

# Differences among higher education students from the ICT field: Formal education vs. lifelong learning

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**Abstract:** Recovery and resilience plan (RRP) approved by the European Commission fosters the development of lifelong learning programs to upgrade employees' skills and knowledge for digital and green transitions. Within higher education, the field of information and communication technology (ICT) is also a priority area, so we compared the demographic variables of students enrolled in formal first-cycle higher education programs in ICT with those enrolled in lifelong ICT programs within the framework of the Advanced Computer Skills project funded by the RRP in Slovenia. The results show that formal first-cycle higher education in the field of ICT remains strongly male-dominated, whereas, among participants in lifelong learning, the percentage of females stands out. Bachelor programs in ICT are primarily enrolled by young people aged up to 24 years, while shorter university-based lifelong learning programs attract mostly older participants with higher completed formal education and from a broader range of prior educational backgrounds. Finally, when all three variables (gender, age and level of prior formal education) are considered, participants in lifelong learning are much more similar to part-time students than full-time bachelor ICT students, although the percentage of men in formal education is still predominant even in part-time studies. The research findings highlight the need for further efforts to offer lifelong learning in ICT to enable individuals to improve their employment prospects, progress in the workplace or even change their field of work.

**Keywords:** higher education; ICT education; lifelong learning; gender divide; age differences; prior education; formal education

## 1. Introduction

Slovenia's recovery and resilience plan (RRP), approved by the European Commission in 2021, includes investments enhancing sustainability, resilience, and preparedness for the challenges and opportunities presented by the green and digital transitions. Within this RRP, public higher education (HE) institutions are funded from 2022 to 2025 to offer newly developed lifelong learning programs to increase digital competencies and other competencies required by the professions of the future. These programs are intended as pilots for the establishment of micro-credentials. However, as the country's micro-credential system has not yet been developed, public HE institutions offer such educational programs as part of non-formal education. One of these HE institutions is the Faculty of Information Studies in Novo mesto (FIS), which is implementing the "Advanced Computer Skills" (ACS) pilot project. Among other tasks, the project carries out half-year education programs in the field of ICT as a form of lifelong learning. The half-year programs award students with up to 36 ECTS (European Credit Transfer System).

Since lifelong learning offerings are still developing in the Slovenian HE system, we analysed the data on the structure of participants within the ACS project and compared them with the data of traditional students at FIS, in Slovenia and the European Union (EU). The presented perspective on the research topic is a novelty, as no other studies have compared participants' demographics in a specific lifelong ICT education with study programs at the same HE institution, nor with the broader context in the country and the EU. Namely, Kálmán and Thwe (2024), based on an analysis of previous studies, found that demographic components such as gender, age, subjects and level of education, in addition to external barriers, metacognition and personality determinants, can also have a significant impact on lifelong learning. Therefore, this paper aims to present gender (in) equality, age representation, and prior education differences of lifelong learners compared to full-time and part-time students. The following section hence provides an overview of the literature, including gender distribution in HE programs from the ICT field and age representation of traditional HE students compared to participants in lifelong learning. Furthermore, based on the literature, we present the differences between full-time and part-time HE students and prior education obtained by HE students.

## **2. Literature review**

Concerning the hypotheses, the literature review includes four sub-sections focusing on differences between higher education students and lifelong learners regarding gender, age, and prior education. Finally, it also highlights these differences from the perspective of full-time and part-time study.

### **2.1. Gender of students in higher education and of participants in lifelong learning in the ICT field**

ICT skills are required for many professions, as well as in the education sector, for both teachers and students (Kilag et al., 2023). The ICT sector, including education, is characterised by a gender gap, which is problematic given the increasing demand for digital competence (Kurti et al., 2024). The insight into the gender distribution of students in higher education within the ICT field reveals that women are significantly underrepresented in ICT higher education, e.g., in Europe, only 17% of ICT specialists are women (Holgado et al., 2020). Moreover, women in ICT fields may face gender-based discrimination and have different motivations and perceptions regarding their academic environment (Kurti et al., 2024).

Women are generally underrepresented in ICT fields across various regions, including developed and gender-progressive societies (Acilar and Sæbø, 2021; Berbic et al., 2024; Charles and Chow, 2019). Therefore, HE institutions need to focus on creating inclusive environments and promoting gender equality to attract and retain female students (Beric et al., 2024; Kurti et al., 2024).

Since fewer women participate in ICT work and education, efforts are being made to address this imbalance and encourage more women to enter and remain in the ICT sector (Bernhardt, 2014; Corneliussen and Simonsen, 2020). Consequently, lifelong learning programs in ICT often see higher female participation rates (Hansen et al., 2016; Lipphardt et al., 2018). Wenzel et al. (2024) also found that

lifelong learning programs for older adults attract a predominantly white female population, the majority of whom are married, retired, and have high levels of educational attainment.

Besides, studies reveal that men and women have different motivations for participating in ICT lifelong learning. Men are more likely to participate for reasons of social belonging and instrumentality, while women's participation is often influenced by gender-specific needs and interests (Lipphardt et al., 2018).

Factors such as academic performance, early exposure to ICT, and gender play a role in the distribution of students in ICT higher education programs. Moreover, some factors influencing the age of students in ICT higher education programs are notable, such as area of expertise, marital status, and pre-tertiary factors like gender, citizenship, and entry qualification (Herbert et al., 2019; Nurtayeva et al., 2024).

## **2.2. Age of students in higher education programs compared to participants in lifelong learning**

Traditional higher education students are typically between 18 and 22 years old (Jepsen and Montgomery, 2012; Zaporozhetz, 2021). Nonetheless, enrolment trends indicate an increasing number of non-traditional students (typically over 25 years old) in higher education (Rhijn, 2023). Therefore, the number of adult learners in higher education is increasing, with "nontraditional" students already nearly equaling the number of traditional students (Lee and Margrett, 2015).

On the other hand, lifelong learning participants are primarily older adults, with many participants even over 60 years old, who continue their education after retirement (Park et al., 2016; Wenzel et al., 2024). A study involving older adults from five European countries had a mean age of 67.1 years, indicating active participation of older individuals in e-learning programs on ICT (Lipphardt et al., 2018).

Thus, lifelong learning demographics data show that predominantly older adults are included, often retired, seeking personal development and social engagement (Hansen et al., 2016; Park et al., 2016; Wenzel et al., 2024). As follows, lifelong learning programs, particularly university-based ones, attract older adults, providing them with opportunities to develop skills, expand social networks, increase emotional satisfaction (Park et al., 2016) and improve psychological well-being, even for those typically classified as vulnerable (Narushima et al., 2018). As well older adults who participate in ICT learning report various reasons, including personal growth, social belonging, and competition, along with improvements in digital literacy, well-being, and quality of life (Díaz-López et al., 2016; Pihlainen et al., 2021). Nonetheless, we should keep in mind that older adults generally have lower motivation for learning than younger adults and facilitating long-term participation in learning activities is challenging (Yamashita et al., 2015).

## **2.3. Prior education level and field obtained by participants in lifelong learning**

In the field of lifelong learning, HE institutions can play two roles: They can ensure that graduates of formal and accredited programs have the skills needed for

lifelong learning, and they can offer courses and continuing education programs designed to meet the needs of lifelong learners (Lindqvist et al., 2024). Lifelong learning, therefore, encompasses a broad spectrum of fields aimed at improving qualifications, updating skills, or retraining for new specialisations (Mosawi, 2010). Moreover, participants in lifelong learning programs generally have diverse educational backgrounds, with a significant proportion having high levels of prior education (De Wever and Van Nieuwenhove, 2023; Sarsa et al., 2022).

The field of prior education can impact participation in lifelong learning, as the validation of prior learning aims to fully use learning results and work experience gained by individuals over their lifespan, irrespective of where, when, and how the learning took place (Bohlinger, 2017). Therefore, recognising prior learning is crucial in lifelong learning, allowing individuals to formalise skills and knowledge acquired through life experiences. This process is central to lifelong learning and helps in the requalification and continuous improvement of the workforce (Garcia and Silva, 2019; Miguel et al., 2016).

Older adults' participation in lifelong learning activities varies across countries, with those with above high school education being the most likely to participate (Dačiulytė and Dudaitė, 2021). Also, the majority of participants in ICT lifelong programs tend to be female, and many have high levels of educational attainment, with a significant proportion having completed college or graduate programs (Hansen et al., 2016).

#### **2.4. Differences in gender, age and prior education between full-time and part-time higher education students**

To understand the differences between full-time and part-time higher education students, several key aspects should be considered:

- **Age and Employment:** Part-time students are generally older and more likely to be in full-time employment than full-time students (Hayden and Long, 2006).
- **Performance Outcomes:** Part-time students often perform better academically than full-time students, possibly due to their work experience and practical application of knowledge (Howson, 2013).
- **Balancing Commitments:** One of the main problems for part-time students is finding enough time for their studies amidst their existing commitments to work, family, and social life (Andrade et al., 2024).
- **Financial Challenges:** Financial circumstances were a significant factor preventing part-time undergraduates from studying full-time (Hayden and Long, 2006).

Also, the choice of field of study is influenced by expected costs for different types of higher education and training, besides individual ability level, expected success probabilities, and socio-cultural distance to tertiary education (Becker et al., 2010).

Thus, the diverse needs and backgrounds of full-time and part-time students are well-visible, resulting in differences in gender, age, and prior education. Part-time students tend to be older than full-time students and in full-time employment (Jahn, 2020; McDonald, 2013), while full-time students are generally younger, often

entering higher education straight from high school (Callender, 2015; Osam et al., 2017).

Moreover, women are more likely to engage in part-time studies due to various factors, including balancing work and family responsibilities (Wesolowska-Gorniak et al., 2019). Men and women also differ in their motivations and fields of study, which can influence their choice between full-time and part-time education (Gardner et al., 2022; Gorjón et al., 2022).

Furthermore, part-time students often have higher levels of prior education and more work experience. This is because many part-time students are returning to education to enhance their skills or change careers (Gardner et al., 2022; Hayden and Long, 2006).

### **3. Hypotheses**

Our research goal was to identify the differences in the structure of participants within the ACS project, so-called lifelong learners, compared with the structure of traditional students at FIS, in Slovenia and the EU. We aimed to examine diversity in gender, age, as well as in their level and field of prior education, and finally to observe to which group of students (full-time and part-time) the participants of the ACS project more closely resemble. Based on the analysis of the project data and literature review, we formulated the following four hypotheses:

H1: Enrolment in the formal first-cycle higher education in ICT is still strongly male-dominated, but there is a higher percentage of females enrolled in shorter forms of higher education, such as the lifelong learning programs within the Advanced Computer Skills project.

H2: Formal first-cycle higher education in ICT is mainly enrolled by young people, directly after high school, while shorter forms of higher education, such as the lifelong learning programs within the Advanced Computer Skills project, have a much higher average age of learners.

H3: Enrolment in the formal first-cycle higher education in ICT is mainly through high school, while shorter forms of higher education, such as the lifelong learning programs within the Advanced Computer Skills project, have, on average, a higher level of prior formal education of the participants, and also varies considerably by field.

H4: Part-time students enrolled in the formal first-cycle of higher education from the field of ICT are more similar to those enrolled in shorter forms of higher education, such as the lifelong learning programs within the Advanced Computer Skills project, in terms of gender, age and level of prior formal education than full-time students.

### **4. Methodology**

Our study compares selected demographic data for the participants of the half-year lifelong education programs within the RRP pilot project ACS and newly enrolled students in formal first-cycle higher education study programs at FIS, in Slovenia and the EU. According to the structure of the education system in Slovenia (Government of the Republic of Slovenia, n.d.), the first-cycle of higher education

includes only bachelor's programs (professional and academic), and consequently, we explore data only for bachelor's programs. To do so, we used different data sources; the data for participants of the half-year education programs within the ACS project and newly enrolled bachelor students in higher education study programs at FIS was acquired from the enrolment data from the FIS information system. Those two groups of learners both enrolled in the programs from the ICT field. For this reason, we used data on ICT students also on the national (Slovenia) and international (EU) levels for comparison, where available.

Data on students enrolled in higher education study programs in Slovenia was gathered from the Statistical Office of the Republic of Slovenia (SORS, 2024), and data on students enrolled in higher education study programs in the EU was gathered from the Organisation for Economic Co-operation and Development (OECD, 2024a; OECD, 2024b). Using the latter, we aggregated the data on all current member states except Malta, for which data was unavailable. The timeframe we have focused on to answer the hypotheses is the last two study years, i.e., 2022/2023 and 2023/2024, as the ACS project only started in 2022.

We initially pre-processed the data using Python programming language. The data for analysis included information on 189 ACS project participants, 245 bachelor students at FIS, 1020 newly enrolled students in higher education study programs in the field of ICT in Slovenia, 15,182 newly enrolled bachelor students (all fields) in Slovenia, and 268,665 newly enrolled bachelor students in the EU member states.

To present the analysis results, we used graphical representations of each variable (number, gender, age, prior education) percentages. We added additional computations, such as average annual growth rate (AAGR) and compound average growth rate (CAGR). To test the first hypothesis, we compared the gender structure of participants in ACS lifelong education and newly enrolled bachelor students in the field of ICT at FIS, in Slovenia and the EU. We also carried out the proportion tests using the chi-square ( $\chi^2$ ) statistics to test the significance of the differences in the percentages of women in different groups of students and participants at the 0.05 significance level.

To answer the second hypothesis, we compared the age groups split by gender of participants in ACS lifelong education, newly enrolled bachelor students from the field of ICT at FIS, and in Slovenia. To enable comparison to the EU, we also added the age groups split by gender of all newly enrolled students in Slovenia and the EU, since the data for the newly enrolled bachelor students in the field of ICT were not available for the EU. We used a chi-square ( $\chi^2$ ) to test the association between the age and different groups of students and participants at the 0.05 significance level. To test the differences between specific age groups of students, we used the proportion test using the chi-square ( $\chi^2$ ) statistics. To highlight the age differences between the data compared, we also calculated the approximate values of the averages based on the data grouped by the age of lifelong learning participants or students.

To test the third hypothesis, we compared the percentages of participants in ACS lifelong education, bachelor students at FIS and bachelor ICT students in Slovenia according to their level of prior formal education, and additionally also the

percentages of participants in ACS lifelong education and bachelor ICT students at FIS according to the field of their prior education. We used the Slovenian classification system of education known as KLASIUS to determine the level and the field of prior education. It is divided into KLASIUS-SRV (different levels of education) and KLASIUS P-16 (different fields of education). KLASIUS-SRV follows the concept of the International Standard Classification of Education (ISCED 1997; ISCED 2011) but is not directly comparable to ISCED. The KLASIUS-SRV consists of 4 hierarchical classification levels in which different levels of education are classified, from pre-primary education to the doctoral degree. In our research, we use levels, shown in **Table 1** (SORS, n.d.), to describe prior education as a prerequisite for enrolment in the lifelong learning programs within the ACS project and the bachelor’s degree programs in upper secondary education (level V).

**Table 1.** Levels of education.

<b>Level</b>	<b>Description</b>
V	Upper secondary general education, Upper secondary technical education, Upper secondary education, Upper technical education
VI/1	Short-cycle higher vocational education
VI/2	Professional Bachelor’s degree, Academic Bachelor’s degree
VII	Master’s degree
VIII/1	Master’s degree in science
VIII/2	Doctorate

KLASIUS-P-16 is a classification that divides education and training activities or outcomes into groups or categories according to the fields of education and training. It consists of three hierarchical classification levels, with the first consisting of eleven broad areas and one supplementary (99) classification category (SORS, n.d.), as presented in **Table 2**.

**Table 2.** Broad areas of classification categories.

<b>Code—level 1</b>	<b>Descriptor</b>
0	Generic programs and qualifications
1	Education
2	Arts and humanities
3	Social sciences, journalism, and information
4	Business, administration, and law
5	Natural sciences, mathematics, and statistics
6	Information and Communication Technologies (ICTs)
7	Engineering, manufacturing, and construction
8	Agriculture, forestry, fisheries and veterinary
9	Health and welfare
10	Services
99	Field unknown

The association between the level of prior education and different groups of students and participants was tested using a chi-square test ( $\chi^2$ ) at the 0.05 significance level.

Lastly, to verify the fourth hypothesis, we compared the data of participants in ACS lifelong education with part-time and full-time bachelor students from the field of ICT at FIS and in Slovenia, comparing their gender, age and level of prior education. Due to data unavailability, we could not make this comparison with the EU. We also carried out the proportion tests using the chi-square ( $\chi^2$ ) statistics to test the significance of the differences in the percentages of male and female students among part-time and full-time students, as well as the differences between levels of education among part-time and full-time students at the 0.05 significance level.

## 5. Results

This chapter is divided into four parts, each focusing on a specific hypothesis. The first part provides a brief insight into the percentage of bachelor students enrolled in ICT programs, indicating a growing interest in this field of study both in Slovenia and in the EU.

Multiannual data for Slovenia and the EU (OECD, 2024a) in **Table 3** show a constant increase in the percentage of students enrolled in ICT programs. The AAGR of the percentage of ICT students in Slovenia is more than double the AAGR in the EU, which resulted in a larger percentage in Slovenia than in the EU in the last observed year. Moreover, Slovenia’s CAGR is four times that of the EU from 2015 to 2022.

**Table 3.** Share of bachelor students enrolled (new entrants) in ICT education for Slovenia and the EU (25 member states).

Year	2015	2016	2017	2018	2019	2020	2021	2022	
Slovenia	4.91	5.53	5.75	5.99	6.31	6.34	6.43	7.50	
AAGR		12.8%	3.9%	4.2%	5.2%	0.5%	1.5%	16.6%	6.4%
CAGR									14.6%
EU	5.53	5.48	5.97	6.38	6.53	6.63	6.64	6.82	
AAGR		-0.9%	8.8%	7.0%	2.3%	1.5%	0.2%	2.6%	3.1%
CAGR									3.6%

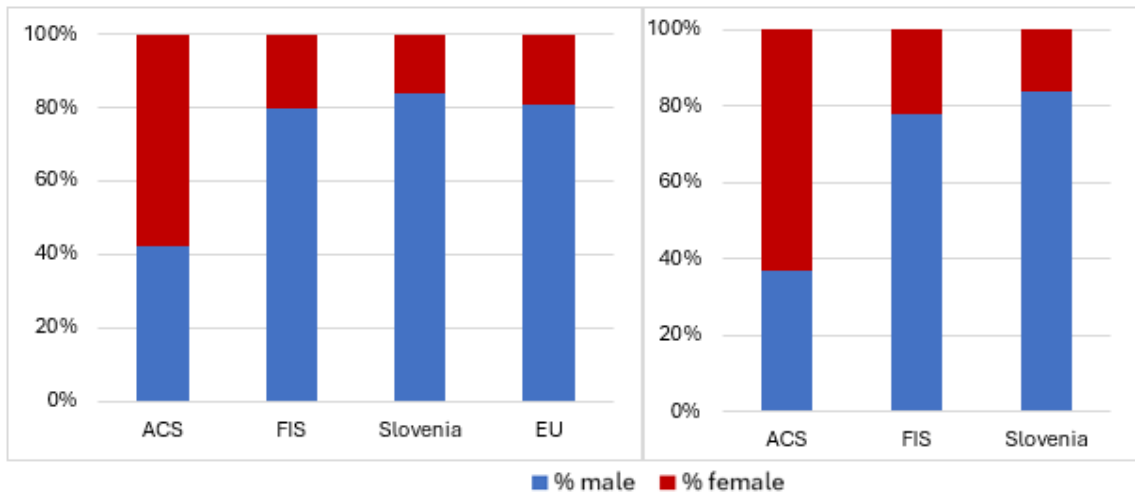
### 5.1. Gender analysis

Regarding H1, we examined the gender structure among participants in the lifelong learning programs within the ACS project and among newly enrolled bachelor ICT students at FIS, in Slovenia, and in the EU in the study year 2022/23. For the study year 2023/24, we could only compare data for the ACS project, FIS, and Slovenia, as data for the EU were not yet available.

The graphs in **Figure 1** show that men predominate among newly enrolled bachelor students in higher education study programs at FIS, in Slovenia and the EU. In the study year 2022/23, the percentage of men in these programs exceeded 80% in all three cases, while in the study year 2023/24, the same applies only to Slovenia. In



both study years, the highest proportion of men was observed in Slovenia, accounting for 84%.



**Figure 1.** Gender structure of participants in ACS lifelong education compared to newly enrolled bachelor ICT students at FIS, in Slovenia and the EU in 2022/23 (left) and 2023/24 (right) study years.

In contrast, the lifelong learning programs within the ACS project had a significantly higher percentage of women than the bachelor study programs. This percentage accounted for approximately 60% of lifelong learners within the ACS project in both academic years. In the study year 2022/23, the percentage of women enrolled in the lifelong learning programs within the ACS project amounts to 58%, which is statistically significantly higher than the 20% percentage of female bachelor students enrolled in the higher education study programs at FIS ( $\chi^2 = 24.420$ ;  $p = 3.872 \times 10^{-7}$ ), the 16% percentage of female bachelor students enrolled in the higher education study programs in Slovenia ( $\chi^2 = 58.064$ ;  $p = 1.269 \times 10^{-14}$ ), and the 19% percentage of female bachelor students enrolled in the higher education study programs in the EU ( $\chi^2 = 30.493$ ;  $p = 1.675 \times 10^{-8}$ ). In the study year 2023/24, the percentage of women enrolled in the lifelong learning programs within the ACS project amounts to 63%, which is statistically significantly higher than the 22% percentage of female bachelor students enrolled in the higher education study programs at FIS ( $\chi^2 = 44.155$ ;  $p = 1.517 \times 10^{-11}$ ), and the 16% percentage of female bachelor students enrolled in the higher education study programs in Slovenia ( $\chi^2 = 113.790$ ;  $p = 2.200 \times 10^{-16}$ ).

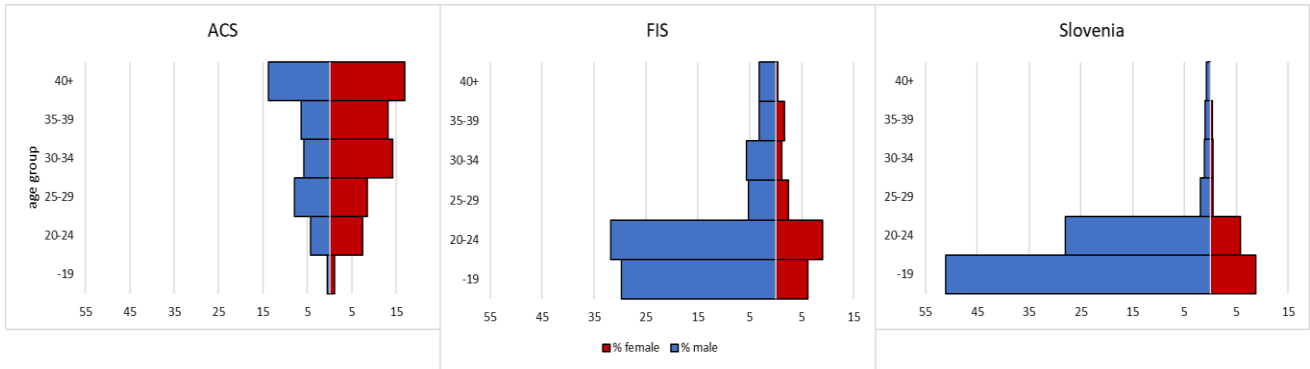
There has also been a 5% increase in the percentage of women enrolled in the lifelong learning programs within the ACS project between 2022/23 and 2023/24, but this change is not statistically significant ( $\chi^2 = 0.244$ ;  $p = 0.311$ ).

## 5.2. Age analysis

Referring to H2, we first examined the age groups split by gender of the participants within the ACS project and newly enrolled bachelor students at FIS and in Slovenia from the field of ICT in study years 2022/2023 and 2023/2024.

As shown in **Figure 2**, only a small percentage of participants in ACS lifelong learning education are in the age group up to 19 years, and the percentage of

participants increases with age. On the other hand, the situation among newly enrolled bachelor students at FIS and in Slovenia is quite the opposite, with the largest percentage of students in the first two age groups, i.e., up to 19 years and 20–24 years. This difference is also statistically significant ( $\chi^2 = 723.890$ ;  $p = 2.2 \times 10^{-16}$ ).

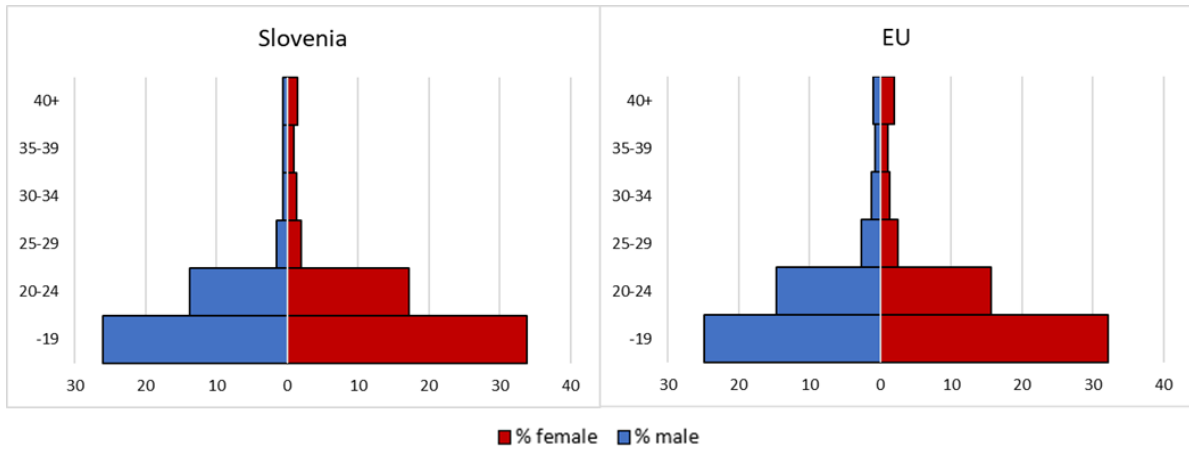


**Figure 2.** Age structure split by gender of participants in ACS lifelong education, newly enrolled bachelor ICT students at FIS and in Slovenia in 2022/23 and 2023/24 study years.

The difference is evident in terms of average age as well, where the average age of the participants within the ACS project (approximately 33.8 years) is significantly higher than the average age of the newly enrolled bachelor students in ICT programs at FIS (approximately 22.8 years) and in Slovenia (approximately 19.7 years).

We also examined the age groups split by gender of the newly enrolled students at all higher education study programs in Slovenia and the EU in 2022/23.

Graphs in **Figure 3** show that, in general, both in Slovenia and in the EU, the largest percentage of all newly enrolled bachelor students is in the age group up to 24 years, with a statistically significant higher percentage of those aged up to 19 as compared to the percentage of those between 20 and 24 years of age ( $\chi^2 = 2553.900$ ;  $p = 2.2 \times 10^{-16}$  for Slovenia and  $\chi^2 = 389,419.000$ ;  $p = 2.2 \times 10^{-16}$  for the EU). The average age of new bachelor students in Slovenia is slightly lower (approximately 20.0 years) than the average age of these students in the EU (approximately 20.5 years). Moreover, the average age of all newly enrolled bachelor students in Slovenia (approximately 20.0 years) is very close to that of the newly enrolled bachelor students enrolled in ICT programs in Slovenia (approximately 19.7 years).

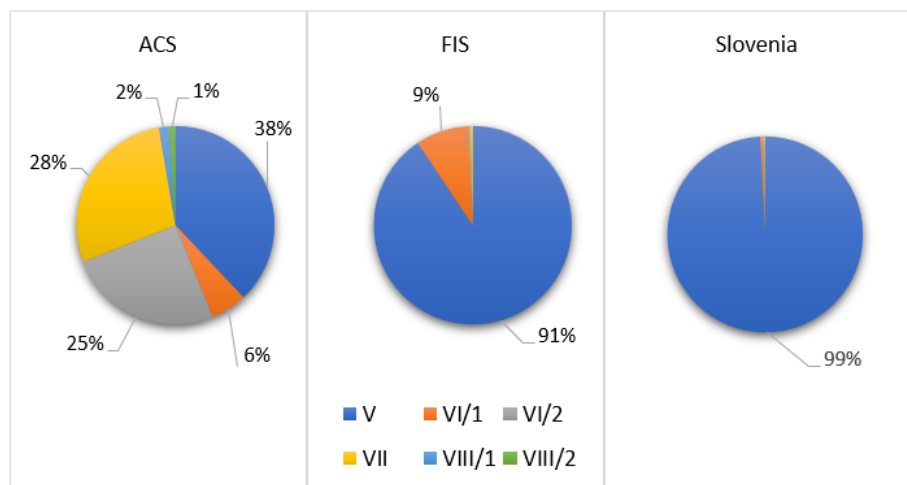


**Figure 3.** Age structure split by gender of all newly enrolled bachelor students in Slovenia and the EU in the 2022/23 study year.

### 5.3. Prior education analysis

Related to H3, we examined the data on the prior formal education of the participants in the lifelong learning programs within the ACS project, the bachelor students at FIS and the bachelor ICT students in Slovenia.

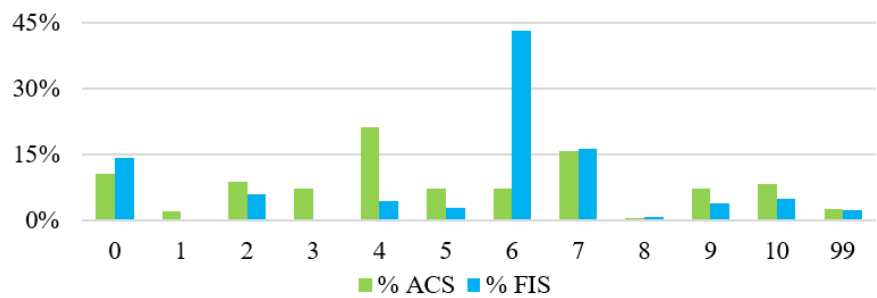
The graphs in **Figure 4** show the distribution of levels of prior formal education among participants in the lifelong learning programs within the ACS project, bachelor ICT students at FIS and bachelor ICT students in Slovenia. We observed that only 10% of all newly enrolled students at FIS have a higher level of prior formal education, while the majority have a level V of prior formal education. The data for ICT students in Slovenia also show that level V (being the lowest required education level) of prior formal education is by far the most common level of educational attainment among newly enrolled students. Only a small percentage of newly enrolled ICT students have a prior education level above the upper secondary level (above level V). This shows that enrolment in bachelor’s education is mostly carried out directly through upper secondary education.



**Figure 4.** Percentage of participants in ACS lifelong education, newly enrolled bachelor ICT students at FIS and in Slovenia per level of prior formal education in 2022/23 and 2023/24 study years.

On the other hand, participants in the lifelong learning programs within ACS have more diverse prior formal education levels. A significant percentage of participants, 62%, have a prior formal education higher than level V. Some participants in the lifelong learning programs within the ACS project also hold doctoral degrees. The difference between the distribution of bachelor students at FIS and in Slovenia according to the level of prior education, on the one hand, and the distribution of participants in the lifelong learning programs within the ACS project according to the level of prior education, on the other hand, is also statistically significant ( $\chi^2 = 790.510$ ;  $p = 0.004 \times 10^{-1}$ ).

**Figure 5** presents fields of prior education for two generations (2022/23 and 2023/24 study years), consisting of 189 ACS project participants and 245 bachelor students at FIS. **Figure 5** shows a clear difference according to previous education. While it should be considered that individual fields of education do not contain as many different educational programs as others, as the number and supply are also adjusted according to demand, it can nevertheless be seen that, depending on the field, lifelong learning participants have prior education from all the different fields, but students do not.



**Figure 5.** Percentage of participants in the ACS lifelong education vs. bachelor ICT students at FIS per field of prior education in 2022/23 and 2023/24 study years.

It is also very clear that the majority of students have a previous qualification in the field of study (6-ICT), while the majority of participants in lifelong learning programs have a prior qualification in field 4 (Business, administration and law), followed by field 7 (Engineering, manufacturing and construction).

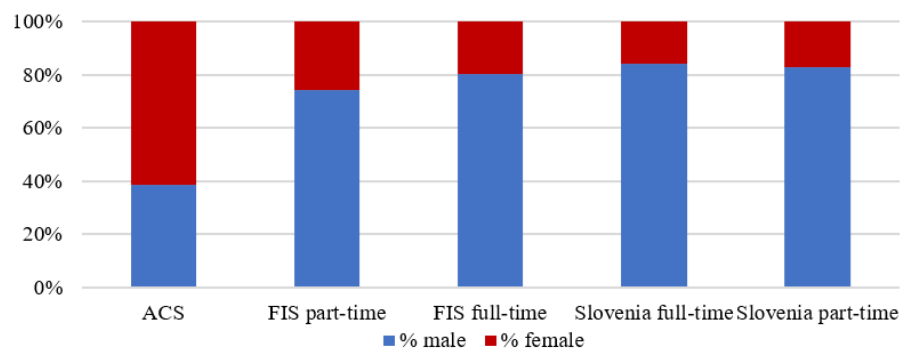
However, the most striking feature is the more even distribution of prior qualifications across the different fields of lifelong learners. For these, the variation between the individual fields is up to 20 percentage points, while for students, the variation is much larger, up to 43 percentage points. This confirms that prior education is more diverse across the fields among lifelong learners, although there is also diversity among traditional students. For students, however, there is a notably more consistent pattern in terms of choice of further education, with 43% of students having completed their prior education in ICT.

#### 5.4. Comparison between part-time and full-time students

Regarding H4, we analysed separately the gender and age structure, as well as the level of prior formal education of full-time and part-time bachelor students at FIS and bachelor ICT students in Slovenia. We then compared the demographic data of

these groups with those of the participants in the lifelong learning programs within the ACS project.

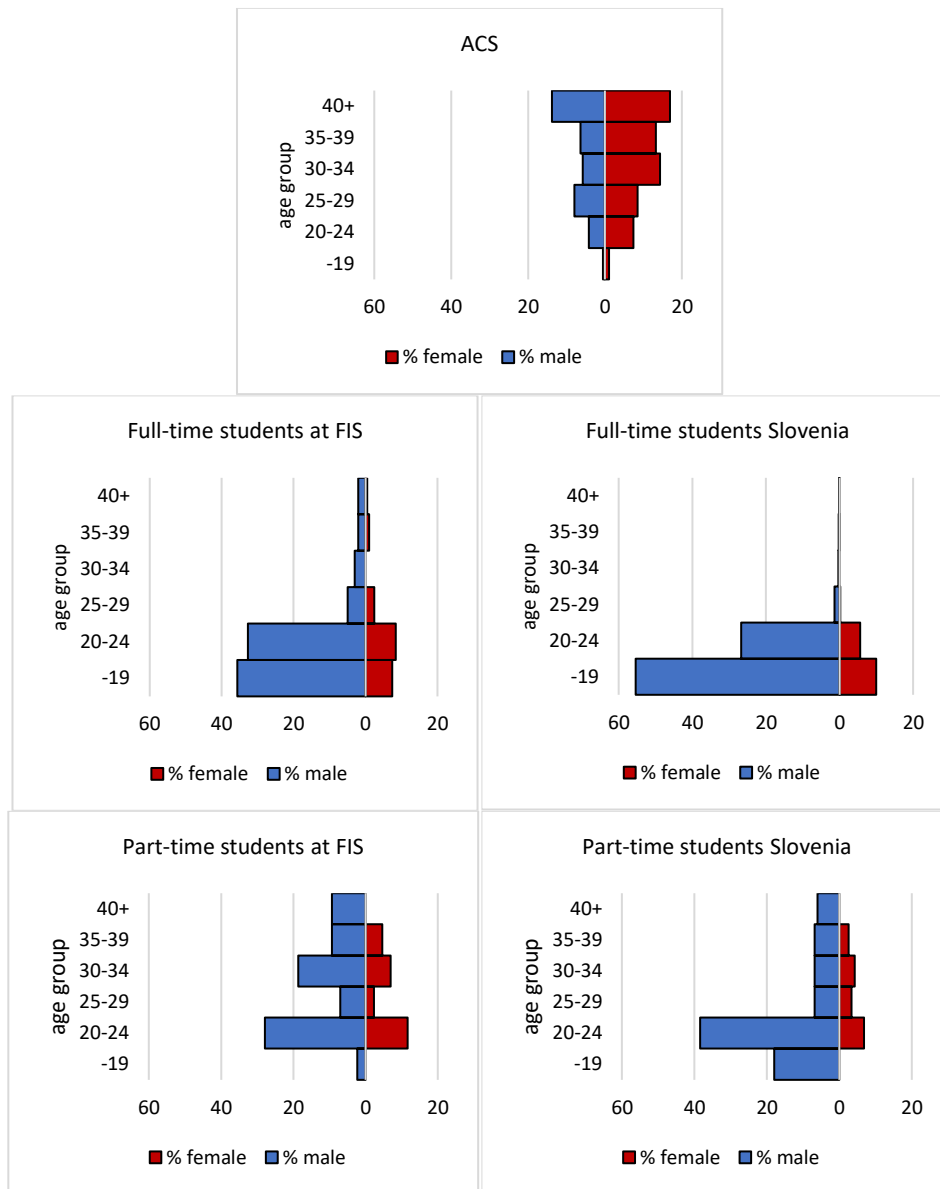
The data presented in **Figure 6** show that men represent a statistically significant higher percentage of the newly enrolled student population in both groups, full-time and part-time bachelor students. This holds for FIS ( $\chi^2 = 18.605$ ;  $p = 8.041 \times 10^{-6}$  for part-time,  $\chi^2 = 144.960$ ;  $p = 2.200 \times 10^{-16}$  for full-time) as well as for bachelor ICT students in Slovenia ( $\chi^2 = 98.735$ ;  $p = 2.200 \times 10^{-16}$  for part-time,  $\chi^2 = 834.990$ ;  $p = 2.200 \times 10^{-16}$  for full-time). The percentage of female students appears to be slightly higher only among part-time students at FIS (26%) compared to the other three groups, where female students account for less than 20%. This again indicates a pronounced dominance of men.



**Figure 6.** Gender structure of participants in ACS lifelong education, newly enrolled part-time and full-time bachelor students at FIS and newly enrolled part-time and full-time bachelor ICT students in Slovenia in 2022/23 and 2023/24 study years.

On the other hand, as already observed in **Figure 1**, the lifelong learning programs within the ACS project have a higher percentage of female participants, with women making up approximately 60% of all participants. This does not align with the gender distribution of part-time students, although the percentage of women among part-time bachelor students is somewhat but not statistically significantly higher than among full-time students ( $\chi^2 = 0.411$ ;  $p = 0.261$  for FIS,  $\chi^2 = 0.034$ ;  $p = 427$  for Slovenia).

As shown in **Figure 7**, the prevailing percentages of full-time students are in the age groups up to 19 years and 20–24 years, both at FIS and in Slovenia. However, part-time students are, on average, relatively older than full-time students. The average age of part-time students at FIS is approximately 28.9 years, while that of part-time students in Slovenia is around 25.3 years. These numbers are notably higher than the average ages of full-time students, which are approximately 21.5 years at FIS and 18.9 years in Slovenia. The average age of part-time ICT students at FIS is, therefore, much closer to that of participants in the ACS project, which is approximately 33.8 years. This suggests that part-time students percentage more demographic similarities with ACS participants regarding age.

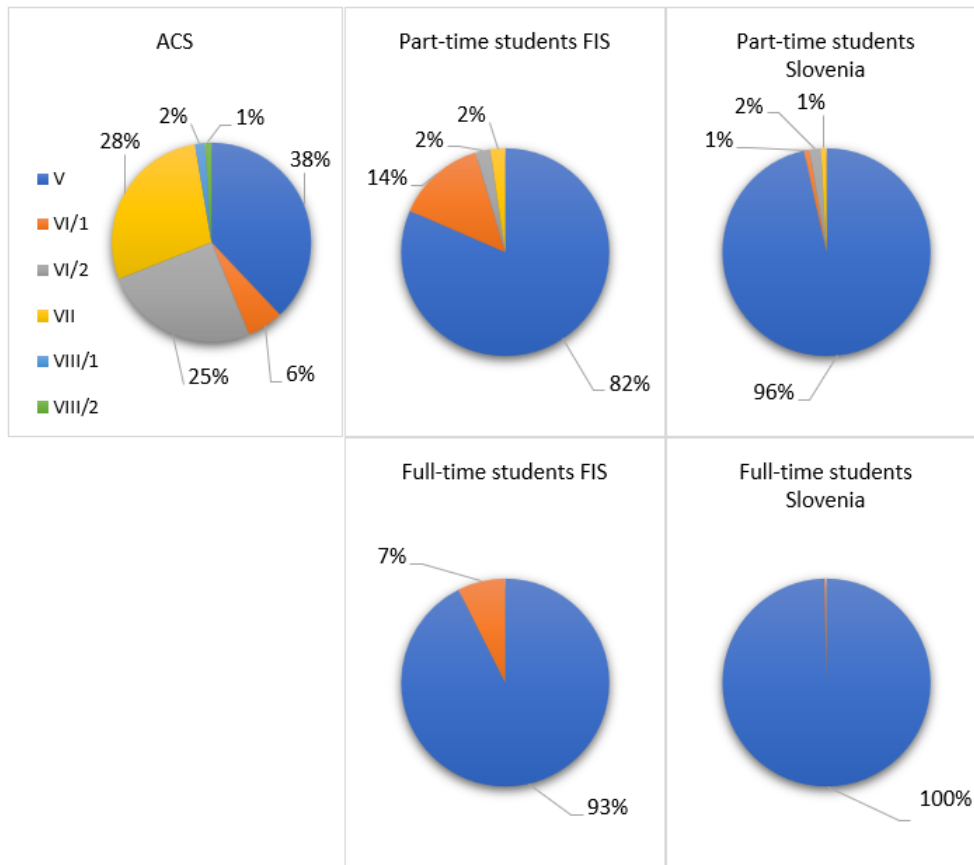


**Figure 7.** The age structure of participants in ACS lifelong education, part-time and full-time bachelor students at FIS, and part-time and full-time bachelor ICT students in Slovenia in 2022/23 and 2023/24 study years.

Among full-time and part-time students, a gender imbalance is also more than evident. Women are underrepresented in all age groups, which is not the case for participants in the lifelong learning programs within the ACS project.

As already observed in **Figure 4**, the lifelong learning programs within ACS attract participants with a higher level of education. **Figure 8** shows that in the groups of part-time bachelor students, there is a slightly higher percentage of individuals with prior formal education above level V than full-time bachelor students. Although part-time students show a somewhat broader range of prior formal education levels, their education remains predominantly at level V, which differs from the significantly higher levels of prior formal education observed among ACS participants ( $\chi^2 = 24.817$ ;  $p = 3.152 \times 10^{-7}$  for FIS,  $\chi^2 = 100.290$ ;  $p = 2.200 \times 10^{-16}$  for Slovenia). Nevertheless, part-time bachelor students are more

similar to ACS participants regarding diversity in prior education levels than full-time students.



**Figure 8.** Percentage of participants in ACS lifelong education, part-time and full-time bachelor students at FIS, and part-time and full-time bachelor ICT students per level of prior formal education in Slovenia in 2022/23 and 2023/24 study years.

## 6. Discussion

Based on the collected data, hypothesis H1 is confirmed. Formal higher education in the field of ICT remains strongly male-dominated, with men accounting for more than 80% of all enrolled students. In contrast, shorter forms of higher education, such as the lifelong learning programs within the ACS project, show a significantly higher female enrolment, with around 60% of all participants being women. This observation corresponds to existing studies, which highlight that lifelong learning programs in ICT often achieve higher female participation rates (Hansen et al., 2016; Lipphardt et al., 2018). A slight increase in the percentage of women between 2022/23 and 2023/24 further strengthens this observation, underscoring the potential of lifelong learning initiatives to bridge the gender gap in ICT education.

Given the data on the age structure split by gender, hypothesis H2 is confirmed as well. Bachelor education in ICT and in general is mainly enrolled by young people, directly after high school, in the age group up to 19 years. Shorter forms of higher education, such as the ACS lifelong learning programs, tend to be attended by participants with a higher average age. Our findings are consistent with those of

other studies highlighting that traditional higher education students are typically between 18–22 years old (Jepsen and Montgomery, 2012; Zaporozhcz, 2021) and that lifelong learning programs attract older adults with which they develop skills (Park et al., 2016; Wenzel et al., 2024).

Findings based on prior education show that lifelong learning programs, such as ACS, attract participants with a higher level of prior formal education. The average level of prior education attained by ACS lifelong learners is namely VI (higher vocational or bachelor's educational; VI/1 or VI/2). In contrast, the vast majority of enrolled students in the bachelor's ICT programs at FIS and in Slovenia have completed level V (upper secondary education), which confirms the first part of H3, stating "Enrolment in the formal first-cycle higher education in ICT is mainly through high school, while shorter forms of higher education, such as the lifelong learning programs within the Advanced Computer Skills project, have on average a higher level of prior formal education of the participants".

Moreover, the second part of H3, "and also varies considerably by field", is confirmed by a significantly greater variation between the individual fields of prior education among ACS learners compared to bachelor students at FIS. We could also observe that ACS participants have all possible different fields of prior education, with the largest percentage from field 4 (Business, administration, and law). At the same time, data for bachelor students show the biggest percentage of students having completed their prior education in field 6 (ICT). Thus, our research findings are aligned with the literature review, e.g., with Sarsa et al. (2022) claiming that participants in lifelong learning programs, particularly those in ICT, usually come from various educational backgrounds.

The analysis of gender, age and prior formal education among part-time and full-time students, as well as participants in the lifelong learning programs within the ACS project, indicates that H4 is partially confirmed. In particular, the gender distribution does not align, as the ACS programs have a higher percentage of female participants, in contrast to the pronounced male dominance observed among both part-time and full-time ICT students. Despite this finding, it is worth mentioning that the percentage of women among part-time ICT students is somehow higher than among full-time ICT students.

The average age of part-time students is significantly closer to that of ACS participants (compared to full-time students), although a notable gap still exists. As regards the level of prior education, lifelong learners within the ACS project, on average, have prior education of level VI, and bachelor students, on average, have prior education of level V. However, part-time bachelor students have a higher percentage of individuals with prior formal education above level V than full-time bachelor students.

These observations are consistent with the literature review, which highlights that full-time students are generally younger and more likely to enter higher education directly from high school (Callender, 2015; Osam et al., 2017), whereas part-time students tend to be older (Gardner et al., 2022; Hayden and Long, 2006).

## **7. Conclusion**



Although our hypotheses are mostly confirmed, we have to mention certain limitations that we have encountered during our research. One of these limitations is the absence of data for the EU on the level of prior education of students enrolled in bachelor's programs, another is the absence of data for the EU for the academic year 2023/24, and a third is the absence of data for the field of prior education for ICT bachelor students for Slovenia and the EU. In addition, there is an opportunity for further research by comparing data from several academic years, but this will be possible only when the data become available. Despite these limitations and the mentioned opportunity, the research results presented here illustrate the actual situation and imply that policies to include more balanced inclusion of women in ICT education are successful in lifelong learning and that policies to include older individuals in lifelong learning are also thriving. They are involved in ICT lifelong learning education regardless of their previous formal education level and the field of their prior education. The data, therefore, confirm the need for further efforts to offer lifelong education in the field of ICT, possibly also in the form of micro-credentials. Namely, according to the main reasons identified for including participants in lifelong learning in the ACS project, individuals want to improve their employment prospects, advance in their careers, or even change their field of work. Besides this, older adults who participate in ICT learning programs also report other reasons, including (Díaz-López et al., 2016; Narushima et al., 2018; Park et al., 2016; Pihlainen et al., 2021) personal growth, social belonging, psychological well-being, and quality of life, which all contributes to the general well-being of the society.

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