Teachers’ Perceptions of Digital Learning Path in Mathematics, Languages and Programming

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Abstract - ViLLE is an exercise-based digital learning platform designed and implemented at University of Turku. The digital learning path in ViLLE is a pedagogic methodology of utilizing educational technology effectively in classroom: with learning path, one mathematics, language or programming lesson in a week is transformed into digital learning experience. The learning path in ViLLE is already used in one third of Finnish schools. In this article, we present the results of surveying teachers’ perceptions about the usage of learning path, it’s pedagogic value and their ideas of improving the environment and the learning experience. 280 teachers answered to the survey. Majority of the teachers were very happy with the learning experience. The digital learning path in ViLLE is already used in one third of Finnish schools. In this article, we present the results of surveying teachers’ perceptions about the usage of learning path, it’s pedagogic value and their ideas of improving the environment and the learning experience. 280 teachers answered to the survey. Majority of the teachers were very happy with the learning experience. The learning path in ViLLE is already used in one third of Finnish schools. In this article, we present the results of surveying teachers’ perceptions about the usage of learning path, it’s pedagogic value and their ideas of improving the environment and the learning experience. 280 teachers answered to the survey. Majority of the teachers were very happy with the learning experience. The learning path in ViLLE is already used in one third of Finnish schools. In this article, we present the results of surveying teachers’ perceptions about the usage of learning path, it’s pedagogic value and their ideas of improving the environment and the learning experience. 280 teachers answered to the survey. Majority of the teachers were very happy with the learning experience. The learning path in ViLLE is already used in one third of Finnish schools.

Moreover, Niess [7] continues to present TPACK - a dynamic framework that describes “teachers’ knowledge required for designing, implementing, and evaluating curriculum and instruction with technology” and a strategy for deciding on when, where and how to use domain-specific knowledge.

Teachers’ adaptation to technology might not be an easy task, especially for teachers with years of experience of teaching without technology. Still, the early career teachers might struggle with use of technology as well. Moursund et al. [8] found out that even before the turn of the millennium, technology infrastructure in classrooms was growing rapidly. However, according to [9], the teachers still find the availability of technology as the greatest barrier for technology usage in classroom. Likewise, [10] state that the biggest barrier is the ineffective field experience. The meta-analysis of [11] concludes, that the relationship between technology and pedagogical beliefs is a complex issue, and needs a multi-dimensional approach and knowledge of the school context to be understood.

In addition to technology usage, the questions in the survey covered gamification [12], differentiation (see for example [13, 14]), homework [15] and collaboration [16, 17, 18, 19].

III. DIGITAL LEARNING PATHS

Digital content requires carefully planned adaptation [20] to be effective and motivating. We have previously described the planning and implementation of digital learning path for mathematics, languages and programming [21]. Currently, more than 7,000 teachers and 190,000 students use the digital learning path (DLP). In fact, more than one third of all schools in Finland have at least one teacher using DLP in their teaching. The DLP is implemented by using ViLLE - a collaborative, exercise-based learning tool [22] with more than 150 different exercise types and full support for gamification and comprehensive learning analytics.

The basic principle behind the digital learning paths is one digital lesson every week. In this lesson, the students typically solve 20 to 30 automatically assessed exercises about the topic at hand. Most of the exercises are initialized with random values and all of them provide instant feedback when completed. Teacher can differentiate the content and provide either warm-up or bonus exercises to students with too much or too little challenge. The teachers can utilize the built-in real-time learning analytics, which include for example an
automatic detection of students’ misconceptions in different mathematical topics [23].

The teachers’ workflow with digital learning paths starts with selecting the suitable content for the class. The DLP follow Finnish curriculum in mathematics and in Finnish language, and the content adapts to all workbooks the teachers may use. Before the lesson starts, the teacher needs to open the suitable digital lesson in the tool. Moreover, the teacher needs to decide for example on the following issues:

- Whether the material is worked on as alone or in collaboration with another student? Digital collaboration has been proven as beneficial for learning in many studies [16, 17, 18, 19]. On the other hand, collaboration has potential drawbacks, such as the concept of free-riders and the problems in group selection (see for example [24]).
- Whether to utilize differentiation for some students or not. In the platform used, it is possible to provide warm-up exercises for students who are struggling with the basic content. Moreover, bonus exercises can be provided for students who are not challenged enough.
- The differentiation can also be done by modifying the digital trophies provided. The platform utilized gamification for example by providing students virtual trophies on their achievements while doing the exercises. Typically, bronze trophy is awarded for completing half of the required exercises, and silver, gold and diamond trophies when more or all exercises are completed. The teacher can modify the score limits for all of the trophies for individual students, meaning that the number of points needed for bronze trophy might be different to all students in class.
- Whether the DLP is only used at school or in home as well? Typically, teachers give the exercises not completed during the lesson as homework in traditional lessons, so why not require the completion of digital exercises at home as well? The problem, if any, might be the unequal digital competences of parents and insufficient devices at home.

In addition, the teachers need to do other pedagogical decisions on using the tool, including for example how often the digital learning paths should be used. The effectiveness of the learning paths have been previously studied in various setups (see [25, 26, 27, 28, 29]) and the results show, that the DLP can be highly effective to students’ performance and arithmetic fluency. In this article, we however concentrate on teachers’ pedagogical approaches while using the digital learning paths with their students.

IV. RESEARCH SETUP

The survey was conducted on April in 2018. We used Google Forms as a survey platform. The survey was sent as an email attached to newsletter to all teachers using our learning path materials during that time. A reminder to answer the survey was sent six days later to expert teachers (N=143). We reminded the expert teachers to remind also their colleagues in their school. There were altogether 2032 recipients and 630 opened the email (31%). We got 280 answers (13.8%). The teachers range from first grade teachers to ninth grade IT or mathematics teachers. This information was only collected, if the teacher gave feedback on content. This was optional.

The goal of the survey was to find out how teachers use ViLLE, which features they use the most frequently and get feedback from mathematics, Finnish language and programming contents. We also asked in which direction the teachers hope ViLLE would develop. Contents of the survey are discussed in more detail in next chapter.

A. Survey

The survey was created on Google Forms. We informed teachers it would take 5-10 minutes to answer the questionnaire. Three types of questions were used in the survey. We had predefined options where answerer chooses the most suitable option. Typically, these questions were accompanied with open field to give more detailed answer, if necessary. Some questions concerning the quality of content or support were asked in 5 step likert scale.

Due to low rate of responses in Finnish language (14.6%) and programming (8.8%) we concentrate more on the results for the non-optional topics of the survey. All teacher’s answers were handled in non-optional questions. Content related survey answers were handled by the content team who made decisions how to change the content according to teachers’ wishes.

V. RESULTS

The results section is divided further into four sections. First, we introduce how teachers use ViLLE and how experienced they are. Second, we report how teachers use the differentiation tools provided by ViLLE. Third we concentrate on the feedback from Mathematics content. Languages and programming were left outside of the reporting due the low number of answers. Finally, we report results on support, general user experience and willingness to continue using ViLLE. We also introduce some of the open feedback.

A. General usage and teacher experience

First, we wanted to find out how experienced the respondents were (Figure 1). All 280 respondents answered this question.
Most of the answers came from new users however but there are almost as many 6-12 months experienced as there was 1-2 years experienced users.

We asked teachers to choose from given options how often they usually work with ViLLE (Figure 2). We got 280 answers to this question. We also got 121 open questions to describe in more detail how teachers work with ViLLE.

When we add together usage tendencies from every two weeks to more frequent, it covers 87.7% of all usage. In open answers many of the teacher describe that if there is an exam coming they might use ViLLE more frequently to rehearse. The frequency also varies depending on the topics student currently learn. Many also mention that the frequency depend on the availability of IT-devices.

Figure 2 Frequency of using ViLLE with students.

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The more experienced the users are the more frequently they use ViLLE. The number of ViLLE teachers has increased rapidly, hence it’s natural that most of the respondents are new users.

We recommend teachers to give homework from ViLLE. We asked how often they give homework to students (Figure 4). Also, in this question we got 280 answers.

Over half of the respondents assign homework from ViLLE at least sometimes. We got 101 open answers giving more specific answer or explanation to this question. Many answers complain that not all students have necessary skills or devices at home to do homework and thus it’s not mandatory. One teacher answered that he/se did not realise this possibility before and will definitely try it later.

Figure 4 How often teachers assign homework

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The Figure 5 shows the relation between assigning homework and how experienced the teacher is. The less experienced the teacher the less like they will assign homework from ViLLE.

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The Figure 5 shows well the natural tendency, that teachers with more experience and confidence are more willing to assign homework than relatively new users.

B. Differentiation

In Figure 6 we can observe the tendency of giving specific goals for students by customizing the trophy limits for the whole class or for individual students. We got 280 answers to the multiple-choice question.
Figure 6 Have the teacher changed the trophy levels for students.

We got 51 open answers to this question. In many answers, teachers have decreased the limits to motivate students. Also, many answers state that the respondent haven’t had time or knowledge to do this.

Another way to differentiate is to assign students to preliminary group or bonus group. 280 teachers answered as follows (Figure 7).

Figure 7 Has the teacher used preliminary or bonus groups to differentiate

Two thirds of teachers have used either preliminary or bonus groups to differentiate students. We also got 40 open answers. Many of them state that preliminary exercises help low achieving students with their motivation.

There is an option for students to work in pairs. However, teachers must enable this feature. We asked how many have tried this feature (Figure 8). We got 280 answers for this question.

Figure 8 Has the teacher tried the pair work option

Only a small portion of teachers have tried the pair work feature. In 29 open answers giving more specific answer, many teachers tell that they have completely forgotten about the feature or they don’t know how to use it. Some teacher did tell, that they use pair work only, when there are not enough devices available for the whole class.

C. Mathematics content

We asked all teacher, if they would like to give as feedback on mathematics content. We got total 88 answers, where 87 (31%) answered all the questions. First, we asked teachers to choose which grade (or grades) their feedback concerns (Figure 9).

Figure 9 Distribution of feedback among grades

The 1st grade got the lowest number of feedback (11) and 7th grade the most (26). We asked if the number of exercises were suitable and if the difficulty level of the exercises was suitable. Teachers gave answers from scale 1 to 5. The optimal answer was 3. For number of exercises the number one indicated too few exercises and number 5 too many. For difficulty level the number one was too easy and number five too difficult. Teachers’ answers are shown in Figure 11. We divided the grades in primary grades (1-6) and junior high grades (7-9).

Figure 10 Teachers’ perceptions on the difficulty level of the exercises and number of exercises

We asked whether the number of exercises provided each round (or lesson) was suitable. Most teachers evaluated that the number of exercises was suitable but in primary grades there is a slight tendency towards “too many” and in junior high for “too little”. The general difficulty level of exercises was asked in a similar manner as the number of exercises in each lesson. Only a few answers were given to “somewhat easy” or “somewhat difficult” in both primary grades and junior high grades the tendency is towards the difficult side.
D. Support and Training

We wanted to know how well teachers respond to our trainings and if the support is adequate. Our support team provides support via email and phone during office hours. Expert teachers are available at schools to give help and support.

Figure 11 shows how well teachers feel they know how to use ViLLE in general on scale from 1 to 5. All teachers answered this question.

Over 91% of the teachers answered somewhat agree or better.

Support was divided into two questions. Figure 12 shows how well ViLLE Team managed to provide support to teachers and the support provided by colleagues. All teachers answered both questions. We also got 78 open answers that explained teachers’ answers in more detail.

We were able to reach 94% teachers answering “Somewhat agree” or better when asked, if they received help from ViLLE Team when in need.

From open answers we see that many teachers are currently only ViLLE teachers in their school. Others praise that they have a very skilled colleague who is ready to help if there are any problems. Many respondents also state, that they haven’t contacted our team.

Finally, we asked teacher whether they are willing to continue using ViLLE during the next academic year. Again all 280 respondents gave an answer to this question. 98.9% Answered positively that they are going to keep using ViLLE during the next academic year. Only 3 teachers told, that they were not going to continue. We got 52 open answers to this question. One of the respondents retired and one was unsure where he/she would be working the next year. The third one told that he/she would have continued if the class would have remained the same. Now there is no time to familiarize students with ViLLE. Four teachers complained about slowness or insufficient device resources at school.

In other answers teachers praised the platform: “I could not even imagine teaching without ViLLE. Totally fantastic platform. Thank you for your work”. “Definitely the best digital learning environment I have tried. Students have been really excited and motivated. Even sixth-graders are waiting to get new trophies to their board of honor. For teacher it is fast enough and easy to use. Lessons can be opened ad-hoc, which is really important for itinerant special education teacher.”. The comments are freely translated from Finnish.

VI. DISCUSSION

We are thrilled to get feedback from teachers who use our platform regularly to bring versatility and get more date on students learning processes. It’s important for us to be able to meet the needs of teachers. The teacher community is quite active and we receive feedback on daily basis. In the spring of 2018 we collected feedback from our users.

The overall result of the survey was very positive. It might be due the fact that teachers who are more satisfied and active are also more active participating in surveys. This might affect especially the high (98.7%) result on teachers who are very positive on continuing using ViLLE the next academic year as well. This shows that we have answered the needs of the teachers and they keep using the platform. Based on the survey, it’s hard to judge the individual features that make teachers so satisfied. Generally, the satisfaction seems to rise from multiple small details. The high number of new users in contrast to more experienced users is explained by the fact that the number of users is growing rapidly and there just are more new users than more experienced users [22].

The survey shows that teachers who have used ViLLE longer tend to use it more regularly and are also more likely to assign homework for students. Using a new platform requires certain amount of confidence. It is natural that the more confident the teacher is the usage also gets more regular and versatile.

Based on the numeric evaluation of mathematics content the number of exercises and the difficulty level of the exercises were suitable. Teachers gave answers from scale 1 to 5. The optimal answer would be 3. For number of exercises the number one indicated too few exercises and number 5 too many. For difficulty level the number one was too easy and number five too difficult. However, the open answers helped us find some topics that teachers found troubling. For example, many 2nd grade teachers mentioned clock exercises having analog and digital times mixed, which caused problems during lessons. We were able to reorganize the content for better suitability.

The confidence of using ViLLE reported by teachers is relatively high. This indicates that the level of training is sufficient at least to give the basics knowledge how to use ViLLE. However, from the open questions we learned that even though differentiation and other advanced features
are introduced in training and in support material, there were many teachers who did not know about these possibilities. We can use this information to even further emphasize on these features but we can also assume, that there is a need for rehearsal trainings as well.

Our support team got many praises from open feedback. Also, the results of the survey show high satisfaction for getting help from our team. There is still clearly room for improvement when 13 teachers completely disagree. In the open feedback some teachers had clarified the “completely disagree” and “Somewhat agree” answers by stating, that they had not needed any help. The same trend is shown also in the answers getting help from other colleagues except many teachers stated that they are still the only ViLLE-teachers in their school. We were still happy to see that many mentioned that the more experienced ViLLE-users from their school provide support when needed.

To conclude, the given feedback shows that even with comprehensive training there are still topics that some teachers fail to master. This does however not necessarily hinder the user experience or reflect negatively. Also support after training plays an important role for user satisfaction.

REFERENCES


