

Investigation into the Factors Which Influence Students to Study Computer Science between Second and Third-Level Education – A Working Study

Miriam Harte

School of Enterprise Computing
And Digital Transformation
TU Dublin
miriam.harte@tudublin.ie

Keith Quille

School of Enterprise Computing
And Digital Transformation
TU Dublin
keith.quille@tudublin.ie

Rajesh Jaiswal

School of Enterprise Computing
And Digital Transformation
TU Dublin
rajesh.jaiswal@tudublin.ie

Keith Nolan

School of Enterprise Computing
And Digital Transformation
TU Dublin
keith.nolan@tudublin.ie

Abstract

As the demand for digital skills among second-level students continues to grow, there are still unanswered questions regarding the reasons which motivate students to study Computer Science. Much research has been done into the factors which influence students to choose Computer Science at third-level, but corresponding research does not exist across second-level education in Ireland. Furthermore, no longitudinal study exists whereby changes in students' opinions of Computer Science are monitored across latter stages of second-level and into initial third-level education. Intrinsic factors such as academic self-determination and self-efficacy may motivate students to feel well suited to a technical subject such as Computer Science. Similarly, the opinions of family and friends and societal perceptions of Computer Science could be considered relevant extrinsic factors which may influence student subject and career choices. This paper will outline a work-in-progress study designed to longitudinally investigate the educational experiences which influence students to study Computer Science between second and third-level education in Ireland, through a set of surveys, focus groups and interviews.

1. Introduction

At third-level education in Ireland, we are seeing challenges around student admission and retention numbers in the field of Computer Science (CS). Technical complexity, a lack of student confidence and misunderstanding of what CS actually consists of, are considered to be influencing factors within this issue (Tims, Tucker, Weiss, & Zweben, 2024). However, we are not yet fully aware of the factors which influence students to take CS as an optional subject at second-level.

In recent years, the Irish Department of Education has taken action to integrate computing curricula across all stages of formal education. Ireland's second-level education system spans the ages of 12-18 and consists of two phases of state examination - Junior Cycle (JC) at age 14/15 and Senior Cycle (SC) at age 17/18. Students can take an interim year of semi-structured, self-directed learning, Transition Year, around the age of 15. Currently, second-level formal computing is offered as an optional short course in Coding at Junior Cycle and as a state-examined subject of Computer Science at Senior Cycle. Since the introduction of the current Leaving Certificate Computer Science (LCCS) curriculum in Ireland (National Council for Curriculum and Assessment, 2025), we have seen some interest in second-level students in selecting this topic as an optional Leaving Certificate subject. However, we do not yet know much about the experiences which influence students to select Computer Science for their Leaving Certificate.

Recent research by the Ireland's Economic and Social Research Institute (ESRI) has indicated that factors such as school location and social composition influence overall student academic achievement,

rather than the neighbourhood of individual students. Carried out longitudinally, ESRI's *Growing Up in Ireland* study examined the correlations between student background and overall academic achievement (Murray & Smyth, 2020). While this work gives great insight into the current state of art regarding the expected Leaving Certificate outcomes in second-level students, it does not indicate how technical STEM subjects such as Computer Science are affected. At present, no such research exists in Ireland. Despite the ESRI's *Growing Up in Ireland* study, no longitudinal data exists in Ireland in relation to student rationale for their continuation of Computer Science between second and third-level. As part of this research study, we intend to investigate what experiences and factors motivate second-level students to take LCCS and then potentially continue their CS studies at third-level.

Below, we will highlight the research goals, methodology and expected outcome of this unique study, as well as the milestones within the first year of its progress.

2. Research Questions

This study will be guided by the following research questions:

1. How do students' programming self-efficacy, conceptual understanding of computer science, and computing identity influence their decision to persist with computing across the transition from second-level to third-level education?
2. How do second-level learning contexts - including access to computing resources, instructional experiences, and institutional proximity - shape students' beliefs about programming difficulty, relevance, and their likelihood of success in third-level computing?
3. How do prior formal and informal programming experiences influence students' motivation to learn computing and their mental models of programming at the point of entry to third-level education?

Through these research questions, we hope to determine how socioeconomics, family influence and school infrastructure may shape a student's decision to study CS at Leaving Certificate level. Furthermore, we intend to seek any potential correlation between student uptake of CS and pre-existing experience of CS. It is well-documented that early interventions increase student engagement in STEM (Chittum, Jones, Akalin, & Schram, 2017) and the same can be said for CS. We would like to see if these past interventions have lasting impact beyond second-level formal education settings and if they change over the course of the latter years of formal education.

3. Methodology

In order to carry out this study, we will use the following research methods:

- **Surveys and Questionnaires:** Hosted to assess students' perceptions of available educational resources, career aspirations, and influences on their academic decision-making processes. Questions will cover access to technology, quality of computing education, and personal aspirations.
- **Interviews:** Facilitation of in-depth interviews with participants at multiple points during the study to gain insights into their evolving attitudes towards computing and the role it may have in their future education.
- **Focus Groups:** Discussions among students about their experiences and perceptions of computing as a career choice.

3.1. University Ethics Review

Full ethical approval was sought and has been granted by TU Dublin's Research Ethics Committee.

3.2. Survey Development

The main form of data gathering within this study consists of student surveys, distributed across second-level schools. Schools will be recruited via the CSinc Research Centre's teacher mailing list, whereby teachers can volunteer to distribute our research survey to their students.

Within this pilot, we intend to engage with students who are in either Transition Year, 5th Year or 6th Year of Secondary School. Students who enter this stage of their formal education spend the latter two years (5th and 6th Year) preparing to take their final state examination, the Leaving Certificate. As part of the Leaving Certificate, students study up to seven subjects, including three mandatory subjects and four "choice" subjects. Upon completing the Leaving Certificate, students' examination results will be converted into points which will determine which third-level course a student is eligible to study as part of their higher education.

By including Transition Year students, we will also get the chance to engage with students who may be currently exploring more hands-on, project-based subjects, such as coding or digital technology. In Ireland, there is a plethora of introductory Computer Science programmes and events, aimed at engaging TY students with tech and CS. It is our hope that the TY students who participate in our study, will also have some pre-existing educational experience of CS at this stage in their educational journey.

Additionally, the rationale for inviting students in 5th and 6th Year to participate in this research pilot study is two-fold; Firstly, students in 5th/6th Year have already selected their Leaving Certificate subjects, so it may be easier to specifically engage with students opinions on their desire or lack of desire in studying CS for their final formal exam in second-level education. Secondly, most students in 5th/6th Year of Secondary School will be over the age of 16, thus meeting the digital age of consent in Ireland. This means that, even though some students are under the age of 18, they will still be able to self-consent to take part in this research study and will not require parental consent to allow this.

Surveys have been designed to explore the educational experiences, as well as intrinsic and extrinsic factors which have motivated students to study CS. Specifically, student self-determined confidence and academic achievement will be queried. An overall interest in CS and the social and emotional factors which influence this will also be investigated. Lastly, participant demographics will be determined based on location, resource availability and socioeconomic background. The investigation of the aforementioned elements of student subject choice was decided based on pre-existing research by the ESRI (Carmel Hannan, 2025) and similar studies regarding CS educational opportunities (Joseph Mintz, 2024).

3.3. Data Gathering

Participants are being recruited at different stages of their formal education. At present, second-level schools are being invited to participate in this research study through teacher mailing lists, specifically themed around Computer Science education. Once a school expresses an interest in taking part, we provide research information sheets for the teacher/principal. As it has been stipulated by TU Dublin's Research Ethics Committee that board of management approval is required in each participating school, additional information sheets and optional webinars are provided for each board of management. Once the project has been approved, information sheets and consent/assent forms are provided to students and parents. Under Irish guidelines, any child under the age of digital consent (16 years of age), can only provide assent, while parental consent is also required. Once a child reaches the age of digital consent, they can consent to take part of their own volition. Throughout the course of the study, we will seek renewed consent each year and will also seek full adult consent from participants, once they turn 18 years of age.

Participant responses will be gathered on a longitudinal basis spanning four years in total; starting in Transition Year, continuing until their first year in Higher Education. Research data will be gathered in two formats. Firstly, students will be provided with a unique survey link, once a year. This will be sent via e-mail or mobile and students will have a set period of time during which to complete this survey. Secondly, student focus groups will be formed from randomly selected participants. Up to six

students at a time will meet with the research team, either in their school, or online. Similar questions to the survey questions will be asked during the focus group, but with more space for detailed discussion and follow-up questions. It is envisioned that responses from the focus group may also shape future iterations of the survey and future focus group questions.

4. Potential Challenges

4.1. Participant Recruitment

Initial recruitment efforts with small cohorts of recently engaged teachers were fruitless. Research recruitment emails were sent to a small group of teachers who attended a workshop hosted by the CSinc Research Centre. Given their vested interest in supporting their students to learn CS at school, we subsequently reached out to them with the hope that they would take part in a research pilot study. However, none of the teachers from this cohort came forward to participate. We will now cast a wider net among the teaching community in Ireland and share this research with local school contacts and online education forums.

4.2. Participant Retention

Given the longitudinal nature of this study, we are aware that participant retention may be a challenge. The majority of students will be recruited in Transition Year, through to 5th Year, 6th Year and 1st Year of Higher Education. We are mindful that some students may only choose to complete a study survey once and may not feel compelled to complete any consecutive surveys. Additionally, it may be unavoidable to lose touch with participants once they transition from second-level education to Higher Education and consequently move outside of the remit of their school. We intend to ensure participants are given ample opportunity to provide feedback on how the research study could be made more inclusive and engaging, so as to ensure student retention for the entirety of the study's duration.

5. Discussion

A substantial amount of foundation work has been completed to date. University ethical approval has been obtained, and promotional materials have been developed as part of this task. Schools have been engaged with for participation via teacher mailing lists and social media. Recruitment efforts will continue throughout each year of this research study. Project promotional materials have been distributed to interested schools, and we are now awaiting Board of Management approval from these schools, with the intent to commence student data gathering in the next academic year.

Additionally, existing literature has been reviewed to guide the research parameters around this topic, particularly in relation to current gaps in literature. A longitudinal study of this kind has not been completed before in Ireland, specifically in relation to the topic of Computer Science. Thus, taking the time to determine the state of play in this topic has been of great importance.

Finally, it is intended that third-level students will also be surveyed in September 2026, to provide insights into their previous experiences of CS at second-level, and how these experiences may have motivated them to take CS in university. Through these collective next steps, it is envisioned that we will gain a robust community of engaged research study contributors, who will share their experiential journey of Computer Science with us, throughout this dynamic stage of their education.

6. References

- Carmel Hannan, E. S. (2025). Who chooses science? a longitudinal investigation of the role of primary and secondary school factors in shaping science enrolments in Ireland. *Oxford Review of Education*.
- Chittum, J. R., Jones, B. D., Akalin, S., & Schram, Á. B. (2017). The effects of an afterschool stem program on students' motivation and engagement. *International Journal of STEM Education*, 4(1), 11. Retrieved from <https://doi.org/10.1186/s40594-017-0065-4> doi: 10.1186/s40594-017-0065-4
- Joseph Mintz, E. O. L. D. T. O. C., Cornelia Connolly. (2024). Inclusive digital education: Contexts,

- practices and perspectives. *Computers in the Schools*, 41(2), 115-119.
- Murray, A., & Smyth, E. (2020). *Growing up and developing as an adult: A review of the literature on selected topics pertaining to cohort '98 at age 20 years* (Tech. Rep.). Dublin, Ireland: Department of Children, Equality, Disability, Integration and Youth. Retrieved from <https://www.growingup.gov.ie/pubs/Growing-Up-and-Developing-as-an-Adult.pdf>
- National Council for Curriculum and Assessment. (2025, September). *Draft specification for leaving certificate computer science: For consultation*. Retrieved from <https://ncca.ie/media/lufoibx3/draft-specification-for-lccs-for-consultation.pdf> (Draft curriculum document for public consultation)
- Tims, J. L., Tucker, C. S., Weiss, M. A., & Zweben, S. H. (2024). Student enrollment and retention in 2022–23 u.s. undergraduate computing programs. *ACM Inroads*, 15(4), 20–46. Retrieved from <https://doi.org/10.1145/3700774> doi: 10.1145/3700774