable for analysing research in studies where the object of the research changes in one way or another. Background information can be essential in narrative research, and the researcher often relates the texts to their narrators and narrative contexts. In this case, the narrators can be thought to have a significant role as narrators and plotters. The number of interviewees was not very large, and the interviewees had different roles in this study. Therefore, their "stories" content has been analysed as a narrative. [10].

The mean and standard deviation are commonly used to help with quantitative research. In quantitative analysis, the average is widely used to compare estimates. However, the average value does not tell the frequency of average observations, but the standard deviation calculation is suitable for that. The standard deviation is helpful if the observations follow a normal distribution. Valuable information can be obtained using a simple arithmetic method if the mean and standard deviation of the set of observations is known. [11]. In this study, the quantitative responses to the student survey have been analysed using mean values and standard deviation.

3 RESULTS

The subjects of this research cycle were computing students who participated in the 16-week IT project course in spring 2022 in Haaga-Helia. Twenty-four undergraduate students participated in the study module. The LbD action model was used as the teaching method for the study unit, which is suitable as a teaching and learning method for project-based study modules. This study unit of Haaga-Helia was chosen as the subject of the study because, in it, students participate in project implementation related to the development of working life in cooperation with a real customer.

During the study period, students participated in a development project related to working life in cooperation with a client and students both independently and under the guidance of a lecturer. At the beginning of the study period, the researcher introduced the LbD action model to the students, clients and the lecturer and explained why this educational model was used in that study module. The researcher informed the students of a research-related survey at the end of the study module, which will be used for research purposes. The clients and the lecturers of the study module were told about the interview related to the same research done after the study module and asked if they could participate. The research aimed to get information about how the students' skills develop during the study unit and what kind of learning experiences they have from implementing a study unit according to the LbD operating model. The purpose of this study was to get information on how well the LbD approach fits the project-based study course of data processing students at another Finnish university of applied sciences and whether it is a good and functional method, in their opinion. In addition to the survey, the research uses interviews to find answers about the applicability of LbD pedagogy to computer science project entities. Customers were asked about their experiences participating in implementing the LbD action model study module in the role of a customer.

Therefore, the research material was collected from student surveys and customer and lecturer interviews. The student survey and the interviews with customers and teachers were conducted in May-June 2022. The student survey included questions classified according to the Likert scale and free-form questions. 13 out of 24 students answered the survey.

Interviews with customers and lecturers were carried out as themed interviews using a remote connection. All interviews were recorded and transcribed for further analysis. There were a total of four lecturers in the study module, and they were all interviewed separately. Four customers were in the study module, of which representatives of three companies participated in the interviews.

3.1 Students' survey

The survey background related to the development of students' skills is higher education students' general working life skills. In Laurea's 2030 strategy [12], in addition to the general skills of the degree defined and identified, the competence needs of working life have also been strongly included, which are perceived as increasingly essential skills for those who have completed a university of applied sciences degree. These common and general working life skills for all degrees consist of six competencies: self-management and entrepreneurial attitude, critical thinking and problem-solving skills, foresight and innovation skills, communication and interaction skills, global skills and responsibility skills.

The students evaluate the development of their competence in these six areas of competence with a survey, of which each competence complex contains three or four more detailed parts. Students evaluate their level of competence in each area's topics before the study period and at the end of the study unit. Only a few examples of these results have been extracted from the results. Since it is a student's self-assessment, this must be considered when interpreting the answers, and it is presented as a limitation of the reliability of the results.

3.1.1 Students; surveys results in classified questions

The first set of competencies was self-management and an entrepreneurial attitude, and its first question was life management and well-being. Students were asked to rate their competence on a scale of 1 ("no competence") to 5 ("expert"). The results are presented in figure 1. At the beginning of the study module, the students' competence mean was 2.92, and the standard deviation was 1.14. At the end of the study module, the student's competence mean had risen to 3.54, and the standard deviation was 0.93, so the variance had decreased at the end of the study module.

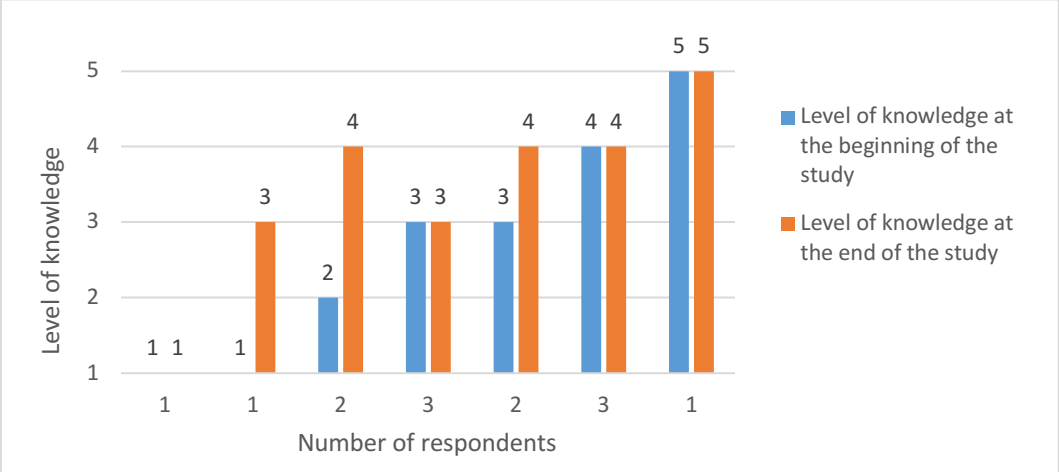

Figure 1. Students' survey results for Life management and well-being.

The second question was how well the students think they can describe their skills and continuous learning skills. The results can be seen in figure 2. The reported average was 2.69 at the beginning of the study module and 3.69 at the end. The standard deviation was 0.99 at the beginning and 0.46 at the end of the study module. The variance had decreased here as well.

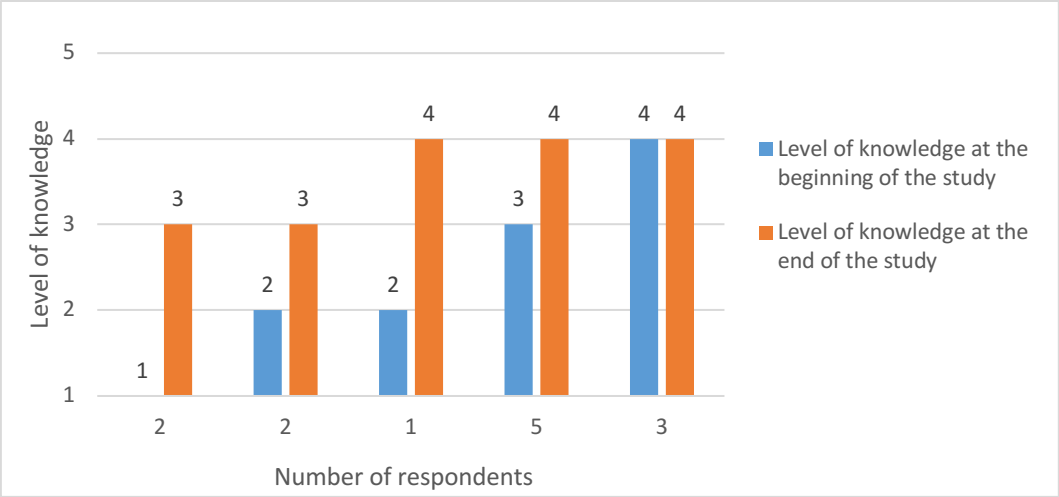

Figure 2. Students' survey results for Own skills and the skills for continuous learning.

The second set of competencies was critical thinking and problem-solving skills, which included three subsets to be evaluated. Figure 3 shows these results for the first question: Critical knowledge acquisition, evaluation and utilisation. The average of these answers was 3.08 at the beginning of the study module and 3.69 at the end. The standard deviation was 0.82 at the beginning of the study module and 0.84 at the end. So the variance increased slightly at the end.

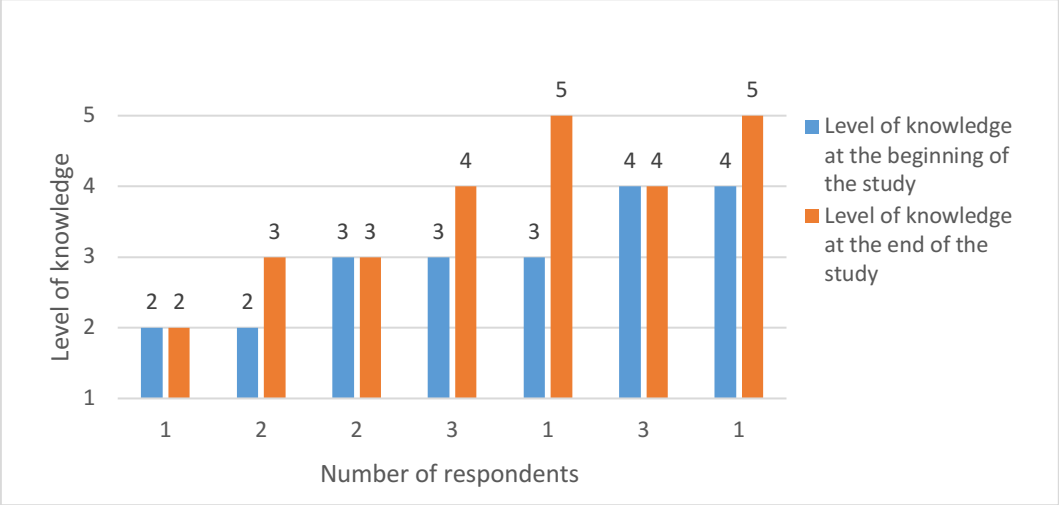

Figure 3. Students' survey results for Critical knowledge acquisition, evaluation and utilisation.

The next question in this section was entity management and systematics. The results are shown in Figure 4. The reported average in these answers was 2.62 at the beginning and 2.77 at the end of the study module. The standard deviation was 0.84 at the beginning of the study module and 0.80 at the end of the study module. Only two students estimated their competence level in this area increased during the study module. It would be interesting to investigate this more because it is an essential skill for students, helps them manage their studies, and is also critical in working life.

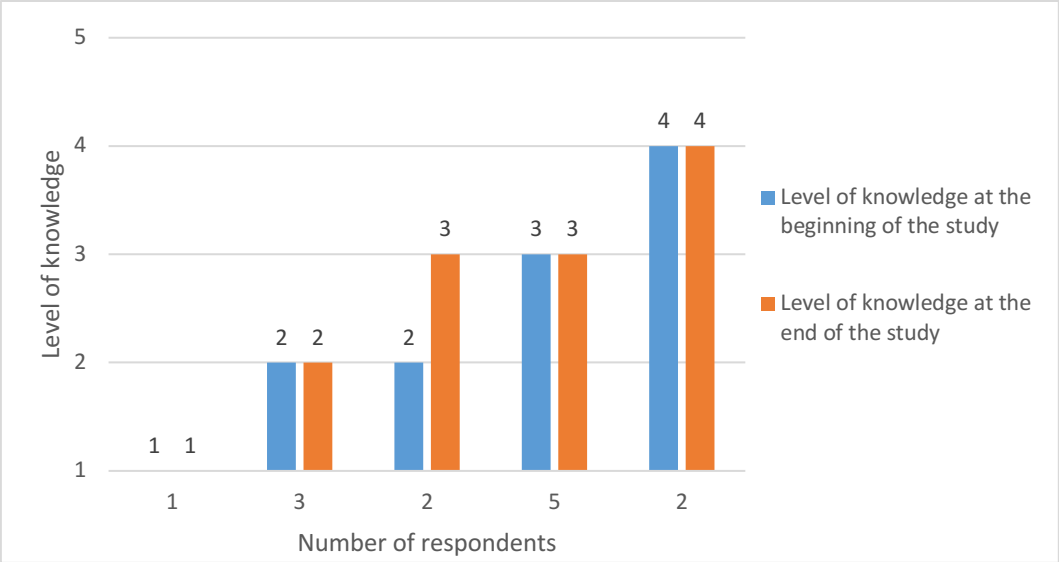

Figure 4. Students' survey results for Entity management and systematics.

The next question in this section was analytical thinking and argumentation. The results can be seen in figure 5. The reported average at the beginning of the study module was 2.92. Eight students assessed that their competence increased in this area of competence during the study module, and five assessed that their competence remained at the initial level. The standard deviation of these answers was 0.83 at the beginning of the study module. At the end of the study module, the variance decreased by 0.75.

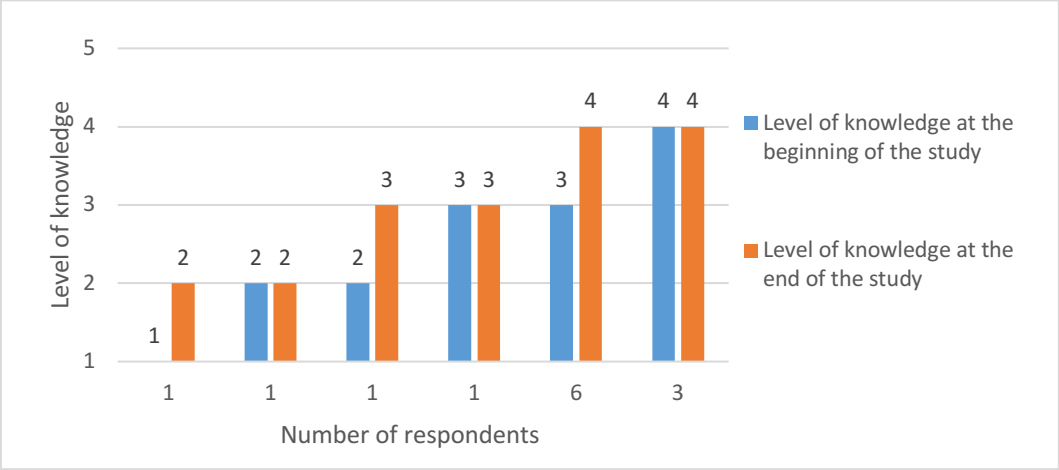

Figure 5. Students' survey results for Analytical thinking and argumentation.

Only a tiny part of the research results is reported here. A more extensive analysis of the research results is still in the works. The studies' results at all three higher education institutions are gathered together and analysed in more detail. The analysis of the results also aims to make comparisons, especially between two Finnish universities of applied sciences. Regarding the research done at RGU, the point of view is slightly different because the starting points and backgrounds are different.

3.1.2 Students' survey answers for free-form questions

Students were also asked to evaluate the numerical self-assessments to freely answer which new things or skills they learned during the study module. The students' free-form answers will be analysed in more detail as the research progresses, but this is an example summary of the answers to a few questions in the questionnaire.

The first free answer question was: What new things and/or skills did you learn during the course? Here are authentic answers given by students:

"I learnt never to give up: to keep trying until I come up with a working solution."

"I learned new skills relating to technologies used in the course project, like Docker. I learned how to better account for customer requirements and needs."

"Technology"

"Better understanding of Scrum."

"New tech and teamwork skills."

"I learned to code much better and know more about coding in working life."

"I learned more about the configuration of different technologies."

"New technologies for both front and back development."

"Better teamwork."

"Working with different kinds of people."

"New technologies and working with a real company."

"Teamwork, sustaining productive direction when doing projects."

The students reported that they learned things by the objectives of the study module, but also other general skills, such as better teamwork. The subject of the study module was a software development project and agile methods. During the study module, the groups participated in a real customer project. The groups' projects and content also affected what was emphasised and learned in each project because the customers' needs differed. This study module was attended by students with a foreign background studying for a Bachelor's degree in Finland.

The students were also asked if they understood what LbD means in practice. The scale was 1 ("no understanding") to 5 ("very good understanding"). Figure 6 shows that eight respondents chose the value three or four. Two students thought their level of understanding was two, and three felt they did not understand LbD at all. Students were also asked to verbally describe what they believe the LbD approach means in practice.

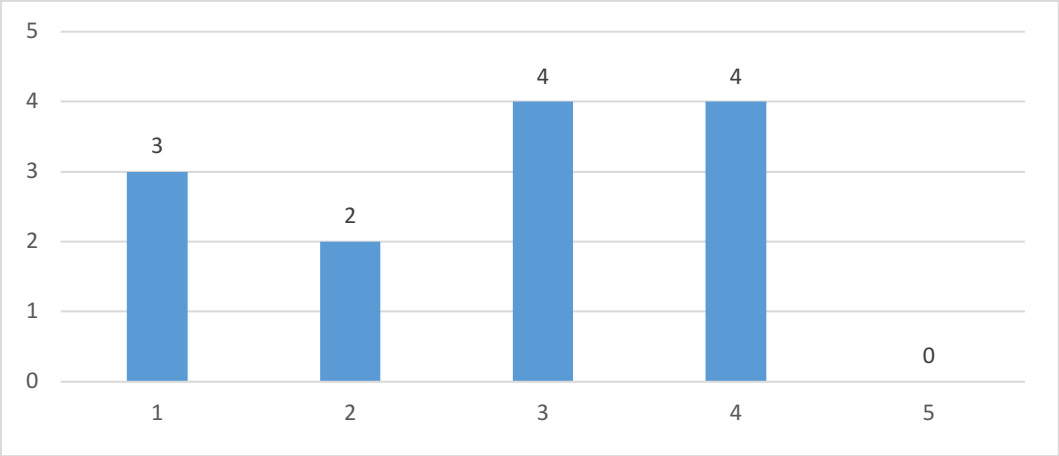

Figure 6. Students' own opinion of understanding what the LbD approach means in practice.

The answers to the numerical self-assessments compared to the verbal descriptions correspond pretty well to each other. Students who had chosen the value 1 ("no understanding at all") on the scale also could not verbally explain what LbD means. Those who chose a number three or four could describe the purpose of LbD relatively well, although a few students wrote that it was learning by doing.

The students were also asked does the LbD suits computer science studies. It can be seen from Figure 7 that only one student thinks it is not at all suitable for computer science studies. Not all students answered this in writing, but most think it fits well because the studied contents are already applied in practice during the study module, instead of studying things only through theory.

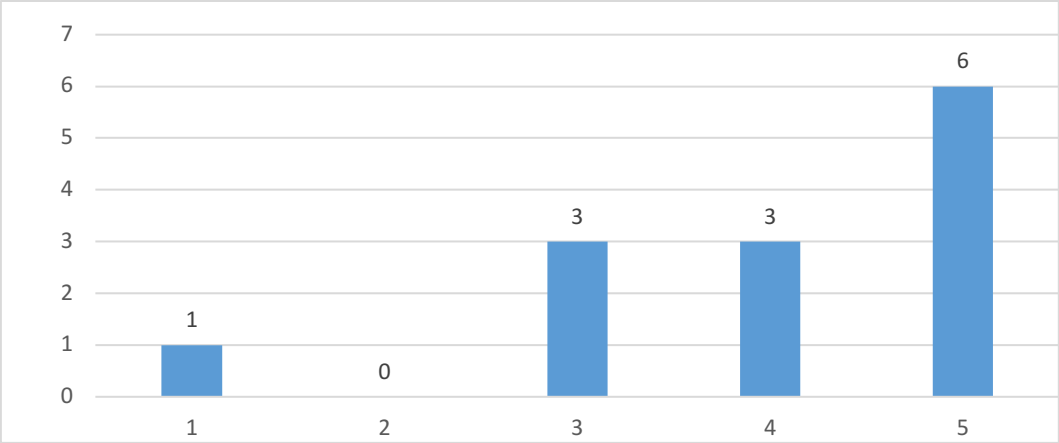

Figure 7. Students' opinions on how well the LbD fits into computing studies.

Here are a few authentic answers to the question: How well does the LbD action model (in your opinion) fit into studying computing science studies?

> *"It should be the main one. Classroom teaching is outdated and risky, as the teacher is likely to not adapt to many of the student's learning styles. Instead, suppose you jump into the action directly and are given enough incentives actually to work and get better. In that case, you will naturally learn in your way, which is infinitely better than someone forcing their learning style upon you (with peer support, of course, as learning alone is very demoralising)."*
>
> *"Yes, because developing products for clients is what most of us computer science students will be doing in a work environment: it's never a bad idea to give students the first taste of their future."*
>
> *"It is very suitable. I do not know any better way to learn computing science than actually."*
>
> *"Really good because you don't learn to code if you don't code yourself."*
>
> *"I think it's an excellent route for students to garner valuable experience in real-world-like projects."*
>
> *"Very suitable. The hands-on experience allows students to practice their newly learned skills."*
>
> *"It is because computer science is about doing and executing in practice."*
>
> *"It gives more real-life experience in working."*
>
> *"Supports the learning of skills that help, for example, in programming (Sustainable development), learning a habit and not, for example, learning a specific technology (Learning to learn something new)."*

Students were also asked how well they thought LbD fit into this study module they participated. Figure 8 shows that to this question, too, only one student answered that LbD does not work.

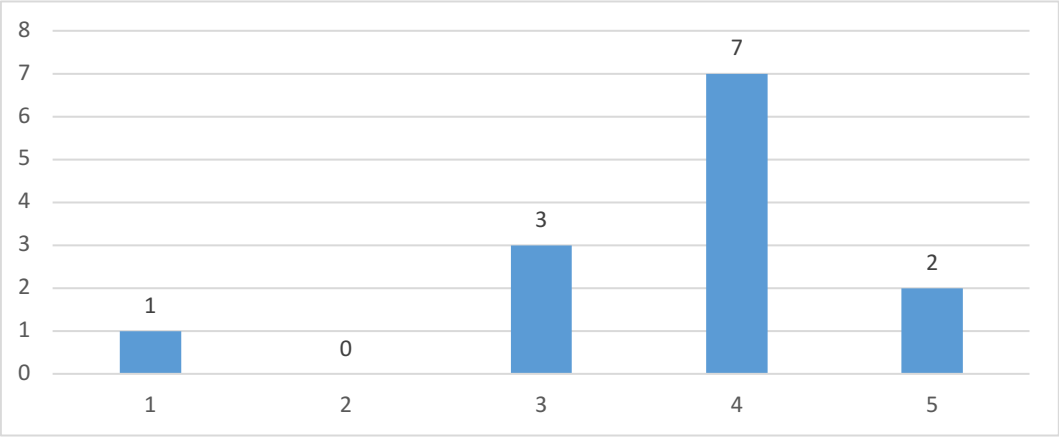

Figure 8. Students' opinions on how well the LbD fit the study module they attended.

A few of the written answers have been collected here, which opens up the matter well from the student's point of view:

> *"LbD was a fitting conclusion to software development studies, as it was more enhanced than we had before: year by year, we had taken more demanding projects, but they were usually based on our ideas. I can't imagine a better target for the last course than an outsider client who gives the project's objectives."*
>
> *"We had to pick up entirely new technology with limited documentation, making it hard to do and test things when you don't know how to do anything. There was barely any actual programming/coding involved in this project."*
>
> *"In coding, no one tells you how things should be coded, but you have to learn them and look them up on the internet. Of course, you can get help from friends if needed, but most of it has to be solved by applying it yourself to produce a working solution."*
>
> *"I think it fits very well."*
>
> *"Very suitable. In addition to helping with learning the technologies, the method makes it so that the group members are more likely to rely on each other and thus help with working for a group."*
>
> *"It was good."*
>
> *"The projects seem more actual and that it has meaning, and your deadlines are actual."*
>
> *"Here, the methods were put to the test."*

Based on the answers, it can be concluded that most students felt that the LbD approach was suitable for such a study module. The students thought that they had learned and absorbed things more deeply because they were able to apply what they learned in practice in real customer projects.

3.2 Interviews of lecturers and customers

In the study, research material was also collected from the lecturers of the study module through thematic interviews. There were a total of four lecturers in the study module, and all of them were interviewed separately. The study's goal was to find out what kind of experiences the lecturers have with using the LbD action model in teaching and how suitable it is as a teaching and learning method in the software development study module, which includes real customer projects. The thematic interviews were conducted remotely and transcribed so the answers could be analysed in more detail. The interviews were conducted in Finnish but have been translated into English.

When the lecturers were asked how well they think the LbD action model fits the study module they teach, all the lecturers thought that LbD is well suited for such study courses, which include a real customer project. One lecturer stated that, in his opinion, LbD is the only natural way for such a study module to be a pedagogical model. One lecturer also noted that, in his view, LbD is designed explicitly for such study modules. According to one lecturer, LbD fits nicely as a pedagogical model for universities of applied sciences because their principle is to study things practically.

The lecturers saw the good or best aspect of LbD in that, already during their studies, students get to see what happens in working life and quite accurately simulate real working life. The good thing is that you get to work on a real working-life project with working-life representatives, and at the same time, you also learn something that you might not otherwise have to learn.

The lecturers were also asked if they saw any weaknesses or shortcomings in the LbD action model. To this, the lecturers replied that LbD requires good preparation and self-management skills from the students. They also saw it as a challenge in LbD that if all parties, students, lecturers and customers, do not adequately commit to or understand the principles of the LbD action model, the result will not be excellent. One of the challenges of the LbD action model is that if the study module's evaluation criteria and methods are not sufficiently clearly defined and explained, it can cause challenging situations among students.

Through thematic interviews, information was also collected from customers who participated in the study module about their experiences of using the LbD operating model in their projects. There were a total of three customer interviews, which were also conducted remotely, and the interviews were transcribed for more detailed analysis. The customers who participated in the interview had no previous experience with this kind of cooperation. At the beginning of the study module, the researcher told the clients about LbD and how the LbD action model is applied in the study module. The active participation

of customers in the project work is of paramount importance in LbD to achieve the project's goals, which were reviewed with the customers. The clients were also given the interview questions in advance and felt that these would help them during the study module and the project.

All customers also had some challenges at the beginning of the cooperation. Some of the problems were related to the organisation of groups and the creation of cooperation methods. According to one customer, the students were too shy to express their opinions and ideas. There were also some technical problems in the early stages of the projects, but after they were resolved, the cooperation started going well. Before starting the project, the customers would have liked to know what the students already knew and what they had studied earlier. In that way, customers would better understand what can be expected from the students. It could also help them better understand where their guidance is needed. According to the customers, the roles between the lecturers and the customers could have been more clearly defined. The role of lecturers can vary a lot in LbD projects. Teaching and guiding are still essential roles of a lecturer. In customer projects, however, the lecturers are not always in-depth experts in the knowledge and skills needed in a particular project, and therefore the role of the customer can often be to teach and guide knowledge and skills. Despite some minor problems initially, all customers found participating in this collaboration to be a positive and good experience.

4 CONCLUSIONS

In summary, it can be stated that in the opinion of the majority of students who participated in the survey, the LbD approach seems to be a reasonable and suitable pedagogical model for computing students' project-based study modules. In particular, the application development project implemented in cooperation with the client and the related study unit seemed to suit the students well. In the opinion of most students, the LbD model, which combines things learned through theory and their application in practice, is a method that deepens competence.

Students' experiences of the LbD approach were generally positive, with a few exceptions. Many students also felt that their skills developed in several different areas during the study module, reinforcing the idea that LbD is also well suited as a learning method for computing students. The competence development areas derived from Laurea's 2030 strategy are broad-based, so some of the competence areas included in it are also ones that are not directly included in the objectives of the software development project study. Despite this, many students' competencies also developed in areas not mentioned in the competence objectives of the study module.

The lecturers' experiences were primarily positive. They all think LbD is well suited as a learning method for the software development project study, where you work on a real customer project. The customers' experiences of participating in a collaborative project according to the LbD action model, where students, lecturers and customers participate together in a project based on real working life, were also positive. The clients felt they got valuable results from the projects and a new kind of "outside the box" thinking. Some of the products are also ones that customers can use directly in their production or process and further refine. The customers saw the students' new views and ideas as adding value to their business.

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