Distance Learning: Student's Perception of the Substitution of on-site Classes by Online Tools during the COVID-19 Pandemic

J. Cunha, S. Teufel, E. Bas, and M. Guillo

***Abstract*—This study draws on social innovation theory and method to analyze how distance learning was perceived by students during the Covid-19 pandemic. By looking in detail at this particular social context, this research uncovers some of the barriers to the continuity and future use of this model. It also contributes by further exploring elements of social innovation, still considered a fragmented and underdeveloped field of research. The findings suggest that students are positive about distance learning on a rational level, slightly positive about it emotionally, and neutral when it comes to resilience. Yet, they strongly believe distance learning could be useful in different contexts and that it has potential for further improvements.**

***Index Terms*—Covid-19, distance learning, social innovation, user perception.**

I. Introduction

Learning at a distance using online tools abruptly became reality for students around the world during the COVID -19 pandemic. As governments took measures to limit social contact and contain the spread of the coronavirus, education became mostly virtual. In the literature, distance education is often cited as an example of social innovation, as it may be used as a form of overcoming educational barriers (Gupta et al., 2020; Ray et al., 2016; Oliveira, 1988).

This study builds on social innovation theory and method to investigate the adoption of distance learning tools from the user's perspective. The findings help identify where there is room for improvement and support decision-making by managers, teachers and specialized technology companies, so that online education practices can be extended to other contexts and used to address pressing educational gaps.

II. Social Innovation

Simply put, the concept of social innovation can be explained as new ideas that address unmet social needs (Mulgan et al., 2007). The scientific literature, however, presents multiple definitions and there is currently no consensus among authors (Nicholls & Edmiston, 2018; Angelidou & Psaltoglou, 2017; Edwards-Schachter & Wallace, 2017). Social innovation is part of human's history and, along with technological innovation, it is considered one of the fundamental determinants of civilized human behavior. Both the ability to innovate and to integrate innovation into social culture are considered unique human characteristics. Hence the founding of countries, states and cities, which can be used as examples of social innovations in early civilizations, built on earlier social structures such as families and tribes (Simms, 2006).

A common starting point for social innovation projects and initiatives is often the imperative need to improve situations that are deteriorating, systems that are not working properly, or institutions unable to face current issues. It can also be driven by new awareness of the gaps between people's needs and actual offers from governments, private organizations, and even non-profit organizations (Mulgan *et al.*, 2007).

The study of social innovation, however, has only recently entered the social sciences. Unlike the concept of innovation, which is associated with the development of technologies, commercial services, or new products, social innovation is still considered an underdeveloped field of research with fragmented and disconnected literature (Cajaiba-Santana, 2014). "There has been relatively little attention to theory, or to history, and although there has been much promising research work in recent years, there are no clearly defined schools of thought, no continuing theoretical arguments, and few major research programs to test theories against the evidence" (Mulgan, 2012, p. 33).

Therefore, despite the importance of the topic and recent interest in this area of research, there is still an urgent need to deepen theoretical knowledge and improve practical tools to reach social innovation's transformative capacity.

III. COVID-19 Pandemic

The spread of coronavirus disease 2019 (COVID-19) became a global health crisis. It is believed to have been first transmitted from bats to humans in December 2019 at a wild animal's market in Wuhan, China. The number of people infected grew exponentially as human to human transmissions began. Rapidly, the virus spread throughout the world and the severity of the infection varied, from mild to deadly. To prevent transmission, the first step was to isolate infected patients (Singhal, 2020; Bulut & Kato, 2020).

In Europe, the first cases of severe complications due to coronavirus infection were recorded in late January 2020, and the first case in Switzerland occurred in February 2020. In March 2020, the Swiss government imposed a national lockdown as the country had one of the highest infection rates of COVID-19 in the world. The strict social-distancing

Manuscript received July 6, 2022; revised August 23, 2022. This work was supported by the Canton of Fribourg, Switzerland, through the Smart Living Lab project at the University of Fribourg.

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doi: 10.18178/ijssh.2022.12.4.1096

measures came in place, as the healthcare system in neighboring countries, like Italy and France, were overwhelmed, with hospital capacities reaching critical conditions (Seiler et al., 2021; Winzeler & Ambuhl, 2020; Salathé *et al*., 2020).

The implemented measures and restrictions were extended to schools, universities, and other educational institutions, which were prohibited from continuing all face-to-face teaching. The constraints were gradually phased out and subsequently reintroduced a few times until face-to-face classes were fully restored in the first half of 2022 (Swissuniversities, 2022).

IV. Distance Education

Distance education started long before computers and internet access became massively accessible. Over the past two centuries, the possibilities to learn at a distance have evolved from basic correspondence through postal service to the online digital tools currently available on the market. In the scientific literature, the term distance education mainly describes this transfer of knowledge from an instructor to a geographically distant learner. Over time and with the emergence of new technologies, the term evolved to describe various forms, including online learning (Moore et al., 2011).

A key factor identified for the effectiveness of distance learning is the engagement of students in collaborative tasks and the availability of additional support. These relying on staff training for appropriate development of approaches and methods (Ertl et al., 2006; Burns, 2002). At the early stage of the COVID-19 pandemic, however, the switch between face-to-face teaching and distance education occurred rapidly. Not all lectures were designed to be held online, and not all lecturers and students were familiar with online teaching tools (Syauqi *et al*., 2020).

A study conducted in Switzerland between 2018 and April 2020, focused on examining student networks and mental health, showed that interactions and collaborative learning decreased during the initial phase of the pandemic, when compared to measurements prior to the switch to online teaching methods. Mental health indicators also deteriorated, particularly among female students (Elmer *et al*, 2020).

V. Methodology

In order to assess students' experiences and perceptions, and to find possible ways to improve distance learning, two research questions are proposed. The first focuses on how students evaluate their experience with distance learning during the COVID-19 pandemic. The second explores differences in the perception of distance learning according to students' age or number of semesters attended.

Due to their intangible nature, complexity, and length, social innovation projects are difficult to measure (Hernandez & Cormican, 2016). Thus, this study relies on a tool called Flux 3D to answer the proposed research questions. This systematic method of data collection begins with the application of a pre-designed questionnaire shaped to capture different and comparable dimensions of users' perceptions and satisfaction when confronted with innovative ideas, products, processes, or services. The method has been developed to allow researchers and practitioners to get an overview of the results without having to perform complex statistical analysis. The final data is presented in a three-dimensional form, a visual output that organizes the user experience in three main axes: emotional, rational and resilience/temporal (Bas & Guillo, 2015).

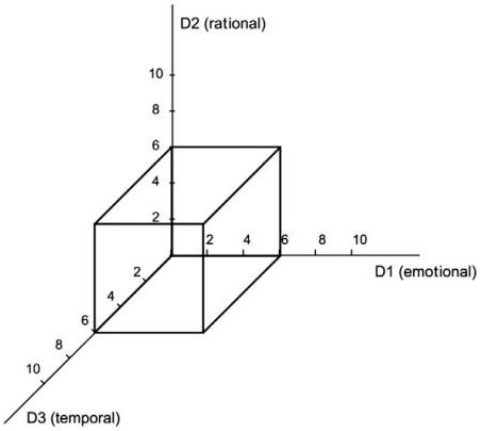

Fig. 1. Flux 3D: example of the final results (Bas & Guillo, 2015).

Fig. 1 shows an example with uniform scores. The more balanced the ratings are, or the more even the shape, the better the overall rating of the innovation. Moreover, the scale ranges from zero to ten. A larger volume and more proportional cube representing a higher satisfaction level.

For analysis purposes, each dimension of the cube includes three subcategories or indicators. These are then composed of three other variables or statements. In other words, students had to rate a total of 27 statements, and rank each of them on a scale of zero to ten, with zero representing "strongly disagree" and ten representing "strongly agree".

Questions were also asked about the profile of the participants to determine age, gender, and semester attended. To frame this particular context and study case, the questionnaire was adapted and sent by e-mail to the 2'600 bachelor students in the Faculty of Humanities at the University of Fribourg in Switzerland. The survey was conducted during two weeks in February 2022 in English, German and French.

VI. Results

A total of 454 participants compose this study's sample, representing a confidence level above 95% and a margin of error under 5%. Replies in French were the majority, 73.8%, while 23.8% preferred to answer in German and 2.4% in English. Most of the participants were women, 75.6%, and men, 21.4%. Non-binary, other genders, or students who preferred not to answer this question summed 3.1%.

Regarding respondents' age group, 71.6% declared having between 18 and 23 years old, while 23.3% are between 24 and 29, and 5.1% are over 30 years old.

Table 1 indicates how many semesters the students who participated in the survey have attended:

TABLE I: Sample Details: N° of Semesters Attended. Own Elaboration

1 Semester	17,40%
2 Semesters	11,45%

3 Semesters	20,48%
4 Semesters	16,08%
5 Semesters	14,98%
6 Semesters	13,22%
7 Semesters	3,52%
8 Semesters	1,76%
9 Semesters +	1,1%

Additionally, students were asked about the different tools they have used for distance learning. With the highest rates, Microsoft Teams and Moodle, were used by 90% and 98% of the students, respectively. Another collaboration tool, Zoom, also registered an elevated adoption rate, mentioned by 78.4% of the respondents. E-mail, web videos, and social media were used by 57.4%, 23%, and 6.2% of the students, respectively.

A. Overview

Following the chosen methodology, the median was calculated, resulting in 6 points for the X-axis (emotional); 8 for the Y-axis (rational); and 5 for Z-axis (temporal/resilience). The outcome is an elongated shape, instead of a proportionally balanced cube (see Fig. 2).

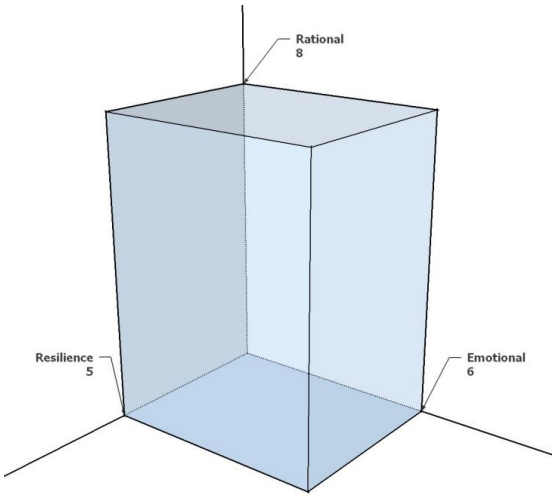

Fig. 2. Flux 3D: final results. Own elaboration.

For clarity, each dimension as well as its respective subcategories and statements are now addressed separately.

B. From a Rational Point of View

This dimension had the highest score, 8 points out of 10. It consists of three subcategories: "Accessibility" (including statements focused on distance learning's *Visibility*, *Availability*, and *Affordability*), "Usability" (composed by statements regarding *Intuitive Use*, *User Information*, and *User Service*) and "Usefulness" (which encompassed *Effectiveness*, *Efficiency*, and *Reliability*). The final scores being 8, 8 and 7 points, for each subcategory respectively.

Looking at the scores given to individual statements, a few positive highlights were observed. Such as for "Affordability" *(personal costs for attending distance learning were reasonable)* and "Efficiency" *(distance learning was the best option to bypass Covid-19 pandemic constraints / satisfying students and teaching staff needs)*. Students mainly agreed, and the final score in both cases was 9 points out of 10.

Whereas "Visibility" *(it was easy to find information about the online classes);* "User service" *(help / guidance / user service was available when needed);* "Effectiveness" *(distance learning served its purpose well and needs were satisfied)*, and "Reliability" *(distance learning is a trustworthy / reliable alternative to on-site classes)*, were rated the lowest scores of this dimension, with 7 points each.

C. From an Emotional Point of View

This dimension received 6 as a general score. On a more detailed level, looking into its three subcategories, one in particular stands out due to its low score. While "Pleasure" (which includes aspects of *Novelty*, *Style*, and *Flow*), and "Alignment" (composed by *User Purpose*, *User Connection*, and *User Integration*) received 6 points each, "Self-Realization" (that encompasses *Self-Esteem*, *Independence*, and *Sociability*), had 4 points.

Ratings of individual statements in this dimension reveal great discrepancy of student's perception among the different topics investigated. The highest scores were related to the "Novelty" aspect (*when implemented, distance learning was new to me*); and "Independence" (*distance learning makes me feel free / autonomous while using / accessing online tools / classes*), with 10 and 8 points, respectively.

On the other hand, statements with the lowest scores were: "Self-esteem" (*distance learning makes me feel better / stronger / more fulfilled*) and "Sociability" (*distance learning promotes / enables positive interactions with others*); with 4 and 1 point, respectively.

Students kept a neutral point of view regarding two statements: "Flow" (*I enjoy attending online classes*) and "User connection" (*distance learning feels just right for me*), which had 5 points each.

D. Temporal / Resilience Point of View

This dimension received the lowest score of all three, 5 points. In this case, indicating neutrality from students. By looking at a more detailed level, scores vary greatly. The subcategory focused on the "Potential" of distance learning (including elements such as *Improvability*, *Versatility*, and *Convergence*) received 8 points; while "Autonomy" (composed by *Self-sufficiency*, *Competitiveness*, and *Regulatory Environment*) scored 2 points. Finally, "Sustainability" (*Set-up durability*, *Concept Durability*, and *Impact*), had 5 points.

Looking at the individual statements, the highest score was given to "Versatility" *(distance learning could be useful in different contexts beyond the pandemic)*, with 9 points; while "Improvability" *(the implemented distance learning methods have the potential for further improvements / development)*; "Convergence" *(distance learning could be well combined with other on-site classes)*; and "Concept Durability" *(the concept of distance learning will remain relevant in time)*, had 8 points each.

The two statements with the lowest scores were: "Self-sufficiency" *(distance learning is useful on its own / not dependent on on-site classes)*; and "Competitiveness" *(no other method is equal to or better than distance learning)*, with 2 points each.

Students were rather neutral when it comes to aspects such as "Set-up durability" (*distance learning should keep working / remain functional as it is*) and "Impact" (*distance learning is good for society*), having 5 points each.

E. Overview by Groups

The most remarkable finding, when grouping the results by students' age and number of semesters attended, is how critical younger (18–24 years) and first year students were towards distance learning, while older students (30+ years) or the ones attending the university for more than 7 semesters were generally more positive towards the adoption of the online methods.

When looking into the lowest scores, students between 18 and 24 years old stand out, highly critical to the statements regarding distance leaning's "Sociability" (*distance learning promotes / enables positive interactions with others*) and "Self-Esteem" (*distance learning makes me feel better / stronger / more fulfilled*), given 1 and 3 points respectively.

It is also worth noting that students from different semesters rated the "Novelty" aspect from this educational method (*when implemented, distance learning was new to me*) with 10 points, the maximum score possible. Which means they fully agree with the statement. The only exception was the first-year students, who gave 8 points, indicating that they already had some experience with the method.

VII. Discussion and Conclusion

This study shows that students rationally view distance learning positively. It was considered affordable and efficient, although they could benefit from better access to necessary information, user assistance, or guidance. On the emotional side, despite the slightly positive overall result, major issues were identified, and must be addressed moving forward. While learning at a distance allowed students to feel free, independent, and autonomous, the method did not promote self-realization, particularly by not fostering positive social interactions and due to issues related to self-esteem. Students did not feel better, stronger, or more fulfilled while using the available online tools. Given this scenario, the respondents were neutral in their assessment of the temporal/resilience dimension. It was identified a high potential for distance learning, its continued relevance, and its use beyond the pandemic context. Yet, respondents did not see it as the best educational resource, rather as a method to be combined with on-site classes.

In addition, it is interesting to note that the replacement of on-site courses with distance learning met an important educational need during the pandemic and when implemented in early 2020. The use of this solution was seen by students as a new experience, highlighting its innovative nature in this context.

Students considered distance learning both effective, serving its purpose, and efficient, as the best way to bypass Covid-19 constraints. They were, however, neutral when evaluating the impact of adopting this new method, and judging whether it is good for society.

In answering the second research question, which focused on the different opinions according to age group and academic level, somewhat counter intuitive results emerged. Younger students were generally more critical than older students when it came to evaluating their online experience. The same was true for students who have been at the university longer, who were more positive than the ones in their first year of study.

Despite being identified by this research, the contrasts related to the age or seniority cannot be explained by the adopted methodology. We therefore suggest further studies focused on investigating and expanding on the reasons for these differences. The use of statistical methods, for example, may provide new venues to explore the correlations between variables. Overall, new methods for measuring the outcomes and success rate of social innovations are desirable and necessary to further develop this area of research and the understanding of its outcomes.

As mentioned in the literature review, student engagement in collaborative tasks and the availability of additional support could be beneficial and increase the effectiveness of distance learning. Interestingly, this research has identified a lack of positive interactions with others and the potential for improvement regarding user help and guidance. Therefore, it would be relevant to research to what extent these issues have affected overall learning in the given period.

Furthermore, it is important to emphasize that this study represents a specific reality, as it focuses on the perspective of students at a Swiss university, which is certainly not the same as other undergraduates, in different institutions, countries, or socioeconomic contexts. Therefore, in order to obtain a more comprehensive overview, we recommend extending this analysis to other contexts or to more representative samples.

One limitation noted concerns potential bias due to language, gender, age, and semester of the respondents. The majority of the participants were female, French-speaking, between 18 and 23 years old, and attending up to the second year of study.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

This study contributes both by further exploring the social innovation research stream and by analyzing distance learning, a current and relevant innovation method adapted massively and rapidly during the Coronavirus pandemic. All authors participated in the adaptation of the questionnaire and approved the final version.

References

[1] M. Angelidou and A. Psaltoglou, "An empirical investigation of social innovation initiatives for sustainable urban development," *Sustainable Cities and Society*, vol. 33, pp. 113-125, 2017.

[2] E. Bas and M. Guillo, "Participatory foresight for social innovation. FLUX-3D method (forward looking user experience), a tool for evaluating innovations," *Technological Forecasting and Social Change*, vol. 101, pp. 275-290, 2015.

[3] C. Bulut and Y. Kato, "Epidemiology of COVID-19," *Turkish Journal of Medical Sciences*, vol. 50, pp. 563-570, 2020.

[4] J. T. Burns, "Evaluating staff development and training models to support the implementation of videoconferencing technology for teaching and learning in a distributed University," *Retrieved March*, vol. 17, 2008.

[5] G. C. Santana, "Social innovation: Moving the field forward, A conceptual framework," *Technological Forecasting and Social Change*, vol. 82, pp. 42-51, 2014.

[6] M. E. Schachter and M. L. Wallace, "Shaken, but not stirred': Sixty years of defining social innovation," *Technological Forecasting and Social Change*, vol. 119, pp. 64-79, 2017.

[7] T. Elmer, K. Mepham, and C. Stadtfeld, "Students under lockdown: Comparisons of students' social networks and mental health before and

during the COVID-19 crisis in Switzerland," *Plos One*, vol. 15, no. 7, 2020.
[8] B. Ertl, F. Fischer, and H. Mandl, "Conceptual and socio-cognitive support for collaborative learning in videoconferencing environments," *Computers and Education*, vol. 47, no. 3, pp. 298-315, 2006.
[9] S. Gupta, V. Kumar, and E. Karam, "New-age technologies-driven social innovation: What, how, where, and why?" *Industrial Marketing Management*, vol. 89, pp. 499-516, 2020.
[10] Y. Hernandez and K. Cormican, "Towards the effective management of social innovation projects: Insights from project management," *Procedia Computer Science*, vol. 100, pp. 237-243, 2016.
[11] J. L. Moore, C. D. Deane, and K. Galyen, "e-Learning, online learning, and distance learning environments: Are they the same?" *The Internet and Higher Education*, vol. 14, no. 2, pp. 129-135, 2011.
[12] G. Mulgan, "The theoretical foundations of social innovation," *Social Innovation*, Palgrave Macmillan, London, pp. 33-65, 2012.
[13] G. Mulgan, S. Tucker, R. Ali, and B. Sanders, "Social Innovation: What it is, why it matters, how it can be accelerated," 2007.
[14] A. Nicholls and D. Edmiston, "Social innovation policy in the European union," *Policy Design in the European Union*, Palgrave Macmillan, Cham, pp. 161-190, 2018.
[15] J. Oliveira, "Trends in distance learning: A new wave," Development Communication Report, vol. 63, pp. 1-4, 1988.
[16] S. Ray, S. Srivastava, S. Diwakar, B. Nair, and V. Özdemir, "Delivering on the promise of bioeconomy in the developing world: link it with social innovation and education," *Biomarker Discovery in the Developing World: Dissecting the Pipeline for Meeting the Challenges*, pp. 73-81, 2016.
[17] M. Salathé, C. L. Althaus, R. Neher, S. Stringhini, E. Hodcroft *et al*., "COVID-19 epidemic in Switzerland: on the importance of testing, contact tracing and isolation," *Swiss Medical Weekly*, vol. 150, 2020.
[18] M. Seiler, G. Staubli, J. Hoeffe, G. Gualco, S. Manzano, and R. D. Goldman, "A tale of two parts of Switzerland: regional differences in the impact of the COVID-19 pandemic on parents," *BMC Public Health*, vol. 21, no. 1, pp. 1-6, 2021.
[19] J. R. Simms, "Technical and social innovation determinants of behaviour," *Systems Research and Behavioral Science: The Official Journal of the International Federation for Systems Research*, vol. 23, no. 3, pp. 383-393, 2006.
[20] T. Singhal, "A review of coronavirus disease-2019 (COVID-19)," *The Indian Journal of Pediatrics*, vol. 87, no. 4, pp. 281-286, 2020.
[21] Swissuniversities. (2022, May 05). [Online]. Available: https://www.swissuniversities.ch/en/topics/coronavirus
[22] K. Syauqi, S. Munadi, and M. B. Triyono, "Students' perceptions toward vocational education on online learning during the COVID-19 pandemic," *International Journal of Evaluation and Research in Education*, vol. 9, no. 4, pp. 881-886, 2020.
[23] R. Winzeler and P. Ambuhl, "COVID-19 pandemic in dialysis patients in Switzerland," *Swiss Medical Weekly*, 11S-11S, 2020.

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