# CHALLENGES AND BENEFITS OF REMOTE LEARNING IN CONTEXT OF COMPETENCE DEVELOPMENT OF ENGINEERI1NG STUDENTS DURING COVID-19 PANDEMIC

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**Abstract.** For almost a year now, due to the restrictions of the Covid-19 pandemic, engineering studies at all universities have been organized remotely. Challenges of remote studies, which are not usually relevant in the face-to-face learning environment, are now emerging. This leads to new learning experiences that open opportunities to develop the competencies needed by engineering professionals. This article analysis challenges and benefits of remote learning at three Baltics States universities with focus on influence to the development of personal, social and learning to learn competence. The theoretical basis of the research is formed by self-directed learning findings, focusing on students' purposefulness and responsibility for learning. The empirical part is based on a survey of engineering students from the Latvia University of Life Sciences and Technologies, the Vytautas Magnus University and the Estonian University of Life Sciences on the challenges and benefits of remote learning during the COVID-19 pandemic. The results show that almost a quarter of the respondents prefer remote studies, which are mainly based on the principles of self-directed learning. Main challenges in the context of personal competence are difficulty focusing or paying attention to remote studies, and also motivation/desire to complete assignments, in the context of social competence – communication with the teacher but learning to learn competence - digital skills to use distance learning platforms and tools and also the problem of availability of information on remote studies. The main differences between the countries: Estonian students communicate much more with each other, Lithuanians have the best digital skills to use distance learning platforms and tools, but almost all Latvians and Estonians participated in online lectures.

**Keywords:** competence, engineering, life-long, remote, self-directed learning.

## Introduction

Due to the Covid-19 pandemic, studies at universities are carried out remotely. Despite the fact that e-learning has long been introduced as part of the study process, a number of challenges have emerged, the expansion of which is relevant. Literature highlights certain factors, such as levels of motivation, teachers' knowledge of e-learning techniques and pedagogy, and the structured learning environment influencing student satisfaction with their remote learning experience during the COVID19 pandemic [1]. Challenges, such as coping with feelings of stress, anxiety, social isolation and loneliness, which are not usually relevant in the face-to-face learning environment, are now emerging [2]. This leads to new learning experiences that open up opportunities to develop the competencies, such as personal, social and learning to learn that are needed by engineering professionals in the context of both the Fourth Industrial Revolution and sustainable development [3]. These competences have been recognized by the European Union as key competences for lifelong learning [4; 5]. These competences include the ability to cope with uncertainty and complexity, effectively manage time and information, work with others in a constructive way, remain resilient and manage one's own learning, etc. [5].

Looking at the challenges of remote learning in the context of competence development of engineering students, technological knowledge, communication skills and time management skills are the ones that determine the effectiveness of remote learning [6]. According to Yu, students must be able to analyse various sources of information, create and understand multimedia texts and other multimedia platforms, meet the requirements of the remote learning course and independently meet the deadlines [7]. He also points several benefits from remote learning, namely, the ability to work at own pace, a variety of online communication methods, the ability to learn anywhere, and less anxiety during tests.

An important component of remote learning is communication skills, which are promoted by collaborative learning and help reduce feelings of social isolation and improve students' active online learning [8]. Interactions between teachers and individual students, between groups of students, and between students and the curriculum are also important [7; 8].

Although students have a lot of contact with teachers when studying at a distance, there are cases when students have to decide for themselves and choose what to focus on, identify things that are

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successful and areas where little more work may be needed. This kind of responsibility for one's own education is characterized by self-directed learning. Although self-directed learning is an important part of higher education, its importance becomes more relevant during remote learning. Thus, the aim of this study is to identify the challenges and benefits of remote learning during the COVID-19 pandemic and to determine their impact on the development of personal, social and learning competences of engineering students in the context of self-directed learning.

**Materials and methods**

The theoretical basis of the research is formed by self-directed learning findings, focusing on students' purposefulness and responsibility for learning, seeing self-directed learning as a means of promoting lifelong learning, problem-solving, management and flexible adaptation to social and economic situations [9]. In scientific literature, elements of self-directed learning include focus on purposefulness, motivation of knowledge, effective implementation of learning strategy, responsibility, controlling assessment of learning progress, the importance of expressing opinions and time management [9; 10].

According to these findings on self-directed learning, as well as considering the above-mentioned research results on the challenges and benefits of distance learning, a research methodology which includes questionnaire for students was developed with eight components of personal, social and learning to learn competence to determine the impact of distance learning on engineering students' competence development (Table 1, Table 2).

One of the question groups was related to the students' attitude towards challenges posed by remote learning. Questions on this topic were divided into 3 groups reflecting different competencies: personal, social, and learning to learn (Table 1). In response to the provided statements, respondents were able to choose one of the following answer options: always, often, rarely, never. Chi square test was used to determine the differences between the countries. The reliability of the obtained data was checked by determining the Cronbach's alpha coefficient.

Table 1

**Components of competence and appropriate statements in the questionnaire**

| Compe-tence | Components of competence: | Statements in the questionnaire |
|---|---|---|
| Personal (*Internal conditions*) | Adaptability | Difficulty focusing or paying attention to remote studies |
| | Motivation | Personal motivation/desire to complete assignments |
| | Skills | Digital skills to use distance learning platforms/tools offered by teachers |
| Social | | Communication with teachers |
| | | Interaction with classmates |
| Learning to learn | Context conditions | Availability of information on e-learning opportunities/remote study process |
| | | Volume of study works |
| | | Implementation of practical/laboratory work/practice |
| | Responsibility | To achieve the study results provided for in the study courses |
| | Supportive context | Availability of appropriate hardware/smart devices/software at home |
| | | Internet connection instability |

Other question groups were related to the students' attitude towards benefits of remote studies by evaluation of students' habits during remote studies. Students had four answers to choose from: never, rarely, often, and always. The different issues are presented in Table 2 and we analyse these from three different perspectives: (1) Are there differences between the countries? (2) Are there differences in the way of learning in the groups? (3) Are there differences in the learning effectiveness between the groups? Group differences by country, by learning preferences and by learning effectiveness are identified using nonparametric Kruskal-Wallis test and Tukey test for pairwise comparison.

Table 2

**Statements in the questionnaire describing competencies**

| Competence | Statements in the questionnaire |
|---|---|
| Ability to adapt to situations | I attended online lectures |
| | I watched/read video lectures/written materials to the end |
| Effectively manage time | I completed the tasks and submitted them on time |
| Responsibility | I performed study tasks independently and with a high sense of responsibility |
| Effectively manage information | I used the electronic materials provided by the library |
| | Searched for information on the Internet |
| Cooperation | Asked for classmates help |
| | I communicate with teachers using various opportunities to ask questions and ask for help |

Empirical research includes a survey of engineering students at three Baltic Agrometric network universities: the Latvia University of Life Sciences and Technologies, the Vytautas Magnus University and the Estonian University of Life Sciences on the challenges and benefits of remote learning during the COVID-19 pandemic. A total of 387 students from various engineering specialties answered the questionnaire. The sample consisted of 147 students from Latvian (LV) universities, 122 students from Estonia (EE) and 118 students from Lithuania (LT).

The study used the self-assessment method, which is recognized as the most powerful tool for understanding and improving the performance of higher education institutions. To make improvements and promote learning, self-assessment aims to identify strengths and weaknesses in own work or behaviour [11].

**Results and discussion**

When assessing engineering student personal competencies 47.7% of respondents noted that they often had difficulty focusing or paying attention to remote studies. 33.1% of students rarely had such difficulties. No statistically significant differences were found between assessments of respondents from different countries. Problems related to personal motivation/desire to complete assignments were often encountered by 39.9% of respondents, rarely by 42.1%. No statistically significant differences were found between assessments of respondents from different countries. There was a statistically significant difference in the respondents' assessments of digital skills to use distance learning platforms/tools offered by teachers (Table 3).

Table 3

**Answers to question: "Have you had problems with digital skills to use distance learning platforms/tools offered by teachers?"**

| Country | Answers | | | |
|---|---|---|---|---|
| | always | often | rarely | never |
| Chi-square = 38.39, p-value < 0.001 | | | | |
| Estonia (ET) | 9.9% | 29.7% | 50.5% | 9.9% |
| Lithuania (LT) | 7.4% | 16.7% | 42.6% | 33.3% |
| Latvia (LV) | 21.5% | 40.5% | 29.8% | 8.3% |

This lack of digital skills was mainly experienced by Latvian students. 62.0% of students noted that they had problems with the platforms offered by the teachers. This problem was the least faced by Lithuanian students. 75.9% of Lithuanian students stated that they lacked these skills rarely or not at all. At the Vytautas Magnus University, students work with the Moodle system, which is used unanimously by all teachers. Lectures, seminars, and practical projects were taught using one of the selected systems – MsTeams or BigBlueButton.

When analysing social competencies, no statistically significant differences between respondents in assessing communication with teachers and interaction with classmates were found. However, it should be noted that 69.9% of respondents stated that problems related to communication with teachers

occurred always or often. Interaction with classmates was assessed positively and negatively by a similar number of respondents. The answers of respondents from the different countries did not coincide in assessing learning to learn competencies (Table 4).

Table 4

**Answers to question: "What problems you encountered in remote learning?"**

| Country | Answers | | | |
|---|---|---|---|---|
| | **always** | **often** | **rarely** | **never** |
| **Availability of information on e-learning opportunities/remote study process** | | | | |
| Chi-square = 13.86 p-value = 0.031 | | | | |
| Estonia (ET) | 11.0% | 19.8% | 46.2% | 23.1% |
| Lithuania (LT) | 5.6% | 14.8% | 57.4% | 22.2% |
| Latvia (LV) | 14.0% | 32.2% | 40.5% | 13.2% |
| **Volume of study works** | | | | |
| Chi-square = 28.32 p-value < 0.001 | | | | |
| Estonia (ET) | 25.3% | 46.2% | 25.3% | 3.3% |
| Lithuania (LT) | 9.3% | 37.0% | 38.9% | 14.8% |
| Latvia (LV) | 9.9% | 28.1% | 46.3% | 15.7% |
| **Implementation of practical/laboratory work/practice** | | | | |
| Chi-square = 37.22 p-value < 0.001 | | | | |
| Estonia (ET) | 8.8% | 19.8% | 44.0% | 27.5% |
| Lithuania (LT) | 7.4% | 22.2% | 37.0% | 33.3% |
| Latvia (LV) | 30.6% | 33.1% | 22.3% | 14.0% |
| **To achieve the study results provided for in the study courses** | | | | |
| Chi-square = 31.57 p-value < 0.001 | | | | |
| Estonia (ET) | 6.6% | 20.9% | 45.1% | 27.5% |
| Lithuania (LT) | 7.4% | 22.2% | 38.9% | 31.5% |
| Latvia (LV) | 27.3% | 31.4% | 28.1% | 13.2% |
| **Availability of appropriate hardware/smart devices/software at home** | | | | |
| Chi-square = 7.58 p-value = 0.270 | | | | |
| Estonia (ET) | 4.4% | 20.9% | 41.8% | 33.0% |
| Lithuania (LT) | 5.6% | 20.4% | 59.3% | 14.8% |
| Latvia (LV) | 5.8% | 24.8% | 45.5% | 24.0% |
| **Internet connection instability** | | | | |
| Chi-square = 17.36 p-value = 0.008 | | | | |
| Estonia (ET) | 11.0% | 39.6% | 45.1% | 4.4% |
| Lithuania (LT) | 11.1% | 18.5% | 53.7% | 16.7% |
| Latvia (LV) | 10.7% | 46.3% | 33.1% | 9.9% |

Respondents from Lithuania faced the least the problem of availability of information on e-learning opportunities /remote study process. Estonian and Latvian students often mentioned that they had encountered this problem rarely or never, and among Latvian students the difference in these answers was less noticeable.

The problem of the volume of study works was most encountered by Estonian students and least by Latvian students. The answers of Lithuanian students were more diverse, the reason of which might have been the subjective factors, such as taught subjects, teacher's attitude, or motivation of students.

Latvian students reported that they encountered the problem of implementation of practical/laboratory work/practice often or very often, the answers of Estonian and Lithuanian respondents did not differ considerably. About 70% of Estonian and Lithuanian respondents encountered this problem rarely or never.

Latvian students reported that they faced a challenge to achieve the study results provided for in the study courses often or very often, while the answers of Estonian and Lithuanian respondents did not differ considerably. About 70% of Estonian and Lithuanian respondents encountered this problem rarely or never.

There were no statistically significant differences in the assessment of the availability of appropriate hardware/smart devices/software at home. The analysis of students' assessment of the internet connection instability determined that 50.6% of Estonian respondents and 57.0% of Latvian respondents have encountered this problem always or often. 70.4% of Lithuanian respondents stated that this problem occurred rarely or never.

The benefits of remote learning in the context of competence development of engineering students during the Covid-19 pandemic were identified by assessing students' habits during distance learning. Whichever way of study one prefers, there were 5 different choices: I prefer learning face to face with a teacher; I prefer remote learning; I prefer learning in a group; I prefer learning by myself; Other. Other option was chosen when students could not choose one and combined two options from the previous list. There were 4.8% students who chose Other in the three countries (see Table 5). Estonian (21.0%) and Latvian (19.5%) students like to study face to face with a lecturer the most. At the same time Lithuanian students like to study equally face to face with a lecturer (6.3%) and remotely (6.6%).

Table 5

**Learning form preferences by country**

| Country | Others | Remote learning | I like to study face to face with a teacher | I prefer to study in a group | I prefer to study individually | Total |
|---------|--------|-----------------|---------------------------------------------|------------------------------|--------------------------------|-------|
| Estonia | 2.2% | 6.3% | 21.0% | 4.1% | 0.4% | 34.0% |
| Lithuania | 1.5% | 6.6% | 6.3% | 3.3% | 3.0% | 20.7% |
| Latvia | 1.1% | 11.1% | 19.6% | 8.9% | 4.7% | 45.3% |
| Total | 4.8% | 24.0% | 46.9% | 16.3% | 8.1% | 100.0% |

Using nonparametric Kruskal-Wallis test and Tukey test for pairwise comparison we clarify if there are group differences by country, by learning form preferences and by learning effectiveness. In Tables 6, 7 and 8 "a" and "b" mean that these groups are different, and "ab" indicates that there is no difference in the groups.

By country we find only differences in the following answers: I attended online lectures, I performed study tasks independently and I asked for classmates help (see Table 6). One of the differences is that Lithuanian students never (3.6%) participate in online lectures or participate rarely (10.7%), while Estonian and Latvian students participate in online lectures often (24%) or always (75%). Estonian students answered never (2.2%) or rarely (10.7%) to the question "I perform study tasks independently" what shows that students use other students' help or even present other student's work as his own. About half of students in all countries often do their work independently. Latvian and Lithuanian students always (41%) do their work independently, when only 27% of Estonian students work independently. The answers to question "Asked for classmates help" are the same. In Estonia 24% of students asked for help from their classmates whereas 9% of Latvian and Lithuanian students asked for help. About half of students in Latvia and Lithuania asked for help rarely and in Estonia only 30% of students asked for help. This shows that Estonian students communicate much more with each other.

The other questions were answered the same in three countries. About 90% of students of all countries watched or read video lectures always or often. That shows how important it is to record lectures and practicums. In Latvia and Lithuania about 90% of the students completed the assignments and submitted them on time always or often, in Estonia this number is 80%, and 12% of Estonian students submitted their works rarely. In Kruskal-Wallis test the above difference was statistically insignificant. In all countries, students rarely (40%) or never (42%) use library electronic materials. Most (95%) use the Internet materials often or always. Asking for help from teachers is also not very popular. About 50% of students do so rarely and only 8% of students always ask for teacher's help.

Learning form preferences in groups – I prefer learning face to face with a teacher; I prefer e-learning/ remote learning; I prefer learning in a group; I prefer learning by myself; Other – are the same with questions I attended online lectures, I watch or read video lectures, I am looking for information on the Internet. All students prefer always (68%) and often (30%) to attend online lectures. About 40% watch or read video lectures always and about half of students do this often. Students who preferred to study in a group answered to the question "I completed the assignments and submitted them on time"

that they always do so 38% and often 54%. And in the group – I prefer study individually – students answered always 30% and often 61%. The students who prefer distance learning or study in group are more than 50% do their work on time always and less than 40% do this often.

Table 6

**Respondents' habits during distance learning by country**

| Habits | Lithuania | Latvia | Estonia | p value |
|---|---|---|---|---|
| Online lectures | a | b | b | 0.003 |
| I watched/read video lectures/written materials to the end | a | a | a | 0.279 |
| I completed the assignments and submitted them on time | a | a | a | 0.073 |
| I perform study tasks independently | ab | b | a | 0.047 |
| I use electronic materials provided by the library | a | a | a | 0.061 |
| I am looking for information on the Internet | a | a | a | 0.355 |
| Asked for classmates help | a | a | b | 0.002 |
| Communicate with teachers | a | a | a | 0.093 |

The percentages between different learning preferences change in the same way as we look at them for independent work. 36% of students who prefer work in the group never use electronic materials of the library and 46% of students who prefer work individually. The other groups use electronic materials of the library rarely (45% of students) and never use 25%. About half of students who prefer distance learning ask for help from classmates rarely, often ask 37% and always ask 4.6%. Students who prefer learning in the group they ask for help rarely (34%), 52% ask often and 11% ask always. Communicate with teachers using various opportunities to ask questions and ask for help that possibility is used rarely (45.6%) by students who prefer studying in a group and 72.7% of students who prefer to study individually. Students who prefer to study face to face with a teacher also ask for help (12%) directly from the teacher the most.

Learning effectiveness in the context of remote learning consists of 4 different options: I cannot learn as well as in the classroom, I do not see much difference between full-time and remote learning, I learn better than in the classroom, I cannot answer. If we compare the students' habits in terms of leaning efficiency, there are no differences between attended online lectures, completed assignments and submitted on time, searching for information on the Internet and asking for classmates help.

Regardless of the learning effectiveness of the group, most students always (more 65%) participate in an online lecture. About half of students always completed the assignments and submitted them on time and about 50% look information from the Internet often and the same goes for asking for help from classmates. The other half of students look for information from the Internet rarely. About 50% of students watch or read video lectures often in groups "I cannot study as well as in the classroom" and "I cannot answer", and the same number of students in other groups watch video always. Often (56.8%) I perform study tasks independently in group "I cannot study as well as in the classroom", always to do this 29.6% and rarely 11.2% of students.

In group "I learn better than in the classroom" about 50% perform study tasks independently often and others do this always. This shows that distance learning is very suitable for these students and they are good at self-management. Last two groups use electronic materials provided by the library slightly differently. Students (48.8%) who "study as well as in the classroom" never use electronic materials provided by the library and rarely use 40%. Students (41.4%) who "study better than in the classroom" rarely use electronic materials provided by the library and often use 18.4%.

Asking for help from the teacher the differences are between the same groups. Students (61.6%) who "study better than in the classroom" ask for help rarely and students who "study better than in the classroom" ask for help rarely 52.9% and 16.1% of students always ask for help. The library materials are not very popular.

Table 7

**Respondents' habits during distance learning by learning form preference**

| Habits | e-learning /distance learning | I like to study face to face with a teacher | I prefer group learning | I prefer to study individually | Other | p value |
|---|---|---|---|---|---|---|
| Online lectures | a | a | a | a | a | 0.096 |
| I watched/read video lectures/written materials to the end | a | a | a | a | a | 0.416 |
| I completed the assignments and submitted them on time | ab | ab | a | b | ab | 0.012 |
| I perform study tasks independently | ab | ab | a | b | ab | 0.024 |
| I use electronic materials provided by the library | ab | ab | a | b | ab | 0.004 |
| I am looking for information on the Internet | a | a | a | a | a | 0.278 |
| Asked for classmates help | a | b | ab | ab | ab | 0.026 |
| Communicate with teachers | ab | ab | a | b | ab | 0.065 |

Table 8

**Respondents' habits during distance learning by learning effectiveness**

| Habits | I cannot study as well as in the classroom | I cannot answer | I learn better than in the classroom | I do not see a difference between contact learning and distance learning | p value |
|---|---|---|---|---|---|
| Online lectures | a | a | a | a | 0.225 |
| I watched/read video lectures/written materials to the end | a | a | b | ab | 0.005 |
| I completed the assignments and submitted them on time | a | a | a | a | 0.073 |
| I perform study tasks independently | a | ab | b | ab | 0.006 |
| I use electronic materials provided by the library | a | ab | b | ab | 0.004 |
| I am looking for information on the Internet | a | a | a | a | 0.224 |
| Asked for classmates help | a | a | a | a | 0.103 |
| Communicate with teachers | a | ab | b | ab | 0.037 |

**Conclusions**

1. Main challenges in the context of personal competence are the difficulty focusing or paying attention to remote studies and the motivation/desire to complete assignments, in the context of social competence - communication with the teacher, but learning to learn competence – digital skills to use distance learning platforms/tools offered by teachers and the problem of availability of information on e-learning opportunities /remote studies.

2. Almost a quarter of the surveyed students prefer distance learning, which is based mainly on the principles of self-directed learning. About half of students in all countries often do their work

independently. Majority of students who prefer distance learning do their work on time always, do learning tasks independently, it proves that they manage themselves well.

3. The results show that recording of lectures and practicums are very important, as 90% of students of all countries watched or read video lectures always or often.

4. If we compare the students' habits in terms of leaning efficiency, there are no differences between attended online lectures, completed assignments and submitted on time, searching for information on the Internet and asking for classmates help.

5. The main differences between the countries resulting from the results of the study are: Estonian students communicate much more with each other than Lithuanians or Latvians, the least faced lack of digital skills to use distance learning platforms/tools offered by teachers are experienced by Lithuanians, almost all Latvian and Estonian students participated in online lectures, but Latvian and Lithuanian students most often completed the assignments and submitted them on time.

6. Cronbach's alpha is used to identify the level of reliability. Checking the "Group of competences" with Cronbach's alpha, the test showed that it is 0.77, but when checking the subgroups "Personal" and "Social" it was 0.26 and 0.41. It should be noted that this was a case study, and we are not going to generalize the information of subgroups.

7. Checking the test without the statements "Difficulty focusing or paying attention to remote studies", "Personal motivation/desire to complete assignments", "Volume of study works", "Availability of appropriate hardware/smart devices/software at home" we found that in this case Cronbach's alpha was higher (0.83). So, these statements should not be assigned to group "challenges".

8. The study mainly uses the self-assessment method, so the results were based on the opinion of the respondents and therefore the results cannot be generalized, but can be used to identify problems and identify future actions or research directions.

9. In terms of the reliability of the study results, some limitations have to be noted. First, the study required voluntary participation from the students. This might have caused positive involvement by the students. Second, given the small sample size, this work should be seen as early findings to inform a future larger scale study.

## References

[1] Baber H. Determinants of students' perceived learning outcome and satisfaction in online learning during the pandemic of COVID 19. Journal of Education and e-Learning Research, (7)3, 2020, pp. 285-292.

[2] Elmer T, Mepham K, Stadtfeld C. Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. PLoS ONE 15(7): e0236337, 2020. DOI: 10.1371/journal.pone.0236337.

[3] Creating a Shared Future in a Fractured World. World Economic Forum Report. World Economic Forum, 2018. [online] [15.03.2021]. Available at: http://www3.weforum.org/docs/WEF_AM18_Report.pdf.

[4] Annex to Proposal for a Council Recommendations on Key Competences for Life-long Learning. A European Reference Framework. EC, 2018. [online] [02.03.2021]. Available at: https://eur-lex.europa.eu/resource.html?uri = cellar:395443f6-fb6d-11e7-b8f5-01aa75ed71a1.0001.02/DOC_2&format = PDF.

[5] Caena F. Developing a European Framework for the Personal, Social & Learning to Learn Key Competence (LifEComp). Literature Review & Analysis of Frameworks, Punie, Y. (ed), Publications Office of the European Union, Luxembourg, 2019. [online] [12.03.2021]. Available at: file:///C:/Users/Lietotajs/Downloads/KJNA29855ENN.en.pdf.

[6] Martin F., Stamper B., Flowers C. Examining student perception of reading for online learning: Importance and confidence. Online Learning, 24(2), 2020, pp. 38-58.

[7] Yu E. Student-inspired optimal design of online learning for Generation Z. Journal of Educators Online, 17(1), 2020. [online] [10.03.2021]. Available at: https://www.thejeo.com/archive/2020_17_1/yu.

[8] Demosthenous G., Panaoura A., Eteokleous N. The Use of Collaborative Assignment in Online Learning Environments: The Case of Higher Education. International Journal of Technology in Education and Science, 4(2), 2020. [online] [07.03.2021]. Available at: https://ijtes.net/index.php/ijtes/article/view/43.

[9] Briede B. Students' self-directed learning in the context of industrial challenges: Latvia University of Life Sciences and Technologies case. Proceeding of 5th International Conference on Higher Education Advances (HEAd'19) Valencia, Spain, June 26-28, 2019, pp. 685-694.

[10] Briede B., Popova N. Self-directed learning of university engineering students in context of fourth industrial revolution. Proceedings of 19th International scientific conference "Engineering for rural development", Jelgava, Latvia, May 20 - 22, 2020, pp. 1594.-1600.

[11] Andrade, H., Valtcheva, A.: Promoting learning and achievement through self-assessment. Theory into Practice, 48, 2009, pp. 12-19.