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Raising Awareness of Students' Self-directed Learning Readiness (SDLR)

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Abstract: This paper describes the mapping of self-directed learning readiness (SDLR) for adult students applying for a master's degree program delivered entirely as distanced learning. Since SDLR is strongly linked to both adult learning and online education, developing of self-directed learning (SDL) skills should be taken into consideration in our degree program. Making future students aware of SDLR is the first stage in introducing self-directed learning methods and practices in learning environments. The easiest way to do this is to have students answer an SDLR self-assessment questionnaire and give them feedback regarding their SDLR level. This paper presents how this is realized and provides the preliminary results of the study and the applicants' SDLR score distributions. The results indicate high SDLR among all applicants.

1 INTRODUCTION

Knowles (Knowles, 1975) defined self-directed learning (SDL) as “a process in which an individual takes the initiative, with or without the help of others, in diagnosing their learning needs, formulating and implementing appropriate learning strategies and evaluating learning outcomes.” This is perhaps the most widely accepted definition of SDL. Self-directed learning readiness (SDLR) comprises personality characteristics that define an individual's degree of self-management, desire to learn, and self-control (Fisher et al., 2001). We live in a rapidly changing society, and to maintain professional skills, self-directed lifelong learning is a necessity (Guglielmino, 2013). As Knowles (Knowles, 1975) expressed, “We must think of learning as being the same as living.” He argued that learners with initiative learn more and better than passive “reactive” learners. Self-directed learners have greater motivation and tend to retain and make use of what they learn. Knowles considered SDL to be part of the natural process of human psychological development.

Adapting the definition by Knowles, Guglielmino and Guglielmino (Guglielmino and Guglielmino, 2001) defined SDL as “a process in which the learner is responsible for identifying what is to be learned,

when it is to be learned and how it is to be learned. The learner is also responsible for evaluating not only if the learning occurs but if it is relevant to the objective.” When developing her self-directed learning readiness scale (SDLRS) using the Delphi technique, Guglielmino (Guglielmino, 1978) connected a highly self-directed learner with qualities like initiative, independence, persistence, self-discipline, curiosity, responsibility, self-confidence, strong desire for learning, goal-orientation, and organizing skills.

Since SDL may also bring about many abilities supporting studying, such as increased retention, greater interest in continued learning, greater interest in the subject, more positive attitudes toward the instructor, and enhanced self-concept (Brockett and Hiemstra, 1991), the benefits of SDL are hard to deny. Fortunately, there is evidence that SDLR can be developed. Knowing their own SDLR levels may arouse students' interest in enhancing their SDL skills. Thus, this research will promote the growth of students' awareness of SDLR. In addition, the distribution of students' SDLRS scores may convince education organizers and lecturers to take SDLR theory into account when arranging and planning instruction.

In this preliminary stage of the study, we identified a way to realize SDLR evaluation in an online environment. We also examined the SDLRS score distributions of first-year students and student applicants. The future goal is to observe possible changes in adult students' SDLR levels in a master's program

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delivered as distance learning and to find a means of developing SDL skills in online environments. In the long run, collecting applicants' SDLRS scores may also enable the detection of whether their SDLR levels will affect their ability to be accepted into the program and commit to it. The SDLR survey by Fisher, King, and Tague (Fisher et al., 2001) was integrated into the virtual learning environment. Students were given materials that explained the purpose of the survey and provided information on how SDLR could be developed in connection with the education program. Responding to the survey constituted part of the first compulsory course for new students, which addresses academic study practices and skills.

The paper is organized as follows: Section 2 introduces SDL in more detail and connects it to our students. Section 3 discusses the related work. Section 4 explains how the SDLR scale is realized in our learning platform. The results and their meaning are discussed in section 5. Section 6 concludes the paper.

2 SELF-DIRECTED LEARNING

The introduction already provided some definitions for SDL. In this section, SDL is explored through SDL models. In addition, the relationship between SDL and online/distance learning and adult education, as well as the ways to measure SDLR levels, will be considered.

2.1 Self-directed learning models

Garrison's (Garrison, 1997) model includes three overlapping SDLR dimensions: motivation, self-management, and self-monitoring. Garrison defines self-directed learning as "an approach where learners are motivated to assume personal responsibility and collaborative control of the cognitive (self-monitoring) and contextual (self-management) processes in constructing and confirming a meaningful and worthwhile learning outcome." Motivation is a key factor in initiating and maintaining learning processes. Garrison classifies motivation into two terms: entering motivation and task motivation. "Entering motivation establishes commitment to a particular goal and the intent to act. Task motivation is the tendency to focus on and persist in learning activities and goals" (Garrison, 1997). Regarding Garrison's three overlapping dimensions, self-management focuses on external activities associated with the learning process and considers functions for achieving learning goals and learning resource management. Self-monitoring refers to the "responsibil-

ity to construct meaning." This includes developing new knowledge and reconciling new information with previous knowledge. Self-monitoring ensures that the learning goals are being met.

Brockett and Hiemstra (Brockett and Hiemstra, 1991) introduced the Personal Responsibility Orientation (PRO) model. It separates SDL into two dimensions: *instructional transaction characteristic* (teaching-learning process) and a *learner's personal characteristics*. The dimensions are guided by personal responsibility, which works as a starting point and is influenced by social context. To clarify some confusion, the model was aroused during years and was updated and reconfigured into the Person-Process-Context (PPC) Model (Hiemstra and Brockett, 2012) in order to disengage themselves from the political tone that the term "personal responsibility" may have obtained. *Person* (or a learner's personal characteristics in the PRO model) refers to one's characteristics, such as their "creativity, critical reflection, enthusiasm, life experience, life satisfaction, motivation, previous education, resilience, and self-concept". *Process* (or instructional transaction characteristic in the PRO model) refers to one's "facilitation, learning skills, learning styles, planning, organizing, and evaluating abilities, teaching styles, and technological skills." Adding the *Context* element to the model separates the model from many other SDL definitions. Context takes into account "the environmental and sociopolitical climate, such as culture, power, learning environment, finances, gender, learning climate, organizational policies, political milieu, race, and sexual orientation". Learning activities cannot be separated from the social context in which they occur (Brockett and Hiemstra, 1991).

2.2 SDL in the online and adult learning context

As an educator, it is important to understand how online learning affects SDLR and how SDL should be taken into account when arranging education for adult students, most of whom already have at least one previous degree and several years of work experience. The interest in SDL in relation to distance learning emerged from the structural constraints of distance education and the independence that distance learners have (Garrison, 2003). Already in the 80s, Moore (Moore, 1986) studied the implications of SDL for distance education and recommended that staff be trained to emphasize SDL in their courses and prepare material to be delivered in a personalized way based on students' needs and interests. SDLR shares multiple features with the requirements of distance learn-

ing.

Song and Hill (Song and Hill, 2007) studied the role of SDL in online learning contexts. They pointed out that initial SDL models were developed when face-to-face instruction was the predominant mode of higher education. Thus, they formed a conceptual model to understand SDL in an online context. In the model, the “learning context” indicates the impact of environmental factors on SDL. This learning context includes “design” elements, like resources, structure, and nature of the learning tasks, and “support” elements, which refer to the instructor’s feedback and peer collaboration. Song and Hill (Song and Hill, 2007) brought out the opportunities and challenges that an online context introduces. They deduced that online learning is closely associated with SDL. To succeed in online learning, many SDL-related skills are needed, such as planning one’s learning pace, monitoring learning comprehension, and exploring and using various learning resources effectively. Students need to be highly motivated as the online context may provide more opportunities to procrastinate studies, as online classes often do not provide strict schedules. In addition, students are more responsible for monitoring their own learning in online environments.

Barak et al. (Barak et al., 2016) suggested that online students were more aware of mastery learning and information processing strategies than their on-campus peers. In addition, online students indicated better planning, control, and evaluation skills for their learning process. Information resource management is an important part of SDL skills. Tang and Tseng (Tang and Tseng, 2013) discovered that distance learners who have higher self-efficacy for information seeking and proficiency in information manipulation exhibited higher self-efficacy for online learning.

Loizzo et al. (Loizzo et al., 2017) studied learners’ motivations for enrolling in a massive open online course (MOOC), their perceptions of success and completion, and the barriers encountered while trying to complete the MOOC from an SDL perspective. In Loizzo et al.’s study, SDL theory was utilized to better understand how adult learners experience MOOCs. According to their survey responses, the students had SDL-related features, like an awareness of their learning purposes, processes, and goals within the MOOC course. However, Loizzo et al. (Loizzo et al., 2017) stated that MOOC courses often do not provide the opportunity for learners to assess their own progress in relation to their personal goals.

Rashid and Asghar (Rashid and Asghar, 2016) studied the relationship between technology use and

academic performance, student engagement, and self-directed learning. Technology use was assessed with a “media and technology usage and attitudes” scale. Only the questions measuring media and technology usage, such as internet, social media, smartphone, and media sharing usage, were included in the research. They found that the use of technology has a directly positive relationship with self-directed learning. The same study also showed a positive correlation between SDL and student engagement.

The online environment also creates possibilities to enhance SDL skills. Kim et al. (Kim et al., 2014) developed a self-directed learning system to guide students to self-manage their own learning processes. The system enabled students to customize content by setting specific learning goals by reflecting on their learning experiences, self-monitoring activities and performances, and collaboration with other students. The system was found to improve students’ overall competency scores in being self-directive by practicing and reinforcing their SDL abilities.

SDLR is often related to lifelong learning, and Knowles’ work has had a great impact on this realization. In addition to SDL, Knowles was a specialist of andragogy (the study of adult learning). He defined the assumptions about the characteristics of learners by saying that “as individuals mature, their self-concept moves from one of being a dependent personality toward being a self-directed human being” (Knowles, 1980). However, age may not directly predict SDLR levels. For example, Heo and Han (Heo and Han, 2018) found no correlation between age and SDLR within their adult online college student. Thus, the link between adulthood and SDLR is based more on “maturity” than age. Knowles also argued that adults have “a deep psychological need to be generally self-directing, although they may be dependent in particular temporary situations” (Knowles, 1980). This means that teacher-centered education may not satisfy adult students.

Applying SDL in formal education is a challenging task. A strict curriculum may hinder the facilitation of SDL, and applying SDL may require extra effort from teachers. According to Guglielmino (Guglielmino, 2013), possible reasons for not adopting SDL are the tendency to teach as one was taught, the ease of assigning a grade based primarily on quantitative evaluation, school and teacher ratings based on testing, increasing class sizes that make it more difficult to use authentic assessment methods, and, for higher education faculty, a lack of instruction in teaching strategies.

2.3 SDLR scales

The most widely used SDLR assessment tool is Guglielmino's (Guglielmino, 1978) SDLRS. This is a self-report questionnaire that consists of 58 Likert-type items drawn up with the help of experts using the Delphi technique. The expert group consisted of 14 authorities in the area of SDL. Among the experts were Malcolm Knowles and Allen Tough, both major contributors in the field of adult education. Guglielmino's model defined eight SDL components: openness to learning opportunities, self-concept as an effective learner, initiative and independence in learning, informed acceptance of responsibility for one's own learning, love of learning, creativity, positive orientation to the future, and ability to use basic study skills, and problem-solving skills.

Guglielmino's SDLRS only measures the degree to which a person perceives themselves as reflecting the skills and attitudes related to SDLR. However, like Brockett and Hiemstra (Brockett and Hiemstra, 1991) point out, there is evidence that SDLRS scores correlate with actual behavior. This correlation was found by Hassan (Hassan, 1981) when she examined the connection of SDLRS scores with the number of learning projects. The learning projects used in the research were planned to fulfill the definition of Tough's (Tough, 1979) definition.

In this research Fisher's SDLRS is used (Fisher and King, 2010). Fisher's scale was developed to correct issues regarding the validity and reliability of Guglielmino's scale and to make it available at no cost. Originally, it was planned for nursing students, but during the principal component analysis of the scale, all questions relating to nursing were removed. The remaining items were comparatively generally applicable. Fisher's SDLRS has three subscales: desire for learning, self-management, and self-control. Fisher et al. (Fisher et al., 2001) did not define these subscales in great detail, but they resulted from an inter-correlation analysis between Likert-type items. The desire for learning (DL) subscale includes questions relating to one's motivation and attitudes toward studying. The self-management (SM) subscale includes questions associated with a person's development of appropriate external conditions and skills for the learning process, such as time management and resource handling. The self-control (SC) subscale includes questions about a person's ability to set goals and evaluate their own learning. The subscales have clear points of overlap with Garrison's (Garrison, 1997) SDLR dimensions: motivation, self-management, and self-monitoring.

Fisher's SDLRS includes 40 5-point Likert-type

items: 13 items for self-management, 12 for desire for learning, and 15 for self-control. The possible total scores can range between 40 and 200. When the SDLRS was originally tested with a sample of 201 students enrolling for a Bachelor of Nursing program at the University of Sydney, Australia, the total scores were normally distributed with a mean of 150.55 (median 150). Thus, Fisher et al. (Fisher et al., 2001) used a total score of greater than 150 to indicate SDLR. Later, Fisher and King (Fisher and King, 2010) re-evaluated the factor structure of the SDLR subscales, and found that the data collected from 227 first-year undergraduate nursing students did not fit the specified factor model until 11 items were removed; however, they recommended that all 40 items should be used until the results could be confirmed with a larger sample.

3 RELATED WORK

Most of the students who participated in this research had an engineering background before applying for the Mathematical Information Technology master's degree program. Fisher's scale was used, when Stewart (Stewart, 2007) mapped final year engineering students' SDLRS scores as a part of the process to integrate project-based learning, as a major component of the institution's learning and teaching options. Based on the data gathered, the average total score of the 26 students was 158.8. Sumuer (Sumuer, 2018) collected SDLRS scores for 153 undergraduate students in the School of Education at a public university in Turkey, identifying the extent to which their SDLR affected their technology SDL (i.e. their use of internet and communication technology (ICT) for learning experiences that enable individuals to take control of planning, implementing, and evaluating their own learning). The average item score was 3.97 (SD = 0.44), making the total mean score also 158.8. The study also found a medium, positive, significant correlation between SDLR and SDL with technology.

Although the SDLR items in Fisher's scale do not include any factors specifically relating to nursing, it is still mainly used to evaluate health care students. In fact, nursing students have been the most extensively studied group for SDLR long before Fisher's scale was developed (Brockett and Hiemstra, 1991). Therefore, we also compared our students to medical students. Abraham et al. (Abraham et al., 2011) explored the SDLR of first-year undergraduate medical students in physiology and searched for possible correlations with academic performance. The aver-

age total score of the students was 151.4, and 60.2% of students had a score greater than 150. The highest mean item score was for questions measuring desire for learning (3.91), followed by self-control (3.87), and then self-management (3.44). Based on their academic performance during the first-year program, students were divided into high achievers ($n = 10$), medium achievers ($n = 41$), and low achievers ($n = 79$). High achievers had the highest score for all three SDLR subscales, and statistical significance was found for self-control.

Deyo et al. (Deyo et al., 2011) studied the effect of SDLR and academic performance on SDL activities and the resources used to prepare for an abilities' laboratory course. The mean SDLRS score was 148.6 for 153 university students participating in a pharmacy course. The median was 149, and 68 students (44%) scored over 150. Similarly, Atwa (Atwa, 2018) collected SDLRS scores for second-year undergraduate medical students and examined the relationship between their scores and the students' grade point averages (GPAs) and gender. The mean SDLRS score for the 239 students was 159.25. Atwa found a statistically significant, positive correlation between GPA and SDLR. Furthermore, the SDLRS scores were also found to be significantly higher for females.

More engineering students' SDLR results can be found from studies using Guglielmino's SDLR scale. The scores for Guglielmino's SDLRS varies between 58 and 290, with values between 202 and 226 indicating an average level of SDLR (Guglielmino and Guglielmino, 2013). Litzinger et al. (Litzinger et al., 2005) tested undergraduate engineering students using Guglielmino's SDLRS. They found that, for first-year students, the mean score was 215 ($n = 80$), which fell into the average category. Guglielmino's SDLRS was also applied by Jiusto et al.'s (Jiusto and DiBiasio, 2006) study, wherein the effects of an experiential academic engineering program that emphasized lifelong learning and SDL skills were examined. The scores were collected before and after a 14-week project. The project experience had a modest positive effect on students' SDLRS scores, as the mean score increased from 219.4 to 222.7, but eventually fell into the average category.

4 RESEARCH OBJECTIVES AND DATA COLLECTION

The master's degree students in Mathematical Information Technology at Kokkola University Consortium Chydenius are mainly working adults who study alongside their work. For this reason, their educa-

tion has been strongly distance-learning-based with the use of educational technologies (Hakala and Myllymäki, 2016). Thus, the students' studies can be tailored to their personal schedules and life situations. In such an educational environment, SDL is of great importance for the progress of learning. Therefore, it is meaningful to examine the students' SDLR levels. It may even be reasonable to expect that students who gravitate towards distance education have higher SDLR scores.

The purpose of this research paper is to identify how we have implemented SDLR evaluation in an online environment. In this research, we also examine the SDLRS score distributions of student applicants and compare the results with other similar surveys. It is hoped that research related to self-direction will increase students' awareness of their own SDLR since, when they become aware of it, they can try to develop it. The broader objective of future research related to self-direction is to examine how SDL skills could be developed in an online environment and how to determine whether there will be any changes in the SDLR of the master's degree students during their studies. One aim of future research is to discover whether there are any differences in SDLR between students admitted to the degree program and those not selected.

4.1 Implementation of an SDLR questionnaire

Students responded to the Fisher's SDLR survey at the beginning their studies in the Mathematical Information Technology program. The survey will be offered them again during graduation. The SDLRS scores are collected during application process. The enrollment process includes an introductory course that applicants must complete to be admitted. The function of the introductory course is to give students some idea of the requirements for studying in this education program in terms of combining their study habits with their life situations and balancing the course workload. In the spring of 2020, there were two introductory courses: Communication Protocols and Introduction to Embedded Systems. The SDLR survey was one of the exercises for the courses.

The survey was completed at the beginning of the introductory course; therefore, it was also answered by students who, for various reasons, dropped out of the course and were not admitted to the degree program. When the survey was first introduced, it was also sent to first year students. The second time the students will complete the SDLR survey is when they attend a master's thesis seminar in the final stages of

their studies.

The survey was delivered as part of a student's profile in the electronic system used for the degree program. Students use the same system to watch, for example, video learning material; hence, it is constantly in active use by the students. Other surveys, such as a learning style survey, have also been integrated into this system in the past (Hakala et al., 2016). The system automatically identifies the responding student and stores the student's responses with the appropriate identification information in a database. For this study, the scale was translated into Finnish and four items were negatively phrased. The items were offered in five, eight-item clusters, and mixed in such a way that each cluster included two or three items for each dimension.

4.2 Feedback given to students

After completing the SDLRS survey, the students were shown a results page where they saw their own results and the average of the results for all students in the degree program. If a graduating student has completed the survey also at the beginning of studies, the results will be shown for both first and latest sets of answers. Along with their own results, the students were given some feedback and information about the SDLR in general. In their SDLRS, Fisher et al. (Fisher et al., 2001) concentrated on developing a statistically valid and internally consistent evaluation tool but did not consider how to give feedback to the students. Our solution was to provide, alongside the SDLRS score, a freely translated version of interpretations for Guglielmino's SDLRS (Guglielmino and Guglielmino, 2013) scores. The SDLRS score result is either high, average, or low, indicating the preferred ratio of self-directed and structured learning.

In addition, the definition and benefits of SDLR, as well as some methods to enhance it, were summarized. For students who wanted to familiarize themselves with the subject in more detail, selected articles were linked to the results site. For example, Guglielmino's paper entitled "Becoming a more self-directed learner" (Guglielmino and Guglielmino, 2004) provides direct guidance to learners.

5 RESULTS AND DISCUSSION

At this first stage of research, 34 applicants completed the SDLR questionnaire, 8 women and 26 men. The mean of the scores was 165.0, with a range of 65. The women's average score was slightly higher than the men's (167.3 vs. 164.3), but the difference was not

statistically significant with this data. Twenty-eight students (82%) scored over 150 (the SDLR boundary). Cronbach's alpha coefficients for self-control, self-management, and desire for learning were 0.83, 0.88, and 0.64, respectively, indicating the scales' good internal consistency and reliability. The distribution of scores is depicted as a boxplot in Fig. 1. The median was 168, and the upper and lower quartiles were 157.0 and 176.3, respectively.

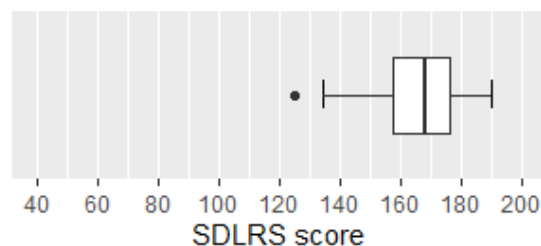


Figure 1: The distribution of students' SDLRS scores. (The outlier in the boxplot is an observation that is further than 1.5 times the width of the box from the lower quartile.)

Since the SDLRS includes an uneven number of items for each subscale, the comparison of dimensions explored students' average item scores for each dimension. The average of the Likert scale items measuring self-control, self-management, and desire for learning were 4.2, 3.9, and 4.3, respectively (Fig. 2). A high desire to learn is a logical result among our students, and a desire to learn informs us of motivation; adult students who chose to study while working are expected to possess this trait.

Compared to related studies (see Table 1), the applicants in this study were highly self-directed, while the order of dimension means (desire of learning

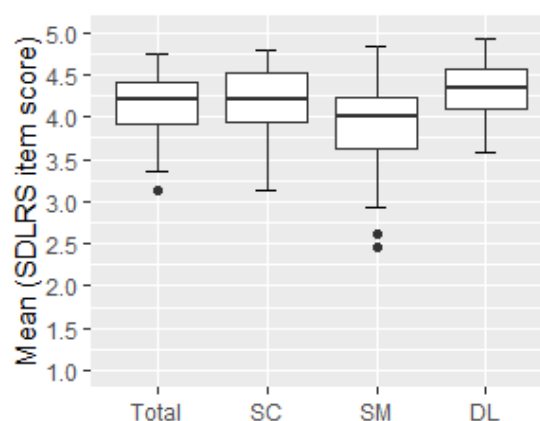


Figure 2: The boxplot of students' mean SDLRS item scores in total, and for each SDLR dimension: self-control (SC), self-management (SM), and desire for learning (DL).

highest and self-management lowest) was common in many studies. The high SDLR levels of our students may have risen from their greater maturity, followed by age, previous degrees and work experience, and family experiences. We can also assume that applicants have a desire to participate in an education program conducted entirely through distance learning and found this studying practice suitable for themselves. Since SDL has a great role in distance learning (Song and Hill, 2007), it may well be that this education program attracts more self-directed people. In addition, distance learning and ICT programs naturally involve the use of technology, which was found to have a positive relationship with SDL (Rashid and Asghar, 2016). From an education organizer perspective, the results are, if not expected, at least very positive.

Table 1: Means of the SDLRS scores presented in the related work of this research.

Source	N	Mean of the SDLRS scores
This research	34	165.0
(Atwa, 2018)	239	159.25
(Stewart, 2007)	26	158.8
(Sumuer, 2018)	153	158.8
(Abraham et al., 2011)	130	151.4
(Deyo et al., 2011)	153	148.6

Due to the high SDLRS scores, we can expect the applicants to have high expectations for the program regarding their ability to apply SDLR to their studies. In our program, students have some control over the pace of learning at which they proceed. The fact that all education is delivered online gives students the freedom and responsibility to set their own weekly schedules. Some courses allow totally independent learning while others establish loose deadlines to encourage students to proceed at the pace of live teaching, while giving enough leeway to accommodate personal study preferences. Although the flexibility of the program was developed to alleviate adult students' time management challenges, it can also foster SDLR. To employ adult students' prior knowledge and serve their interests, students are given more control over course content. Greater emphasis on the delivery of courses is placed on large exercises, such as essays, group work, coding projects, or laboratory assignments, which allows students to freely choose the target of application. Efforts are also made to enable students to share the information they possess with each other, using peer reviews, student presentations, group work, and collaboration tools on the learning platform. To develop our education program in the future, we will add some elements to the online envi-

ronment that reinforce students' SDL skills. Proven methods can be found from the work of Kim et al. (Kim et al., 2014).

6 CONCLUSION

Self-direction plays an emphasized role in online learning environments. The current global situation of the pandemic has created an even greater need to transfer information online. For this reason, research related to self-direction is very topical. This study examined student applicants' SDLRS score mapping in the Mathematical Information Technology master's degree program at Kokkola University Consortium Chydenius and depicted the integration of the SDLR scale into a learning management system. Distance learning and adult education are fundamental elements of the degree program, and SDL is strongly connected to both. Thus, SDL should not be dismissed while organizing education. This preliminary research showed that applicants answered the SDLR questionnaire readily and that their scores were relatively high, indicating that they were already self-directed at the beginning of the education program. This makes education organizers responsible for creating a meaningful learning environment that fulfills students' expectations. In the future, more students will be included in the study to ensure the high SDLR of program applicants. If some applicants fail to be admitted or decide to discontinue their studies, their SDLRS scores will be compared to admitted students' results. Similarly, the change in SDLRS results will be further monitored, and scores can even be compared with study performance. A comparison will also be made between adult students in different disciplines in our institution, and between younger, general upper secondary school, students.

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