A Case Study of Students' Usage of a Platform for Digital Competence Certification in Schools

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Abstract. *In this paper, the authors examine the correlations of variables across constructs – system use, satisfaction, and net impacts from the DeLone and McLean model in the scope of a platform for digital competence acquisition, evaluation and certification. A cross-sectional survey method was implemented online and used to collect 1725 students' answers in six European countries. Descriptive and inferential statistics were used to report data analysis results. Findings indicated that it is possible to implement such platform within a formal curriculum in primary and secondary schools. Also, students' decision on whether they will use the system in the future greatly depends on how the platform contributes to the success of their learning processes. Results also suggest that teachers are inevitable part of such process and are mandatory to achieve the full potential of the platform.*

Keywords. User satisfaction, net impacts, system use, digital competence certification

1 Introduction

Today, a young person needs to acquire a set of digital skills most commonly represented as digital competence (DC) to be able to enter the labour market without the risk of exclusion. The literature review has shown that the best solution for students to acquire digital competences is to integrate them into the formal educational curriculum (Tudor, 2018; Varela et al., 2019). This is further supported by (Casillas Martín et al., 2019; Siddiq et al., 2016, 2017; Zabotkina et al., 2019) who suggest that education and assessment of DC should be started from the earliest age of students and promoted throughout the curriculum. That way, schools could timely identify the lack of a specific DC and intervene with a certain plan of development. However, very few studies have been reported to deal with the assessment of DC at any level of education, especially in primary and secondary education. A three-year longitudinal study (Lazonder et al., 2020) concluded that digital skills do not develop equally over the years of education, e.g. creating information skill has been developing most slowly.

With that respect, an EU funded research project CRISS has been established to develop a standard methodological framework and the online platform for digital competence acquisition, evaluation and certification for students of primary and secondary school (hereinafter referred as CRISS DC platform).

The main aim of this paper is to assess students' satisfaction and use of the CRISS DC platform and to identify and assess the impact such a system has on students' work.

2 Background

Although recent research findings (Cordero & Mory, 2019; Scherer et al., 2019) suggest that teachers are the main drivers for the incorporation of DC assessment and certification into curricula, the main target audience is a population of students who need to benefit from the process. On the other hand, educational systems face a significant challenge to provide its users with an effective learning experience. Outcomes of interaction are most visible after extensive time and effort invested in learning on behalf of students. Therefore, it is up to a system to provide students with an engaging experience to achieve sustainability goals.

Studies have found that students who are satisfied with the system will use it more frequently (Aparicio et al., 2017). Findings also showed that students that could successfully interact with each other and had various ways of learning assessments within the system were more satisfied (Cidral et al., 2018). Students' perception of content structure, functionalities and navigation will also impact their satisfaction and use. The success of the system will be a result of students perceived benefits and attitudes towards the system. With that respect we focus our research on students' perception and define the main research questions:

1. In what ways the CRISS DC platform in primary and secondary schools impacts students' work?
2. What is the relationship between students' use of CRISS DC platform and its impact on the work of students?
3. What is the relationship between students' use of CRISS DC platform and their satisfaction?

Therefore, the research aims are:

1. To examine the relationship between variables of students' use and impacts of CRISS DC platform.
2. To examine the relationship between variables of students' use and satisfaction with the CRISS DC platform.
3. To propose recommendations for practitioners and future academic research to make advancement in the field of DC platform development.

3 Research Context

Our research context was based on the online CRISS platform for DC acquisition, evaluation and certification that was developed to pilot DC evaluation in primary and secondary schools in Europe. It is based on the CRISS Digital Competence framework (hereinafter referred to as CRISS DC Framework) (Guárdia et al., 2017) that decomposes digital competence into five areas and twelve sub-competences. Each sub-competence is composed of a set of performance criteria (PC) that translate the sub-competences into more specific elements of what a student should be able to demonstrate. Teachers are responsible to plan the learning, to provide feedback and to evaluate activities and tasks that relate to an individual sub-competence. The activities and tasks are retrieved by the CRISS repository and teachers can apply them with or without further adaptations. The students should conduct the activities by performing one or more tasks and generate products (the pieces of evidence) to prove the acquisition of a specific sub-competence.

The assessment of digital (sub-)competence is performed through the CRISS DC platform with two types of interventions: human and technological. Human interventions are carried out by teachers and students using tools like Rubrics, Check Lists, Scales, etc., that are automatically generated by the CRISS DC platform and customized by teachers. The technological intervention is executed by the platform automatically which is set to track the students while working in their assigned activities and to collect relevant information i.e. the indicators of the evaluation of the pieces of evidence. The CRISS platform has been piloted in six European countries (Spain, Sweden, Croatia, Greece, Romania and Italy) for several months with a targeted population of students aged between 9 and 16 years.

4 Method

The method covers the respondents of the conducted survey, a developed and used instrument, and procedure of data collection.

4.1 Participants

The total of 1725 students (47% of boys and 53% of girls) participated in the cross-sectional survey between May and September 2019. They represent the sample of eligible individuals, i.e. students who were actively using the CRISS DC platform for at least one month.

An online survey instrument was distributed to primary (29%) and secondary (71%) students aged between 9 and 20 (M=14.91; SD=1.83) in six countries – Croatia (41.6%), Greece (12.3%), Spain (26.7%), Italy (4.8%), Romania (6.7%) and Sweden (7.8%). Most students were between 14 and 17 years old (80.5%). Only 2% of students reported being older than that.

The survey aimed to examine students' satisfaction and use of the system and the impact it had on them during the acquisition and evaluation of digital competences.

4.2 Instrument

To assess and identify the most relevant factors of students' satisfaction, use and impacts of CRISS DC platform we used three constructs from the D&M Model revised in 2016 (DeLone & McLean, 2016). The first construct, User satisfaction measures users' level of satisfaction with reports, platform, and support services. The second construct, System use measures the feedback on using the capabilities of the CRISS DC platform. The third construct, Net impacts measures the extent to which the platform contributes to the success of users. User satisfaction, System use and Net impacts are measured with five, eight and twelve items, respectively.

The instrument development phase was conducted by following the recommendations from Malgady, Rogler, and Cortés (1996), Straub and Gefen (2004), Vogt, King, and King (2004). We started with the operationalization of research constructs based on the existing measures and modified it with a set of new target-specific measures. Content validity was ensured, besides using an extensive literature review, by using focus groups that involved experts in the field of pedagogy, e-learning, assessment, and teaching methodology. The final measurement instrument (see Table 1.) was translated into all target languages of students. Students could record their answers on a 5-point Likert-type scale.

4.3 Procedure

The final instrument was administered to students using the LimeSurvey. This online survey tool was set not to collect personal data or track IP addresses of respondents. The process of gathering data among students was supervised by their teachers during the class. Afterwards, data were calculated using R (R Core Team, 2017).

Table 1. Instrument after content validity

ITEM
System Use
SU1 I would like to use the CRISS platform again in the future.
SU2 I have all the necessary equipment to use the CRISS platform (e.g. computer/tablet/mobile phone, internet connection).
SU3 I use the CRISS platform to organize and publish my work (ePortfolio).
SU4 I use the CRISS platform to work with other students (teamwork).
SU5 I use the CRISS platform features to tag my work (e.g. homework, seminar, project, images, videos, etc.).
SU6 I use the CRISS platform to see my progress and achievements (grades, badges, etc.).
SU7 I use the CRISS platform to see the progress of other students.
SU8 I use the CRISS platform to communicate with my teacher(s).
User Satisfaction
US1 I like using the CRISS platform.
US2 I find the CRISS platform useful for my learning.
US3 I think it is interesting to use the CRISS platform.
US4 I feel confident using the CRISS platform.
US5 I am satisfied with the CRISS platform possibilities.
Net Impacts
NI1 The tasks in the CRISS platform enable me to be creative in solving them (ingenious, original).
NI2 The CRISS platform makes my learning easier.
NI3 The CRISS platform helps me to see my progress.
NI4 Seeing my progress helps me to improve my learning.
NI5 Earning badges motivates me.
NI6 The CRISS platform helps me to develop new skills (making presentations, sharing my work, finding information on the Internet, online communication ...).
NI7 Within the CRISS platform I easily understand how my work is being assessed.
NI8 I get feedback from my teacher more quickly with the CRISS platform.
NI9 The CRISS platform enabled me to show my work in a more attractive way(s) (e.g. my presentations are more visible and organized/my videos can be accessed easily/I can use portabily to show my different works…).
NI10 The CRISS platform enables me to participate in my assessment (i.e. self-assessment, my comments to the teacher).
NI11 The time spent on activities has been useful to learn.
NI12 When I work in the CRISS platform, I realise the process I follow to solve the tasks.
Notes. Answers on 1-5 point Likert-type scale (1 – Strongly disagree; 2 – Disagree; 3 – Uncertain; 4 – Agree; 5 – Strongly agree; NA – not applicable).

5 Results

During the school year 2018/2019, students used the CRISS DC platform every day (1.9%), almost every day (9.9%), at least once a week, but not every day (47.3%), at least once a month, but not every week (25.3%) and never or almost never (15.5%). Their experience of using the system outside school, but also the use frequency of other digital technologies for learning is shown in Table 2.

The mean values at construct levels are 2.79 (*SD*=1.55) for System use, 2.71 (*SD*=1.48) for User satisfaction and 2.80 (*SD*=1.52) for Net impacts. As expected, the median value for all three question categories is 3.00 which indicates the mostly uncertain perception of system use, satisfaction and impact.

Table 2. Descriptive statistics of use frequency

	a. (%)	b. (%)	c. (%)	d. (%)
Never or almost never	46.9	7.9	6.8	36.6
At least once a month, but not every week	20.6	19.1	19.2	16.8
At least once a week, but not every day	26.8	35.1	27.7	17.6
Almost every day	4.9	23.9	28.2	14.4
Every day	0.8	14.1	18.1	16.6

a. Use of CRISS platform outside the school timing.
b. I use digital technologies in school related to schoolwork (e.g. assignments, communication with other students or communication with teachers).
c. I use digital technologies at home related to schoolwork (e.g. assignments, communication with other students or communication with teachers).
d. I use digital technologies outside the school for learning that is not related to school (e.g. robotics or computer classes).

Table 3 displays a summary of the mean and standard deviation of students' responses for each item. Furthermore, survey responses "5 - strongly agree" and "4 - agree" are combined within column "Agree", column "Neutral" represents all "3 - uncertain" answers while "1 - strongly disagree" and "2 - disagree" are combined within column "Disagree".

Table 3. Aggregated survey response of students

Items	Mean (Std. dev)	Agree (%)	Neutral (%)	Disagree (%)
SU1	2.41 (1.47)	467 (27%)	334 (19%)	924 (54%)
SU2	3.96 (1.33)	1311 (76%)	176 (10%)	238 (14%)
SU3	2.86 (1.53)	728 (42%)	345 (20%)	652 (38%)
SU4	3.10 (1.48)	877 (51%)	290 (17%)	558 (32%)
SU5	2.65 (1.49)	586 (34%)	397 (23%)	741 (43%)
SU6	2.74 (1.50)	664 (38%)	329 (19%)	732 (42%)
SU7	2.30 (1.47)	428 (25%)	303 (18%)	994 (58%)
SU8	2.33 (1.39)	415 (24%)	337 (20%)	973 (56%)
US1	2.47 (1.48)	514 (30%)	343 (20%)	868 (50%)
US2	2.75 (1.45)	643 (37%)	352 (20%)	730 (42%)
US3	2.73 (1.50)	635 (37%)	340 (20%)	750 (43%)
US4	2.76 (1.50)	655 (38%)	352 (20%)	718 (42%)
US5	2.84 (1.47)	683 (40%)	359 (21%)	683 (40%)
NI1	2.95 (1.44)	721 (42%)	399 (23%)	605 (35%)
NI2	2.61 (1.43)	528 (31%)	424 (25%)	773 (45%)
NI3	2.81 (1.49)	683 (40%)	365 (21%)	677 (39%)
NI4	2.91 (1.52)	732 (42%)	367 (21%)	626 (36%)
NI5	2.46 (1.66)	560 (32%)	353 (20%)	812 (47%)
NI6	3.02 (1.49)	783 (45%)	381 (22%)	561 (33%)
NI7	2.94 (1.52)	753 (44%)	352 (20%)	620 (36%)
NI8	2.67 (1.55)	627 (36%)	363 (21%)	735 (43%)
NI9	2.82 (1.54)	678 (39%)	399 (23%)	648 (38%)
NI10	2.7 (1.52)	618 (36%)	429 (25%)	677 (39%)
NI11	2.83 (1.52)	695 (40%)	361 (21%)	669 (39%)
NI12	2.93 (1.50)	755 (44%)	346 (20%)	624 (36%)

The mean of answers for System use fluctuates from 2.30 (SU7) to 3.96 (SU2). The highest standard deviation was reported for item SU3 (1.53) regarding the organization and publication of students' work via

ePortfolio. In the satisfaction category, item US5 has the highest mean value of 2.84 and US3 the lowest (2.73). Items NI6, NI1, NI7 and NI12 have the highest mean values 3.02, 2.95, 2.94 and 2.93, respectively. The lowest mean value is reported for NI3 (2.81). Although, there are many items that students are in disagreement with, here we will single out items with a higher percentage of positive responses – SU2, SU3, SU4, NI1, NI3, NI4, NI6, NI7, NI9, NI11 and NI12.

The Pearson correlation coefficient is calculated for variables across three constructs and results are interpreted according to Evans (1996): 0.00 - 0.19 (very weak), 0.20 - 0.39 (weak), 0.40 - 0.59 (moderate), 0.60 - 0.79 (strong) or 0.80 - 1.0 (very strong). The significance of correlations among the variables is tested at $p<0.01$. In Table 4, there is a very strong and significant relationship between SU1 and US1 (r=0.86; $p<0.01$) indicating that students who like to use the platform would like to use it in the future as well. Variable SU2 has weak, although significant relationships ($p<0.01$) with all the other satisfaction variables. Although the correlation between SU1 and US3 is fairly large, it is not significant ($p>0.05$), so there is a high chance this relationship does not exist in the population. All other relationships in Table 4 are moderate to strong and significant ($p<0.01$).

Table 4. Correlations between System use (SU) and User satisfaction (US)

	US1	US2	US3	US4	US5
SU1	**0.86**	**0.76**	0.80**	**0.67**	**0.74**
SU2	0.26	0.32	0.30	0.34	0.34
SU3	**0.60**	**0.63**	**0.64**	0.58	**0.63**
SU4	0.48	0.53	0.51	0.47	0.53
SU5	0.58	**0.60**	**0.60**	0.54	**0.62**
SU6	**0.66**	**0.66**	**0.67**	**0.60**	**0.68**
SU7	**0.60**	**0.60**	**0.60**	0.54	**0.60**
SU8	**0.62**	**0.63**	**0.60**	0.54	**0.60**

Notes. All correlations are significant at the 0.01 level (2-tailed); **except between the variables SU1 and US3. Bold correlations are considered 'strong' or 'very strong'.

Table 5. Correlations between System use (SU) and Net impacts (NI)

	SU1	SU2	SU3	SU4	SU5	SU6	SU7	SU8
NI1	**0.71**	0.41	**0.67**	0.56	**0.64**	**0.69**	**0.61**	0.59
NI2	**0.74**	0.30	**0.63**	0.55	**0.65**	**0.71**	**0.65**	**0.67**
NI3	**0.70**	0.35	**0.65**	0.56	**0.68**	**0.75**	**0.64**	**0.65**
NI4	**0.67**	0.30	**0.61**	0.48	**0.61**	**0.68**	0.59	**0.60**
NI5	**0.68**	0.29	0.59	0.49	**0.63**	**0.68**	**0.62**	**0.60**
NI6	**0.67**	0.39	**0.62**	0.54	**0.62**	**0.67**	0.58	0.58
NI7	**0.64**	0.39	**0.61**	0.51	0.59	**0.65**	0.59	0.56
NI8	**0.65**	0.31	**0.60**	0.51	**0.60**	**0.66**	0.59	**0.61**
NI9	**0.72**	0.36	**0.66**	0.57	**0.66**	**0.72**	**0.67**	**0.64**
NI10	**0.68**	0.34	**0.65**	0.54	**0.65**	**0.70**	**0.65**	**0.64**
NI11	**0.75**	0.31	**0.63**	0.54	**0.62**	**0.71**	**0.64**	**0.64**
NI12	**0.71**	0.39	**0.64**	0.55	**0.61**	**0.68**	**0.62**	**0.63**

Notes. All correlations are significant at the 0.01 level (2-tailed). Bold correlations are considered 'strong' or 'very strong'.

In Table 5 there are numerous moderate to strong and significant relationships (r between 0.40 and 0.79; $p<0.01$). Variable SU2 has only one moderate and significant relationship with the NI1, while all others are weak (r between 0.29 and 0.39), but significant.

6 Discussion

Data from the survey instrument is used to assess and identify the most relevant factors of students' satisfaction, use and net impacts of CRISS DC platform.

The first research question was: *In what ways the CRISS DC platform in primary and secondary schools impacts students' work?* For that purpose, we identified twelve items under Net impacts category. Results indicate that students perceived platform helpful in developing new skills and they could easily understand how their work is being assessed. Furthermore, they were able to be more creative in solving the tasks. On the other hand, student less considered earning badges was essential to their motivation to use the platform.

The second research question was: *What is the relationship between students' use of CRISS DC platform and its impact on the work of students?* The decision of students to reuse the platform in the future would be impacted by all twelve listed net impacts, but only the strongest relationships will be listed: usefulness of spending time on the platform, easier learning, more attractive way of presenting solved tasks, insight into the process of solving the tasks, and others. Both, necessary equipment to use the platform and teamwork with other students are to a less extent influenced by net impacts. Although, the strongest relationships in both cases are related to creativity, the attractiveness of their work and progress tracking. Generally, most of the people found important they can creatively express themselves and get proper feedback for it. Students used ePortfolio to organize and publish their work, but they could not earn the badge which is confirmed by a weaker connection. The same case is between tagging their work and understanding of assessment because they are related to a lesser extent. Results confirmed the CRISS DC platform helps students to effectively track their progress and achievements which in turn makes their learning easier than usual. Knowledge of what they have achieved in real-time gives them a sense of useful utilized time. The fact that students can see the progress of other students positively affects their work. Findings also confirmed the significant relationship between the communication with the teachers via the platform and students' easiness of learning.

The third research question was: *What is the relationship between students' use of CRISS DC platform and their satisfaction?* In this research we did not found a statistical significance between students' decision to continue using the platform again in the

future and whether they consider it to be interesting to use. On the other hand, their decision would be impacted by whether they like using the platform, found it useful for learning or feeling confident and satisfied while using it. Also, they would use ePortfolio for organizing and publishing their work because they have found it interesting. Furthermore, they can use the CRISS DC platform to tag their work and it seems to them as a satisfactory possibility. Overall, the platform gives them proper feedback which they like, consider useful, interesting and it boosts their confidence. It is interesting observing that seeing the results from their colleagues influence their confidence less. The same result is with communication with their teachers.

7 Conclusion

This research addressed the problem of measuring and investigating the relationship between user satisfaction, system use and net impacts of cloud-based infrastructure for acquisition, evaluation and certification of digital competence in primary and secondary education focusing on students' perspective.

It can be concluded that students' confidence is a result of being able to check self-progress and achievements in real-time. It can also impact their decision to use the system again in the future. Whether they have the necessary equipment to use the platform will not affect their satisfaction because most of them have optimal requirements at school. Possibly, they haven't worked a lot with other students in teams, because no stronger relationships were found. Use of educational platforms can be improved if students consider it useful for their learning and if it has satisfactory possibilities. Future studies should analyse which possibilities students liked the most and practitioners could implement it as a baseline in future platforms. Regarding the CRISS DC platform, students were most satisfied with the possibility to track their progress and achievements (grades, badges, etc.) as results of their learning. Nevertheless, they also found it important that they can organize and publish their work, but also to see the progress of other students and to efficiently communicate with their teachers.

Although, students' decision on whether they will use the system in the future greatly depends on how the platform contributes to the success of their learning processes. Students found it important to be able to creatively express themselves, attractively publish their work and get proper feedback for it. Regarding the gamification elements of the system such as earning badges are also an important aspect where they can the direction of learning progress. It is also important that students can see the achievements of other students because it positively impacts their motivation toward education. Their learning is also much easier when they have effective communication with their teachers gained via the platform.

According to our knowledge, CRISS DC platform is the first attempt to create a comprehensive, cloud-based solution for digital competence acquisition, evaluation and certification in Europe, and to pilot such solution within a formal curriculum of primary and secondary schools in six European countries. In that sense, this research further contributes to the field by identifying the most important impacts such system has on the target audience. Also, the results should be encouraging for schools that plan to implement such systems or for those who plan to develop them.

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