ANALYSIS OF THE POSSIBILITIES FOR ENHANCING STUDENTS’ TRAINING PERFORMANCE IN HARD SKILLS SUBJECTS

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Abstract

Technological advances and ICT entering people’s lives have made society adapt to the existing environment, where the lack of digital skills leads to a social and digital exclusion. The focus of the current article is placed on overcoming the barriers in the course of training digital skills among various groups of learners in a university environment. The research defines several basic factors affecting the final outcomes from the hard skills training, among which are: lack of motivation, lack of learning materials adapted to the needs of the learner and lack of flexibility in training approaches. An empirical study has shown the lack of adapted learning materials to the needs of the learners as a major issue in the hard skills training. The suggested approach is focused on creating a flexible educational infrastructure as the first stage of the process of enhancing motivation and digital skills of the learners and is a foundation for the enhancement in students’ performance and training outcomes.

Keywords: education, learning, digital skills, hard skills, motivation.

1 INTRODUCTION

Technological advances and the advent of ICT in the lives of people have made society adapt to the existing environment where the lack of digital skills leads to the lack of opportunities for realization on the labor market. One of the most urgent challenges the world is facing today is how to reduce the number of people excluded from participation in the economic, social, political and cultural life of their communities [4]. Raising digital culture of the population is a step toward overcoming the digital divide [1] in society and a good reason to improve the acquired personal knowledge, skills and competencies [2].

In the course of their university studies, each student receives a set of hard skills and soft skills. Unlike soft skills, which are difficult to quantify and are directly related to the ability of a person to communicate, hard skills are qualitative and can be studied.

In their nature, hard skills are rather technically orientated and are often linked to the use of some kind of a software product or tool (scheduling software; spreadsheets; presentations). “Hard skills” comprise machine operation, computer protocols, safety standards, financial procedures and sales administration. In this sense hard skills can be defined as skills providing the comfort of a person when working with ICT. That is why this article looks at “hard skills” as skills allowing the person to manage, create and modify existing software or content through tools and/or applications.

It can be argued that the hard skills are obtained only in the process of learning or self-learning. However, in order to be seen as an effective learning or self-learning process, training needs to be learner oriented taking into account their input knowledge, skills and abilities. This article presents an approach to adapting learning to the needs of learners and is organized in 3 sections: The first section explores the effectiveness of hard skills training, indicating some conditions affecting the learning process. The second section presents an analysis of the barriers that arise in the course of hard skills training and comments on the stratification of students in groups of similar input skills. The third section offers an approach to overcoming barriers in the course of digital skills training among different learner groups in a university environment. The study defines a number of key factors that influence the final outcomes of students’ learning process and is based on an experiment.

2 CONDITIONS FOR THE EFFECTIVENESS OF THE TRAINING

The learning process can be considered effective when the trainee has acquired new knowledge and skills equal to or more than those set out in the training program. To qualify as an effective training, three conditions are generally needed:
- Preparedness;
- Opportunity;
- Reliability.

Preparedness shows how much the person to be trained has motivation, aspiration and preparedness to learn. Preparedness can be measured with:

- Presence of the necessary input skills to start the training course - each training course puts pre-requisites to its candidates usually associated with the availability of basic skills and/or knowledge (most often linguistic)
- Presence of learner motivation - training is considered to be a voluntary process that ensures the course participants are internally motivated to acquire specific knowledge. In turn, a person who has no internal motivation and strive to gain new knowledge would not achieve the expected outcome of the set requirements in course syllabus.

Opportunity in turn demonstrates the presence of learning materials adapted to the discipline that is studied, which can be used in the course of training and/or self-training.

Reliability guarantees that preparedness as a first stage in the development of hard skills will not be stopped as a result of the impact of side factors. The opportunity created is directed directly to a specific group of learners with equal start in terms of knowledge and skills. Based on the above described conditions, acquiring skills can be presented as a linear process (Fig. 1).

![Figure 1. Conditions for the effective training.](image)

In the learning process, it is important to take into account the starting level of the trainee group. A bad approach and a mistaken decision is that in the same group of trainees there are people who have different pre-training in the problem area under consideration. In such a situation, those behind will be in the process of catching up, and the advanced ones – in the process of waiting. This inequality in input knowledge and skills influences:

- the quality of the learning process – in a group formed without student selection according to any criteria, the teacher faces the task of balancing the knowledge of the students. He or she is required to take into account the level of learners and the level of both his/her weakest student and the most advanced one;
- the motivation of the learners – In order to avoid stopping the motivation of learners, regular incentives must be provided. These may be including additional tasks for the advanced, according to their training and knowledge, as well as to dedicate special time and attention to the underprivileged, so that they quickly catch up with the other members of the group.

In order to neutralize such situations, the best approach is to select candidates for a course already at the entrance according to certain criteria. On the basis of pre-regulated procedures, it is good for learners to be distributed in groups of common interests, but with equal skills. In other words, the most important condition at the beginning of the course is that learners have an equal start and have a level playing field.
To make it possible to form groups, it is necessary to specify the pre-existing criteria for assessing the applicants’ entry level. The distribution could be done by conducting an interview, a placement test or a questionnaire. On the basis of the collected data, the students can be divided into groups according to input knowledge. This will ensure the equal start of all students and will create the conditions for the normal conduct of the learning process on the created learning materials (such as curriculum, textbooks, etc.) for the group level.

3 PREPAREDNESS, STRATIFICATION AND BARRIERS

This paper presents an analysis of the opportunities for enhancing the success and performance of students studying hard skills in the field of computer science and information technology. For the purposes of the research, students from the Content Management Systems (CMS) discipline, which is applied in nature, were studied. Web content management systems are a special class of systems that make it easier for non-specialists to create a web site (as part of this article, people who do not have specific technical knowledge about programming) will be considered. The presented class of systems is popularly known as “Web Content Management Systems” (WCMS), which although designed for use by non-professionals are not intuitive on the interface, and often a specific set of skills possessed by learners is required to be managed. Part of the basic content management skills in most CMS include:

- Work with an operational system
- Work with a browser and Internet applications;
- Work with text editor.

The specificity of this class of systems is that not each of them supports standard set-up functionality for language transliteration in their installation package. This in turn adds the requirement for the person who uses them to have the minimum linguistic capacity and the language in which the system is distributed (the most common language is English). One of the main advantages of popular open source content management systems is that detailed documentation is built for them, and bugs can be easily resolved through discussion in the community of system users. A problem here could be seen among those whose mother tongue is not English due to the fact that much of the resources (online tutorials, manuals, etc.) are only available in English.

In practice, the listed input skills that must be held by the CMS course participants can be divided into two groups:

- Digital skills – In this article will be considered as basic skills for operating an operating system, a text editor, spreadsheets, and Internet applications.
- Language skills – In this article will be assumed the opportunities to read, listen and understanding texts written in a foreign language (most often English)

The main issues encountered in the CMS learning process in the university environment are largely based on learners’ differences in digital skills. Different specifics such as age of learners and computer skills have influenced the ability of students to take up new hard skills. Our observations have shown that women between the ages of 37 and 45 (students being 19 to 45) are most likely to have doubts about their ability to cope with the requirements. They experience the simultaneous lack of both basic digital skills and lack of foreign language competencies. The lack of these skills clearly suppresses self-confidence and maintains the existence of techno-phobia and concern over the forthcoming venture. This compels adding another factor to the availability of preparedness: a psychological preparedness that indicates the presence or absence of doubts for the upcoming tasks in the training course.

The following has been observed:

- Language skills influence the learning of the material and its understanding.
- At the same time, language skills also influence the formation of preconceptions and motivations - the trainee's readiness can be reduced in cases where the training takes place in part or in full in another language or the training starts at a level higher than the knowledge and skills of the student.
- Lack of language skills and / or digital skills leads to demotivation and psychological barriers in terms of learning opportunities, inability to master the material, etc.
Here, motivation can be said to be an important factor in the learning process and digital skills and language competencies can be seen as necessary conditions for motivation and lack of demotivation. In turn, the presence of motivation is a factor in the formation of new knowledge and skills [2]. To build up the new skills, a suitable educational infrastructure is needed (incl. Syllabus, learning materials) as well as flexible educational approaches. Criteria for pre-course assessment of learner knowledge in hard skills disciplines can be the availability of digital skills that are basic to the discipline, as well as search and traceability of learning materials incl. in English.

To confirm these claims, a study of a total of 140 students studying Content Management Systems was conducted. A survey was launched at the beginning of the course, the purpose of which was to stratify students on the basis of common indicators for each of them. The main issues raised in the survey were based on the criteria of language competence and digital skills. Based on the collected data, it was clear that only 34% of learners are fully prepared to start the course (they have the necessary digital skills and foreign language competencies). Partially prepared were two other groups: the share of those with no language skills but with the necessary minimum of digital skills was 39%, while 6% of those with a foreign language competence did not have a digital competence. The remaining 21% identified their level of foreign language competences and digital skills as satisfactory.

Based on the self-assessment of the pre-course knowledge and skills, the students were divided into 2 groups, within which they were trained:

- Group 1: Advanced (in full preparedness)
- Group 2: Beginners (partially prepared or lacking in preparedness)

In order to facilitate student training, it is necessary to adapt or change the syllabus of the subject to be taught so that it meets the needs of the students' training [4]. This is necessary on the one hand to achieve training efficiency and, on the other hand, to eliminate the discrimination of part of the trainees who do not meet specific requirements for starting the course. Based on the proposed stratification, basic learning documents oriented towards each learner's group were developed: curriculum-specific syllabus as well as teaching materials (self-preparation, presentations, demonstration and textbooks). The main differences between the programs of the two groups are expressed in the number of hours of self-study (expressed in self-study tasks), which for the group of beginners are twice as high as those of the advanced ones. In terms of teaching materials, the main difference is in the set of illustrative materials, which in the guides adapted for the needs of the beginner students are 45% higher than those of the students from the advanced group. A difference is also observed in the terms used and professional jargon, which in the process of training of beginners are minimized [3].

As a result of the analysis of the data we had, and on the basis of personal observations, we were able to define the main barriers to hard skills training. They are: lack of motivation, lack of training materials adapted to the needs of learners and lack of flexibility in learning approaches. The main hypotheses of the study were two: The first hypothesis is that students who have technical training and knowledge of a foreign language would do well with the assigned tasks in the course, even though they do not know the subject matter. The second hypothesis is that students with barriers such as lack of foreign language competencies, psychological barriers, or ICT barriers would find it harder to learn the material they handled, but with a flexible learning model, these deficiencies can be overcome. The study confirmed the first of the two hypotheses: students in the advanced group managed to overcome every challenge and covered all the syllabus requirements. The final results of the six-mark assessment system in this group were divided into two: Excellent 6 score - 85% and score Very Good 5 - 15%.

Students from the beginner group showed significantly better results than their colleagues in the previous year, studying the same discipline, but in the absence of stratification (Table 1).

**Table 1.** Comparison of the results of students in two consecutive academic years with applied different approaches in the training but with equal requirements

<table>
<thead>
<tr>
<th>Academic year</th>
<th>Six-mark assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Satisfactory 3</td>
</tr>
<tr>
<td>2015-2016</td>
<td>19%</td>
</tr>
<tr>
<td>2016-2017</td>
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</tbody>
</table>
The analysis of the results indicated the lack of adapted teaching aids to the needs of learners as a major problem in the training of hard skills disciplines.

4 APPROACH TO ENHANCING STUDENT SUCCESS IN HARD SKILLS TRAINING

Based on the information presented in the previous sections, several milestones during which hard training can take place can be summarized. In order to optimize the teaching process on the one hand and on the other to increase the learning outcomes for each student the stages can be reduced to 4 basic ones:

- Stage 1. Studying course candidates based on predefined criteria – involves collecting data through a survey, placement test or interview.
- Stage 2. Stratification of students in groups bringing together students by level of input knowledge and skills
- Stage 3. Conducting training using learning materials tailored to the knowledge, skills, opportunities and needs of students.
- Stage 4. A final exam evaluating learning outcomes.

The proposed approach focuses on building a flexible educational infrastructure as a first step in the process of enhancing motivation and digital skills of learners, and is the foundation for improving the success and performance of students at the final stage.

The block diagram depicted in Fig.2 describes the life cycle of the implementation of step 2. The number of contingent checks depends on the set of criteria defined by the lecturer or the training institution. Depending on the incoming conditions for the start of the course, groups are formed, bringing together the students on equal terms. In the so-called stratification process, a student who does not have the necessary minimum knowledge and skills that are basic to starting the course can not be admitted to the training. At the same time, it is impossible for a student who overcomes all the criteria to fall into the group of beginners and vice-versa – a student who is considered a beginner to the problem area to fall into the group of the advanced students.

![Figure 2. Stratification - cycle of the implementation.](image-url)
Once the students have been grouped, the learning process (step 3) following the pre-designed learning materials. The learning materials should be adapted to the learning outcomes and the available knowledge and skills of the students involved in the group. Training materials adapted for beginners must meet certain conditions including:

to be written in a language that learners know and understand;

the texts should be devoid of superfluous jargon and terminology, which would further complicate the process of learning and perceiving the material.

the textbooks should be filled with sufficient demonstration materials, including figures, illustrations and pictures.

the learning process also includes a self-learning process – to provide the opportunity for independent, self-study hours in order to reach the level of advanced students.

Stage 4 must be implemented following general requirements for students in each of the groups. At this stage, the success of the applied methods and approaches to the training of the respective group is verified.

In order for learning to be useful for both parties (lecturers and trainees) it is necessary to hold regular meetings and provide feedback from the students regarding the level of teaching, the quality of the teaching materials, as well as the possibilities for carrying out the individual assignments. Since it is not possible to predict all the possible situations arising during the training, it is important for the lecturers to be prepared for the need of correction in the syllabus or the training materials to be done “on the move”.

5 CONCLUSION

Digital skills are essential for modern society. This in turn makes hard skills training as important and significant as possible. This article defined conditions of preparedness, opportunity and reliability as an important basis for achieving an effective learning process. On the one hand, readiness ensures the availability of basic digital skills and language competences and on the other hand, the lack of psychological barriers and reservations in the students related to the upcoming training. The opportunity in turn serves to demonstrate the availability or absence of learning tools adapted to learners’ knowledge, skills and needs. Reliability ensures that preparedness as a first stage in the development of hard skills will not be stopped as a result of the impact of side factors and that the opportunity created is targeted directly at a specific group of learners with an equal start in terms of knowledge and skills.

The emphasis of the article is on building an approach to enhancing student success in training in hard skills disciplines. The approach consists of 4 important stages: studying preparedness, stratification of learners, learning process and evaluation of the results achieved. A study showed good performance of the students identified as lagging behind in the discipline studied. This approach focuses on hard skills disciplines but can be applied in almost all areas of knowledge.

REFERENCES


