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DOI: 10.34866/hax4-yv14

Survey of ICT students' views on self-assessment of professional preparation after remote study

Badanie opinii studentów ICT na temat samooceny przygotowania zawodowego po studiach zdalnych

Słowa kluczowe: nauka zdalna, praca zdalna, technologie cyfrowe, studenci ICT.

Streszczenie: Współczesna postpandemiczna rzeczywistość charakteryzuje się bezdyskusyjnym zwrotem w kierunku zdalnej edukacji i pracy. Celem niniejszego artykułu jest identyfikacja oceny studentów ICT w obszarze różnych form studiowania, w tym formy stacjonarnej, zdalnej i hybrydowej; poznanie ich preferencji wobec różnych form edukacji i pracy, a także określenie ich poczucia samoskuteczności w zakresie realizacji zadań zawodowych podejmowanych po zakończeniu edukacji zdalnej. Zastosowano metodę ankietową, a próbę badawczą oparto na doborze celowym. Wyniki wskazują, że chociaż preferowane jest hybrydowe środowisko zarówno w kontekście edukacji, jak i pracy zawodowej, wyzwaniem pozostaje optymalizacja tego formatu w celu poprawy jakości kształcenia, jednakże ankietowani studenci czują się skuteczni w swoich działaniach zawodowych po zakończeniu edukacji zdalnej.

Key words: distance learning, remote working, digital technologies, ICT students.

Abstract: The contemporary post-pandemic reality is characterised by an undisputable shift toward remote education and work. The aim of this article is to identify the assessment of ICT evaluation of different forms of study, including desktop, remote and hybrid forms; to find out their preferences towards different forms of education and work, and to determine their sense of self-efficacy in terms of professional tasks undertaken after remote education. A survey method was used and the research sample was based on purposive sampling. The results indicate that, although a hybrid environment is preferred in both educational and professional contexts, the challenge remains to optimise this format in order to improve the quality of education. Nevertheless, the surveyed students feel self-efficacious in their professional activities after remote education.

Introduction

The COVID-19 pandemic introduced enormous effects on the educational system (Glac, Glac, 2022) and became a catalyst for sudden educational changes related to the need to introduce distance learning (Nowak, Zawisza, 2023). A component of contemporary education entities operating in an era hailed as digital is the new modern technologies that have been the cornerstone of education in recent years (Winarczyk, Warzocha, 2021). Universities, increasingly forced to accelerate digitisation (Salama, Hinton, 2023) have thus embraced online platforms and digital technologies as the primary means of instruction, allowing learning to proceed uninterrupted despite the physical closures of educational institutions (Madalińska-Michalak, 2020). When assessing the adoption of remote learning structures, it is crucial to acknowledge both the advantages and significant challenges associated with this transition. The shift toward online education was propelled by several crucial factors: the rapid advancement of technology, the urgent necessity to introduce new teaching methods suitable for distance learning, and the need to tailor educational resources to cater to diverse learner needs. This swift transition underscored a widespread lack of preparedness among different stakeholders, a circumstance attributed to the sudden nature of this change and its unprecedented impact in various areas. Remote learning has ushered in a new era of flexibility for students, particularly in terms of allocation of time for extracurricular activities, social activities, and employment opportunities. This flexibility demonstrates the potential of remote learning to accommodate and adapt to the diverse lifestyles and responsibilities of the student. These educational approaches cater to students' preferences by focussing on technology-enhanced learning, interactive educational settings, and seamless integration of digital solutions into their learning journey (Szymkowiak et al., 2021).

However, the transition has not been devoid of challenges. Prior studies revealed that online education in general suffers from the perception that it is inherently less quality than in person (Robson, Mills, 2022). This difficulty is exacerbated by student disengagement and educators' reduced ability to cultivate motivation and encourage active participation in a virtual setting. Furthermore, the absence of direct interpersonal interactions among peers and between students and lecturers exacerbates these challenges, hindering the flow of ideas and weakening the vital support networks essential for student achievement. These issues underscore the importance of equipping teaching staff with adequate training and support to ensure their effectiveness in facilitating remote education. Furthermore, the lack of a structured physical learning setting interrupts established routines, potentially fostering inclinations toward procrastination and disengagement among students. Further obstacles to successful remote learning include environmental distractions and background noise, which can decrease the level of interaction and participation during online sessions.

Similarly, the labour landscape has seen significant changes due to the pandemic. Traditional on-site work setups have been replaced with remote or hybrid models in many organisations (Yang, et al., 2022). Businesses facing difficulties in adhering to strict governmental guidelines have adjusted by enabling remote work or adopting hybrid models that blend remote and in-person work, thus ensuring operational flow while staying in line with public health mandates. The remote work model, although it had been recognised and gradually adopted prior to the advent of the COVID-19 pandemic, witnessed a significant surge in acceptance and implementation, supported by progressive advances in digital communication technologies. In the era of the technological and communication revolution, digital competences are considered to be the key resources of employees that determine their work efficiency (Oberländer, Beinicke, Bipp, 2020). Research results show a link between basic digital skills and the probability of continuing to work, which was slightly stronger during the COVID-19 pandemic (Liwiński, Seifert, 2022). This model of employment, distinguished by its flexibility, offers employees the discretion to determine their working hours and location, thus providing them with a superior capacity for personal time management. This flexibility is frequently cited as a pivotal factor that attracts individuals to the remote work model (Athanasiadou et al., 2021). One of the primary benefits that this model provides, appealing to both employees and employers alike, is the elimination of the necessity for daily commuting (Beckel, Fisher, 2022; Konradt et al., 2000). This aspect not only facilitates substantial savings in time and transportation expenses for the workforce, but also enables organisations to realise considerable financial efficiencies. These savings are attributed to a reduction in the necessary expenditure on physical office spaces, utilities, and other related overheads (Sandoval-Reyes et al., 2021). Furthermore, it has been observed that employee productivity tends to improve when individuals engage in their professional duties at home, predominantly during periods that they deem most conducive to their personal productivity. This is largely due to the absence of distractions commonly found in traditional office environments, such as the presence of colleagues who may inadvertently impede task completion (Kłopotek, 2017). Thus, this form of work can also be an important support in the area of the inclusion of vulnerable populations such as neurominorities who face challenges related to sensory vulnerabilities (Tomczak et al., 2022).

However, the remote work model is not without challenges. A notable issue is the psychological impact of isolation and loneliness experienced by some employees. The lack of direct face-to-face interactions with colleagues hinders the team integration process. This issue is further exacerbated by a reliance on digital forms of communication, such as emails and video conferencing, which, while effective to some degree, are prone to misinterpretations that can lead to misunderstandings, potentially escalating into more significant conflicts (Blumberga et al., 2019). Furthermore, the boundary between professional and personal life becomes increasingly blurred for individuals working remotely (Gisin et al., 2016), particularly

when domestic spaces, such as bedrooms, double as offices. This blurring of boundaries can cause elevated stress levels, with potential detrimental effects on mental and physical well-being. The challenge of maintaining a healthy work-life balance therefore becomes a critical concern within the remote work context, necessitating deliberate strategies and measures to mitigate the risks associated with this increasingly prevalent mode of employment (Ferreira et al., 2021).

Having this in mind, we identified the following research objectives:

- First, identify ICT students' assessment of different forms of studying (stationary, remote, and hybrid);
- Second, identify ICT students' preferences towards different forms of education (stationary, remote, and hybrid);
- Third, identify ICT students' preferences towards different forms of work (stationary, remote, and hybrid);
- Fourth, determining ICT students' self-efficacy in the area of fulfilment of professional tasks undertaken after remote education.

Method and research design

Study participants

A total of 115 students from the Faculty of Electronics, Telecommunications, and Informatics at the Gdańsk University of Technology participated in the study. These participants, enrolled in full-time ICT programs across various degrees, were selected using purposive sampling techniques. All individuals had prior experience with different modes of learning, encompassing distance, hybrid, and on-campus (stationary) classroom settings.

Most of the participants comprised first-cycle students, representing 87.8% of the total. Second-cycle students and doctoral candidates accounted for 9.6% and 2.6%, respectively. Regarding the duration of remote learning, 44.4% of the participants participated in remote studies for one semester, 33% for two semesters, 14.8% for three semesters and 7.8% for four semesters. Among the entire group, 19.1% were engaged in professional employment. Female participants made up 21.1% of the study group.

Data collection and measures

The survey was administered electronically to ensure anonymity and voluntary participation. It comprised several sections, with the initial segment dedicated to evaluating the quality of different educational formats. Participants rated stationary, remote, and hybrid lectures, seminars, and laboratories using a 5-point Likert scale (ranging from 1, representing 'very poorly', to 5, representing 'very well'). Additionally, respondents were requested to express their preferences for each mode (stationary, remote, or hybrid) in relation to both studying and working.

In the subsequent section, participants were requested to evaluate their acquisition of theoretical knowledge and practical skills; outcomes that can be perceived as the general effects of learning. This assessment was again performed on a 5-point Likert scale, employing the same anchors as previously described (1 representing 'very poorly' and 5 'very well').

The concluding section of the questionnaire focused on the participants' professional activities, with questions in this segment answered only by those engaged in professional work, to ensure the validity of the results. Respondents assessed their perceived preparedness for professional work and the impact of remote learning on this preparedness, utilizing the previously described 5-point Likert scale. Additionally, this section measured participants' self-efficacy in performing professional tasks. The measurement scale, comprising four items and based on an established scales on creative self-efficacy (Tierney and Farmer, 2002) and digital self-efficacy (Tomczak et al., 2023), included statements such as 'I am always able to solve difficult problems in my work, as long as I try hard enough.' The scale demonstrated high reliability (Cronbach's alpha = 0.84), enabling the computation of a single work self-efficacy measure by averaging the mean responses from individual participants.

Due to the descriptive nature of the study, no preliminary hypotheses were established.

Results

To evaluate the perceived quality across the different study formats, mean values representing the averaged assessments from all participants were calculated for each format. These aggregated mean values, along with their corresponding standard deviations, are presented in Table 1.

Table 1. Assessment of different forms of studying by study participants – descriptive statistics

Study format	Mean	Standard Deviation
Stationary lectures	2.83	1.06
Stationary seminars	3.86	0.97
Stationary laboratories	4.06	1.00
Remote lectures	4.12	1.07
Remote seminars	2.84	1.09
Remote laboratories	2.24	1.13
Hybrid lectures	3.65	1.12
Hybrid seminars	3.55	1.02
Hybrid laboratories	3.30	1.16

Source: own study.

Two study formats: remote lectures (M = 4.12) and stationary laboratories (M = 4.06) received mean scores exceeding 4.0, signifying a notably positive

evaluation from participants. Conversely, three formats were assessed with mean scores below 3.0: stationary lectures ($M = 2.83$), remote seminars ($M = 2.84$), and remote laboratories ($M = 2.24$), suggesting a less favorable perception. These findings suggest that the suitability of remote or stationary study modes may depend on the nature of the class being conducted. Specifically, while students expressed a preference for remote lectures, they rated stationary laboratories more positively, indicating a perceived inadequacy of remote laboratories. Notably, hybrid forms of study yielded intermediate mean scores – 3.65, 3.55, and 3.30 – pointing to a moderate assessment. As the hybrid form entails a combination of remote and stationary sessions, the result may reflect the survey participants' consideration of the advantages and disadvantages of these academic class organization methods.

To verify the relationship between the duration of studying remotely and the assessment of the quality of different studying format, we computed the Spearman's rank correlation coefficient. The obtained values are presented in Table 2.

Table 2. Values of the Spearman's rank coefficient – correlation between the duration of studying remotely and assessment of different studying formats

Study format	Spearman's rank correlation coefficient
Stationary lectures	-0.05
Stationary seminars	-0.42**
Stationary laboratories	-0.24*
Remote lectures	0.10
Remote seminars	0.14
Remote laboratories	0.05
Hybrid lectures	0.14
Hybrid seminars	-0.03
Hybrid laboratories	0.03

** $p < 0.01$, * $p < 0.05$

Source: own study.

The analysis revealed no significant correlation between the length of remote study and the quality assessment of seven study formats, suggesting that the participants' evaluations of these formats remained consistent, irrespective of the amount of time spent in remote learning. However, a statistically significant negative relationship was observed for two stationary study formats: seminars and laboratories. Specifically, the data indicated that the longer students engaged in remote learning, the lower their evaluations of these stationary formats were. This trend may indicate a shift in student preferences, possibly reflecting an increased adaptation to, and appreciation for, the advantages and convenience of online learning. Consequently, this could lead to a more critical perception of traditional, stationary study formats. Such findings prompt the need for further investigation

to fully understand the implications of longer remote learning on students' perceptions of educational methods. Additionally, when interpreting the findings of this study, caution must be exercised due to its correlational design. This design does not allow for direct causal inferences.

Study participants were asked to indicate their preference towards studying remotely, stationary or in the hybrid way. One option could be selected. The distribution of their responses is provided in Table 3.

Table 3. Distribution of the preferences towards hybrid, stationary or remote studying

Preferred mode of studying	Percentage of responses
Stationary	25.2
Remote	13.9
Hybrid	60.9

Source: own study.

Over 60% of the surveyed students preferred the hybrid mode of studying. This preference aligns with their assessments of the quality of various study formats, suggesting that the hybrid mode might allow for the integration of the most positively evaluated formats: stationary laboratories and seminars with remote lectures. From the perspective of the practical significance of these findings, it is important for educational institutions to recognize that the overall student preference for hybrid studies is associated with their evaluations of specific forms of study. Hybrid studies that combine, for example, both stationary and remote sessions within the same course, such as conducting some laboratory sessions on-campus and others remotely, may not be considered the optimal solution by students.

Participants were also asked about their preferences related to the mode of work. The distributions of their responses are presented in Table 4.

Table 4. Distribution of the preferences towards hybrid, stationary or remote work

Preferred mode of working	Percentage of responses
Stationary	18.3
Remote	19.1
Hybrid	53.9
No opinion	8.7

Source: own study.

Again, the hybrid option was the most preferred by the study participants. A similar percentage of students selected the remote and stationary modes (19.1% and 18.3%, respectively). This distribution contrasts with earlier findings regarding preferred study modes, where nearly twice as many participants favored stationary over remote studies (25.2% vs. 13.9%). Additionally, 8.7% of the participants

reported no preference. A further analysis was focused on participants engaged in professional work. It revealed a strong preference for the hybrid mode within this subgroup. Specifically, 72.7% favored hybrid work, 22.7% preferred remote work, and only 4.6% chose stationary work mode. These findings suggest that direct work experience might influence ICT students' preferences, making them less inclined to work in traditional office environments. However, these conclusions should be interpreted with caution due to the relatively small sample size of professionally active students and the correlational character of the present study.

We investigated the relationship between the duration of remote studying and the preference for a specific mode of studying. Preference for a study mode served as a categorical variable for grouping, and we compared the average number of semesters spent in remote study across these groups. The mean scores for this comparison are detailed in Table 5.

Table 5. The mean number of semesters spent studying remotely in groups of participants indicating a preference towards certain mode of studying

Preferred mode of studying	Mean number of semesters studied remotely
Stationary	1.52
Remote	2.56
Hybrid	1.84

Source: own study.

The group that expressed a preference for remote studies, on average, spent the highest number of semesters engaged in remote learning. To verify whether the differences between the groups were statistically significant, a further detailed analysis was conducted. As the groups of participants indicating a specific preference were unequal in size, the Kruskal-Wallis test for independent groups was applied. This non-parametric equivalent of the one-way analysis of variance (ANOVA) yielded a statistically significant result, $H(2) = 9.15$, $p = 0.01$, indicating that there was at least one significant difference between groups. Subsequently, a post hoc analysis using Dunn's pairwise tests with Bonferroni correction was performed to pinpoint the specific differences among groups. The analysis revealed a significant difference in the number of semesters spent studying remotely between students who preferred stationary studies and those who preferred remote studies ($p < 0.01$). No other statistically significant differences were found, although the difference between those who preferred remote studies and those who preferred hybrid studies approached significance ($p = 0.07$). This outcome confirms that the duration of remote study is associated with the formation of such preferences. While the result is correlational, which by definition does not imply causation, it is important to note that due to institutional policies, students involved in the study did not have the option to choose their mode of study, and the time spent in remote learning was determined by how their studies coincided with the Covid-19 pandemic.

We further examined participants' evaluations of the learning outcomes from their studies, specifically their acquired theoretical knowledge and practical skills. The respective mean scores for these outcomes were 3.50 and 3.63. These results suggest that participants considered their competencies in both areas to be moderately satisfactory, indicative of an average level of preparation for professional responsibilities. An important aspect involved investigating the relationship between these assessments and the duration of remote study. To this end, Spearman's rank correlation coefficient was calculated, with the findings detailed in Table 6.

Table 6. Values of the Spearman's rank coefficient – correlation between the duration of studying remotely and assessment of the effects of learning

Effects of learning	Spearman's rank correlation coefficient
Theoretical knowledge	-0.11
Practical skills	-0.01

Source: own study.

The analysis revealed that both correlations were not statistically significant, indicating no discernible relationship between the duration of remote study and the perceived outcomes of learning in terms of theoretical knowledge and practical skills. This finding is particularly noteworthy given the context of earlier results, which could have led to different expectations. Specifically, students who engaged in remote learning for extended periods participated more frequently in remote lectures and laboratories—the formats that received the highest and lowest evaluations, respectively. It could have been hypothesized that a longer exposure to remote study would positively correlate with the assessment of acquired theoretical knowledge, mainly delivered through lectures, and inversely with the evaluation of practical skills, mainly developed during laboratories. The absence of such a correlation is intriguing and warrants further investigation. This outcome may suggest, for example, that students adopt specific strategies to mitigate the limitations of different study formats, and engage in additional efforts to achieve the required educational outcomes.

The impact of remote studying on work preparedness among professionally active participants was also examined. Notably, a significant portion of this subgroup (63.6%) felt that remote studying had no impact on their work preparedness. Meanwhile, 18.2% experienced somewhat positive effects, and 13.6% reported very positive impacts. Only a small fraction (4.6%) perceived the impact as very negative, with none considering it somewhat negative. This finding is particularly intriguing when contrasted with results reported earlier in this paper that suggested a more negative evaluation of certain study formats. It suggests that participants who work might view their studies through a unique lens, adopting a broader perspective. This could imply that working students might engage in specific activities or utilize

external resources to overcome the shortcomings of their study formats, thus enhancing skills development. These hypotheses based on the obtained results requires further investigation.

We assessed students' self-efficacy regarding the fulfillment of professional tasks following remote education. We used the composite score described earlier in the article and calculated the mean self-efficacy level among those who were professionally active. The obtained mean value was 4.19, with a standard deviation of 0.72. Since this score is clearly above the midpoint of the 5-point Likert scale (3.0), it can be considered relatively high. Therefore, it can be cautiously asserted that students feel efficacious about their professional activities after remote education. Further investigation is needed, and a comparison of their self-efficacy levels with those of students who studied exclusively on-site is required to substantiate this finding. In our opinion, this topic presents an interesting avenue for further research.

Conclusions

The research sample comprised exclusively ICT students. Consequently, individuals with non-technical educational backgrounds were excluded from the study. The results cannot be generalised; however, this research among may provide some insight into student perceptions and preferences on different models of learning and working, shaped by the shift to remote and hybrid formats. The findings show a strong preference for hybrid learning modes, which combine the flexibility of remote access with the benefits of face-to-face interactions. Despite this preference, the study indicates that the educational results in all learning formats were considered moderately satisfactory, suggesting that while students value the flexibility of hybrid learning, the actual delivery of educational content and the effectiveness of these formats require further improvement. However, this did not prevent students from feeling effective about their professional activities after the remote education experience.

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