Motivational Challenges of Engineers Participating in an Online Upskilling Program

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Abstract: The present powerful surge of available online learning platforms will provide employees with enhanced opportunities to rapidly develop their skills, regardless of time and place. Despite the potential, there are challenges for participants on online learning platforms to finalise the courses they engage in. The reasons for the high number of students dropping out before completion of the course are motivational, social, and technological. Studies show that large skill gaps exist among industry employees worldwide. It is often caused by the implementation of new technologies, digitalization, as well as increasing requirements on sustainability and resilience. E-learning provides a major opportunity to bridge such skill gaps. Thus, the flexibility offered by online learning platforms can be of high value for upskilling of industrial employees. This paper describes a study on the skills and learning processes of engineers in industry, participating in a national Swedish upskilling programme. The programme offers online learning modules, provided by 13 collaborating Swedish universities. The paper proposes a method for understanding underlying challenges in the participants' motivation and their module completion rates. The questionnaire "HowULearn", developed by Helsinki University, has been previously validated at several universities, consistently delivering a valuable understanding of student learning and motivation. To accommodate the methodological needs of this study, the questionnaire was adapted for an industrial context, investigating motivational challenges of learners on the Ingenjör4.0 platform. The primary outcome of the study is a framework for analysing learner challenges related to motivation within e-learning contexts. Further, this paper suggests a way of utilising the HowULearn questionnaire for participants on the Ingenjör4.0 online learning platform, to understand their challenges. The adapted questionnaire was tested with participants of the platform (22 respondents) and the results were analysed by identifying participant challenges. The outcome and conclusions of this study will improve the Ingenjör4.0 online learning platform but can also be used generically, to improve other e-learning environments.

Keywords: e-learning, online learning platform, motivation, upskilling, industry, engineering

1. Introduction

European Industry is experiencing tremendous changes due to trends like sustainability policies, requirements on resilience and digitalization, and ageing populations. The authors claim that humans are key in the transition towards a sustainable and resilient European industry. These humans are the ones needed to create innovative solutions for overcoming the present challenges faced by the industry. For a long time, the focus has been on improving efficiency and productivity, as supported by the Industry 4.0 approach (Kagermann, Lukas, Wahlster, 2011). To complement this approach, the European Commission recently launched the concept "Industry 5.0", bringing sustainable, resilient, and human-centric solutions into focus, and putting advanced upskilling on the agenda (Breque, de Nul, Petridis, 2021). The rapid transformation results in a huge need for upskilling among industry employees. The increase in online learning opportunities for industry employees shows the reaction of learning suppliers to this need. Industry employees face different challenges in their learning, as compared to regular university students. These people have to use time outside work to upskill, while often having families and other obligations.

One such emerging upskilling platform is Ingenjör4.0, created by 13 collaborating universities in Sweden. The platform consists of 15 modules with lectures, live webinars, reflectional exercises, and quizzes. The platform is used by employees from a range of small to large sized companies, giving engineers a flexible solution to acquire new skills. Even though feedback from Ingenjör4.0 participants is positive, challenges remain. An important question to ask in the light of the strong need for upskilling is what challenges and opportunities the participants of e-learning platforms face. This study aims to better understand such challenges and opportunities of the participants in the Ingenjör4.0 platform. For future life-long and life-wide learning, it is

crucial to identify why some participants are doing good, while some are not, eventually risking dropping out of the learning journey.

2. Theoretical background

According to the World Economic Forum (2020), 50% of the global workforce will need reskilling or upskilling until 2025. This means they will learn new skills, to be eligible for work in many different and future tasks. In their report, the World Economic Forum also lists top skills that are crucial for the future workforce. These skills include analytical thinking and innovation, active learning, complex problem-solving, creativity, leadership and social influence, technology use, technology design, programming, resilience, flexibility, emotional intelligence, service orientation, negotiation, and more (World Economic Forum, 2020). Since the industry is changing faster than ever, there is a special need for industrial digitalization, also described as industry 4.0. Therefore, industry employees need new ways to acquire new skills.

The use of different online learning platforms has increased and the variation of platforms used has grown rapidly. E-learning provides opportunities to study remotely, at your own pace, when not tied to a specific place and time. Creating e-learning platforms requires an understanding of learners and their specific needs (Hills, 2003). As Howard Hills (2003) notes, learners use the learning materials differently depending on their "personality, preferences for learning styles, attitudes to others in the workplace, what is considered acceptable locally, fluency of web familiarity, keyboard dexterity, command of literacy and numeracy". Students' experience, background, interactions and autonomy are linked to student satisfaction in online learning platforms (Abuhassna et al., 2020). Massive Open Online Courses (MOOCs) have become more popular, posing a way to learn something quite quick with easy and free access. However, below 13% of MOOC participants complete the course they signed up for (Onah, Sinclair, Boyatt, 2014).

For self-motivated learners, e-learning may often suit well. But it can also cause motivational challenges to learners (Hills, 2003). Interaction in online learning platforms may be impersonal and it may not support a sense of community, some technical problems may occur and understanding the course objectives may be challenging (Song et al., 2004). Research among university students shows that as support and feedback generally play a role in motivation and learning, instructional support, technical support and peer support also play important roles in course satisfaction within e-learning environments (Lee et al., 2011; Paechter, Maier, Macher, 2010). Instructional support contains clear instructions and guidance during the learning process, correcting and giving constructive feedback to learners. Peer support and collaborative, interactive work are important aspects of learning, also in e-learning platforms where students are often working remotely alone. Familiarity with technology and e-learning platforms, and sufficient technical support help to prevent inconvenience with online learning (Lee et al., 2011). According to Hattie and Timperley (2007), effective and powerful feedback should answer three questions for students; "Where am I going?", "How am I going?" and "Where to next?", and these questions could be made at four levels: task level, process level, self-regulation and self-level (Hattie & Timperley, 2007).

Students have different backgrounds and learning experiences and they also have different approaches to learning. Study approaches are linked to the student's experiences and academic competencies (Entwistle, 2009; Asikainen et al., 2022). The Deep approach refers to seeking a deep understanding of things to be learned, checking the evidence, arguing and being interested in the course content. An organised approach refers to the management of own study schedule and effort. The surface approach refers to storing information that is required in a course without deeper reflection and difficulties in making sense of the content (Entwistle and McCune, 2004; Entwistle, 2009). By understanding the learner's behaviour, needs, motivations and challenges, platforms supporting deep learning can be designed, giving the most appropriate support to them.

Any student's approach toward learning may affect her or his well-being (Asikainen et al., 2020). Student experiences of well-being, feelings about workload, and attitudes toward learning can be approached through the concept of burnout (Salmela-Aro et al., 2009; Salmela-Aro and Read, 2018). The concept of burnout consists of three different dimensions; exhaustion, cynicism and inadequacy. Feelings of exhaustion arise from a high perceived workload in studies and overall fatigue. Cynicism refers to a cynical attitude towards studies and feelings of a loss of interest or meaning in studies. Feelings of inadequacy may arise from reduced beliefs of competence or achievement (Salmela-Aro et al., 2009; Salmela-Aro and Read, 2018).

3. Method

Student experiences will be gathered through the HowULearn questionnaire (Parpala and Linblom-Ylänne, 2012). The questionnaire has been validated and widely used in Finnish and international contexts (Parpala et al., 2021). The HowULearn questionnaire contains different parts/question patterns that measure student experiences and opinions about their studies and studying environment, learning styles, self-efficacy, burnout and general working life competencies. Respondents answer each item on a 5-point Likert scale (1 = totally disagree, 5 = totally agree). The original questionnaire for university students has been slightly modified to make it more suitable for engineers working in the industry, and specifically for the e-learning environment by omitting some questions concerning learning materials. The authors also excluded questions related to self-efficacy beliefs because the questionnaire was sent to participants after they may have finished their studies in modules already.

The HowULearn questionnaire consists of different parts, measuring various aspects of student experiences.
In this research, participants answered some background questions (age, gender, modules that they took part in, module performance rate and job role) and four different parts concerning their learning. These parts indicate learning approaches; experiences about organisation and structure, relevance and support, feedback; burnout; and working life competencies. Questions about learning approaches (12 items) are originally from the Approaches to Learning and Studying Inventory (Entwistle and McCune, 2004).

The question pattern about burnout contains 9 items that measure students' exhaustion (4 items), cynicism (3 items), and inadequacy (2 items) in their studies. Questions about burnout are based on Study Burnout Inventory (SBI-9) by Salmela-Aro et al. (2009). In the same way, the other parts of the questionnaire contain several items that belong together and form an answer to a dimension.

Our object of analysis is engineers in Sweden that take part in the Ingenjör4.0 upskilling modules. The participants have decided by themselves to take modules through the program. The survey was sent out to 100 participants of the Ingenjör4.0 platform that took part in modules during spring 2022. 22 people were responding to the survey, of which 32% were female and 68% male. The respondents' age ranges from 21-60 years, whereof 28% are 21-30 years old, 27% 31-40 years old, 36% 41-50 years old, and 9% 51-60 years old. 82% of the respondents had finished 80%-100% of the module that they were enrolled in. None of the respondents had only completed 0-20% of the module, and 18% had finished between 21%-80% of the module. The respondents work within the following job areas: Sustainability, Production engineering, Product management, R&D, Technical support, Development engineering, Design engineering, Sales, Structural analysis engineering, Digitalization, and Management. The respondents were enrolled in the modules additive manufacturing, management and manufacturing digitalization, smart products and industrial internet of things, standards and interoperability in the digitised industry, and sustainable production systems.

The results of the survey are analysed by visualising histograms of the participants' answers about the different dimensions that are addressed in the survey, using a script in RStudio. The survey items are summarised into mean variables, e.g. burnout, and the script creates histograms for these means. Mean variables are formed based on each subscale of the questionnaire (study approaches, organisation and structure, relevance and support, burnout and working life competencies). Furthermore, Pearson correlations between different variables are calculated and further inspected with scatterplots. Since the sample size is too small to take tests of significance into account, correlation coefficients rather function as an indicator for associations within the sample.

4. Results

The challenges and opportunities that could be identified by the survey are presented in the following part, structured identically to the survey itself, and divided into different topics.

4.1 Study approach

The first part of the survey showed that most of the respondents put a lot of effort into their studies, that they work organised in their studies, and that they try to relate the new material to prior knowledge. This indicates that most of the respondents have a deep learning approach or an organised approach. 23% of respondents

don't think they organise their study time carefully to make the best use of it, and also 23% of respondents think they don't prioritise their time carefully to fit everything in.

4.2 Organisation and structure

Even though 59% of the respondents find it clear what they are expected to learn in the modules, 18% don't. Further, 68% of the respondents think what they are taught matches what they are supposed to learn, while 13,6% of them don't think it matches.

4.3 Relevance and support

91% of respondents can see the relevance of what they were taught, and 77% found most of what they learned interesting. 73% of respondents enjoyed participating in the module. The answers about support from other students were more spread out. Even though most participants say they can work comfortably with other students, 36% of the respondents don't think that students support each other or help when it is needed.

4.4 Feedback

31% of the respondents think that they don't get enough feedback about their learning, while 23% think they do get enough feedback. 32% of respondents think that the feedback given helps them to improve their ways of studying, while 32% of respondents don't think so. 41% of respondents think that the feedback given helps them to clarify things they hadn't fully understood, while 36% don't think so.

4.5 Mental wellbeing

In this part, cynicism, inadequacy and exhaustion are measured. Regarding cynicism, 13,6% of respondents lack study motivation and often think of giving up, while 78% of respondents don't. 13,6% of respondents are continually wondering if their studies have any meaning, while 73% of respondents don't agree with this statement. 13,6% of respondents feel inadequate in their studies, while 59% of respondents don't have this feeling of inadequacy. When it comes to exhaustion, 74% of respondents don't feel overwhelmed by the work related to their studies. Still, 4,6% of respondents do feel overwhelmed. None of the respondents answered that they sleep badly because of the studies. On the other hand, 13,6% of respondents worry about things related to their studies during their free time, but 63,7% don't. None of the respondents answered that the pressure of their studies causes problems in their close relationships with others.

4.6 Working life competencies

This part of the survey gives insights on how well respondents think they can apply their gained knowledge in their working life and about their collaboration and communication with other students. 68% of respondents say they have learned to apply theoretical knowledge to practice. 64% of respondents think that they have learned to see things from different points of view. On the other hand, only 27,3% of respondents think that they have learned to solve problems in practical situations and only 40,9% of respondents think that they have learned to make arguments for their thoughts. When it comes to collaboration with other students, only 31,8% of respondents think that the experience in Ingenjör4.0 has developed their collaboration skills and only 13,6% of respondents think that they could develop their skills in acting as a group member.

4.7 Correlations

There is a correlation between respondents' answers on applying the competencies that they acquired in their working life with what they answered on feedback. There is a tendency that respondents who think that there was satisfying feedback given also think that they can better use the acquired knowledge in their work life. A similar tendency can also be seen in the correlation between feedback and collaboration skills.

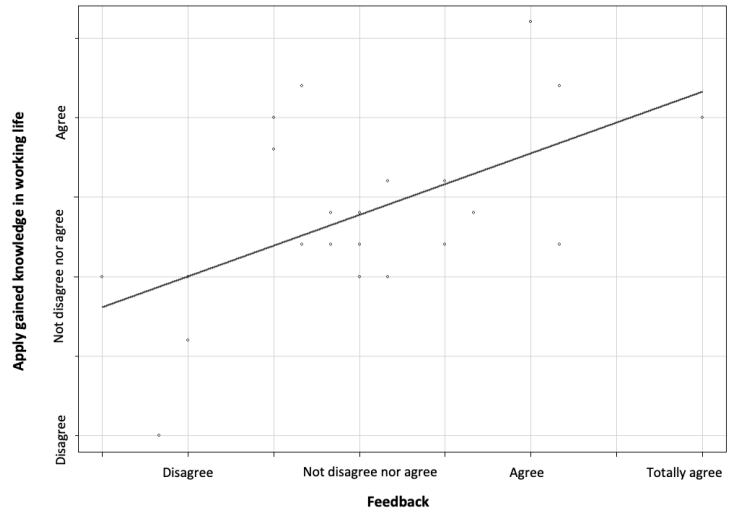

Figure 1: Correlation between respondents' answers on feedback and application of gained knowledge in working life

There is a negative correlation between the respondents' answers about the feeling of support among learners and their answers about study burnout. This means that most of the respondents that answered that they felt support from other learners didn't feel any study burnout.

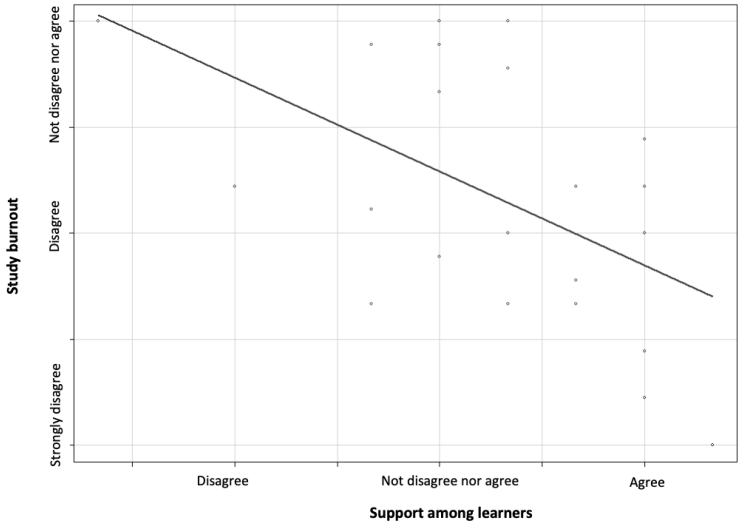

Figure 2: Correlation between respondents' answers on support among learners and study burnout

5. Discussion

The survey results show that the respondents face different challenges while using the online learning platform. These challenges are feedback that is given through the e-learning platform, a lack of collaboration and support among learners, and some small amount of study burnout. The respondents experience very well the relevance of the modules, and the application of gained knowledge in their work-life, and most of them have a deep study approach.

This study's findings have to be viewed in light of the following limitations. Firstly, the sample was quite small, which makes it impossible to draw significant conclusions. The insights from the data can only give implications and further studies are needed. Thus, more data from a bigger sample is necessary to make the research transferable. Secondly, the validity of the HowULearn questionnaire has been proven before, but for university students. In this study, the population consists of engineers working in companies that do these studies besides their normal work-life. The question that arises is if the proven method still provides valid results in the context of people who are in another stage of their life than university students. As an example, employees have another focus in life than university students, which needs to be taken into consideration

when asking questions about wellbeing and burnout. Since the question was put in a way that asked about the participant's stress related to their studies, the stress in other parts of their life maybe wasn't taken into account even though it could be an important factor to understand how a person prioritises parts of their life. Further, in this study, the participants are taking only one module, which means they naturally spend less time on studies as university students.

Still, the results of the HowULearn questionnaire give indications of the learner's experience and further studies should be conducted to allow transferability. More data is needed to identify an actual correlation between for example completion of the module and the different dimensions, such as feedback, burnout, and study approach.

However, this study also has several strengths. First of all, the study has proven that the questionnaire can be used in this context to find out how participants of this e-learning platform experience their learning. Secondly, the questionnaire enables the systematic analysis of the participant's learning experience and pinpoints relevant dimensions that need to be understood to increase the rate of completion of the module. Further, the study can be scaled up in the future to gain statistical significance.

At this point, the results can be used to discuss how the challenges that these learners face can be tackled. One of the challenges is the lack of received feedback. It seems like a challenge to give feedback to each learner in a sufficient way through an e-learning platform. One question to look into further is how feedback could be given by a machine in the platform and if that would be satisfying for the learner. As mentioned before, when giving feedback it is important to include 1) Where am I, 2) Where do I want to go?, and 3) How do I get there? (Hattie). If a machine or a human could ask these questions and support the learner in answering them, the feedback could be given automatically. Another challenge that the learner faces is the collaboration with other participants on the platform. The implementation of collaboration and support spaces for the learners could be discussed in the future.

6. Conclusion

The industry is experiencing a huge transformation that leads to massive needs for upskilling of the workforce. E-learning platforms play an important role since they offer employees a flexible way to learn new skills. However, there remain challenges for those using e-learning platforms. This study has been focused on an e-learning platform for engineers, created by 13 collaborating universities in Sweden. Challenges and opportunities of the learners have been identified by sending out a questionnaire to participants of modules of the e-learning platform, addressing the learning dimensions - study approach, organisation and structure, relevance and support, feedback, mental wellbeing, and working life competencies. The challenges that the 22 respondents of the survey face are the lack of satisfying feedback, a lack of collaboration and support among learners, and in some smaller amounts the feeling of study burnout. On the positive side, most of the respondents have a deep study approach, think that what they learn is relevant, and can apply the gained knowledge from the platform in their work life. The identified challenges create opportunities to improve the learning experience for the participants of the e-learning platform.

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