

An Overview of the Redevelopment of a Computer Science Support Centre and the Associated Pedagogy Impacts.

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Abstract.

“*Support Centres*” are a form of intervention, particularly prevalent in Ireland and the UK through which undergraduate students interact with one or more tutors who help them with their studies. They primarily exist in the Mathematics and Computer Science fields. These centres tend to be remedial, in general aiming to improve the knowledge of struggling students, while also offering additional material to students looking for more of a challenge.

The Computer Science Centre at Maynooth University is a drop-in tutoring service which provides free tutoring to students, primarily of programming modules, in the first and second year of their degree. This service has been running in our Computer Science department since 2012. In the 2019-2020 academic year, two full time tutors were hired to refocus and improve the centre. This resulted in the creation of a redevelopment plan and relaunch of the centre, which will be presented in this paper.

The results of this redevelopment were very promising with the attendance of the centre increasing by over 800% compared to the 2018-2019 academic year. The students who did attend the centre also performed better on average than those students who did not attend the centre in their first-year undergraduate programming modules. An analysis of data relating to students visits to the centre will be presented and discussed.

This paper discusses in detail the redevelopment within the centre and the work carried out by these tutors in their first year, while also presenting future plans for the centre. Guidelines are presented on managing an effective support centre (through our redevelopment plan and support methods), with the hope that more institutions in both Ireland and abroad will consider supporting their students with this methodology.

Keywords: Computer Science Education; Intervention; Social Media; Support Centre; Tutors.

1. Introduction.

“*Support Centres*” are a form of intervention, particularly prevalent in Ireland and the UK in which undergraduate students interact with one or more tutors who support and scaffold their studies. Some examples include the “*Mathematics Support Centre*” at Maynooth University (Mac an Bhaird et al., 2009) and the “*Undergraduate Programming Centre*” at Trinity College Dublin (Stamouli et al., 2004). These centres often focus their resources more heavily on first year and second year undergraduate students, as a method of increasing retention and helping those students who are struggling to understand the introductory material.

The Computer Science Centre (CSC) at Maynooth University is a drop-in tutoring service which provides free tutoring to students taking first and second year Computer Science (CS) modules. This centre has been running since 2012, and was previously known as the Programming Support Centre (Nolan et al., 2015). The CSC is not a remedial centre but is aimed at supporting all students regardless of their ability, and its primary goal is to increase the engagement levels of students with the curricula. Its aim is to increase the retention rate of students who otherwise might drop out of CS, or indeed university altogether. This is an omnipresent goal given the current high dropout rates in CS courses at tertiary level (O’Brien et al., 2016). The CSC focuses on instilling concepts using structured examples and past (but not current) laboratory assignments that the students are struggling with. The centre also provides advanced material for those seeking more of a challenge.

During the 2019-2020 academic year, two full time tutors were hired to oversee the restructuring and expansion of the existing centre with the aim of increasing the engagement of Maynooth University CS students with their course material. With this aim, the hope was to reduce drop-out rates and increase student grades. This paper will discuss the effects those tutors had on the centre, what changes were made to the centre (both in terms of day-to-day running and engagement methods), the outcomes of the CSC for the academic year 2019-2020 and future work that still needs to be done.

2. Background.

Before examining the history of the CSC (Computer Science Department, Maynooth University, 2020), it is important to discuss some of the other support services that exist, both within and external to Ireland. It will be useful to investigate the other methods that educators are using to

support their students. Additionally, it is important to determine how well these interventions are working. This section will investigate these questions and determine where such support centres fit into the pedagogy of CS tertiary education.

In Ireland, several third level institutions run some form of support centre in CS. These include:

- *Computer Drop-In Support Centre* (ComputerDISC) at the National University Galway (National University of Ireland Galway, 2021),
- *Programming Support HelpDesk* at Dublin City University (Dublin City University, 2021),
- *Computing Support Service* at the National College of Ireland (National College of Ireland, 2021),
- *Undergraduate Programming Centre* at Trinity College Dublin (Trinity College Dublin, 2021),
- *Computer Science Support Centre* (CSSC) at University College Dublin (University College Dublin, 2021).
- *IT Learning Centre* at Dundalk Institute of Technology ((Dundalk Institute of Technology, 2021).

All of these centres generally run a drop-in support service, provide tutorials on certain threshold concepts and respond to students via email or by other digital means. Some other institutions (notably many technical universities) offer other supports in the form of helpdesks, general academic learning centres and technical support services for setting up applications and other smaller tasks. For example, University College Cork runs a helpdesk service (University College Cork, 2021). All of these services provide some support to undergraduate students in their early years of study. This is not an exhaustive list of all active services in Ireland, but it is a representative sample.

One case study that has been published around the concept of a CS support centre was that of Stamouli et al. (2004) at Trinity College Dublin. In this study, the authors discuss the structure of their support services as well as the effects that it had on their students. Their centre opened for sixteen hours per week during the 2003-2004 academic year. The focus of the centre was on drop-in support services coupled with reference material and other supports. Over a three-semester period from the initial opening date, the service received 363 visits. Based on feedback from a survey on attendees, the authors found the centre to have been a positive initiative for students. This service which was one of the first of its kind in Ireland is still running today with continuing success.

Computer science learning supports such as these are not as commonplace outside of Ireland. The approaches used in these centres do however hold some similarities to Peer Assisted Study Sessions (PASS) (Dawson et al., 2014; Geerlings et al., 2016). Support centres in Ireland tend not to use academic staff to help students, preferring instead to utilise undergraduate and postgraduate students who have recently finished the material being studied. This allows for tutor familiarity with how a student may be struggling with the material and appears to provide stronger support than an academic rehashing the same material that was covered in lectures. Another method with similarities is that of pair programming (Hanks & Brandt, 2009; McDowell et al., 2002; Williams et al., 2002), where two or more students collaborate to work on a programming question or assignment. This approach has had immense success in third level institutions and is something that we envision our undergraduate tutors as being: they are the (less active) paired programmer collaborating with the struggling student.

The CSC is similar in a lot of ways to the Peer Assisted Study Session (PASS) programme (Student Led Learning, 2015) in that it uses students, who have been trained in best practices, from other years (who have studied the content) to support more novice students. PASS sessions are intended to be supportive and friendly which is something that we endeavour to provide in the CSC. PASS emphasises working cooperatively to share subject-related materials and knowledge which is something that we also offer when groups of students attend looking for help in similar topics. PASS is mainly a facilitation approach whereby students work together under the watchful supervision of a PASS leader. In the CSC however, we do offer tuition to students who need support within a certain topic. Where possible, we encourage group work amongst the students attending the CSC and encourage the paired programming technique (Chong et al., 2005) where this is deemed appropriate.

CS support centres and other similar supports have strong grounding in Ireland. It is the belief of the authors that these centres should be more widespread across the world to help undergraduate programmers with their difficulties. Through strong support, drop-out rates can be reduced (Araque et al., 2009; Kinnunen & Malmi, 2006; Noone & Mooney, 2018; O'Brien et al., 2016), and student self-efficacy can be improved (Irani, 2004; McDowell et al., 2006). In the rest of this paper, the authors will present an overview of the CSC, the engagement levels and outcomes of students, and what the presence of such a centre means to the students.

3. CSC History.

The CSC first opened during the 2012-2013 academic year. Historically, the centre has been managed by an academic staff member and the day-to-day operations coordinated by a member of occasional staff. This day-to-day coordinator has traditionally been a postgraduate student who was paid for 8-12 hours per week. Outside of this coordinator, support at the centre is provided by volunteer (unpaid) peer tutors, mainly comprised of 2nd and 3rd year undergraduate students. The centre is in a small, intimate computer laboratory where students can feel comfortable in a low-pressure environment. The academic staff never attend the CSC when support is being provided.

To determine how the redevelopment of the CSC went, it is important to examine the history of the centre. In the academic year of 2012-2013, the centre opened for a six-week pilot period and targeted one first year programming module. During this period, 79 students attended the centre registering 160 visits in total. These students were an equal mix of top-performing students, average-performing students, and students from the bottom cohort of the class. Initial feedback from these students was extremely positive and coupled with the high number of visits, it was decided to formally open the centre for the next academic year.

During the 2013-2014 academic year, the number of students who attended the CSC increased to 160, with a total of 627 visits recorded. This was the strongest year in the history of the centre. These visits related to students attending the centre for support in three first year modules across two semesters. This year provided some very encouraging data with those who attended the centre doing better on average than those who did not attend. For all three modules the difference in grade of those who attended the centre at least once was statistically significantly better than those who did not attend ($p < 0.001$ in all cases, $p < .05$).

The 2014-2015 academic year saw 128 unique visitors with over 320 visits. Once again, the trend of statistically significant improvements continued across two of the three modules supported. Since then the number of unique students and overall visits can be summarised as follows:

- 2015-2016 saw 136 students and 333 visits.
- 2016-2017 saw 168 students and 534 visits.
- 2017-2018 saw 103 students and 271 visits.
- 2018-2019 saw 51 students and 122 visits.

While the centre has had a strong history of supporting students and increasing the results of students, in recent years the engagement level had begun to subside. Furthermore, in the 2018-2019 academic year, the grades of attendees at the CSC were statistically similar to the grades of non-attendees. As this was the last academic year that the CSC ran before the restructuring, we will present some more details on the running of the centre during the 2018-2019 academic year in the next section.

4. 2018-2019 CSC Structure.

In the 2018-2019 academic year, the CSC was run with a cohort of 16 undergraduate tutors (2nd and 3rd year students who had performed above a predefined threshold in the first-year programming modules) and two postgraduate coordinators (splitting the contact hours evenly with one in charge of administration). All undergraduate tutors were selected based on their responses to an application form, their motivation for wanting to tutor at the centre and their grades in their first-year or second-year programming modules. All undergraduate tutors were hired on a voluntary basis as we have found that this tends to lead to a stronger cohort of undergraduate tutors, as they are choosing to be there of their own volition to help their peers. This motivation is a key factor in supporting student aptitude (Stamouli et al., 2004).

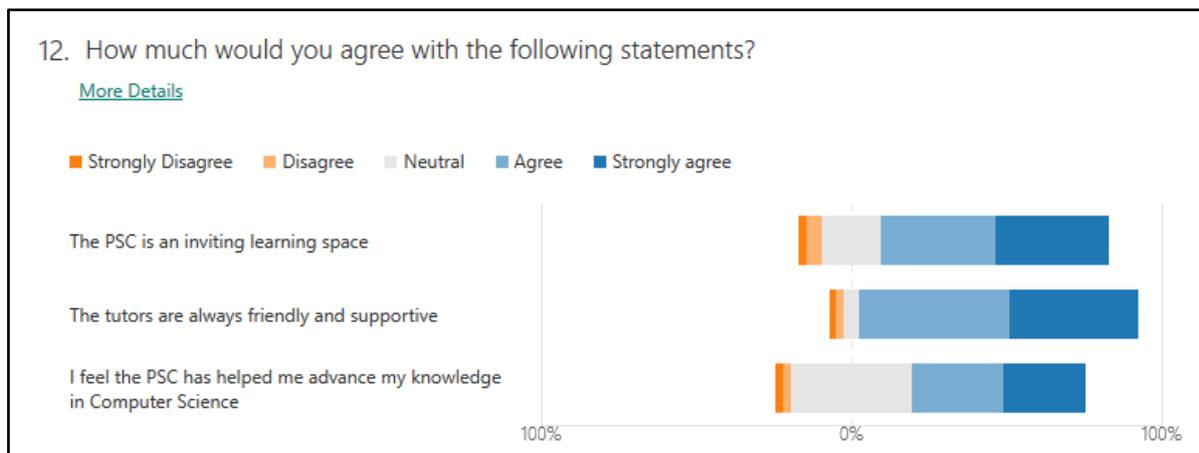
The CSC was open for nine contact hours each week, spread across Monday to Wednesday. The first-year students had their programming laboratories on Thursdays and Fridays, so these days were avoided to ensure as little clash with timetables as possible. Based on an end-of-year survey (which will be discussed in more detail in the “*Results and Outcomes*” section), approximately 23% of all first-year students attended the CSC at least once during this academic year. This level of engagement was very low considering the centre does not only cater to struggling students but also to advanced students.

As well as drop-in support, several tutorials were offered throughout the year on a timetabled basis. These were coordinator led and covered a singular topic in detail, which had been suggested by the students. The feedback for these tutorials was very positive but the attendance rates were lower than had been anticipated. The final forms of communication that the centre offered were email support and social media (Twitter) updates to the students on the centre and the services offered.

5. CSC Redevelopment.

During the summer of 2019, prior to the beginning of the new academic year, a redevelopment plan for the CSC was developed by the CSC manager and the two tutors. This redevelopment was required due to low attendance levels in 2018-2019. The results of an end of year survey from that year showed that only 78 out of 134 respondents were aware of where the centre was located. On a positive note, 73.2% of those who did attend found the centre to be an inviting space which was a positive part of their learning experience. The data relating to this question can be seen in Figure 1 (further analysis of the data will be examined later). From this feedback, it was apparent that some things were going right in the centre but that much more needed to be done to improve it. A lot of the groundwork that was laid for the centre in prior years was maintained, with the redevelopment goal being to expand on the positives in the CSC, with a goal of increasing student attendance and engagement. The following sections will detail changes that were implemented either prior to the commencement of the academic year 2019-2020, or early into it.

Figure 1: 2018-2019 CSC Feedback.



5.1 Rebranding to Computer Science Centre.

The first major decision was to rebrand and rename the centre. As previously mentioned, the centre was originally called the “*Programming Support Centre*”. It was decided to change the name to “*Computer Science Centre*” for several reasons. Firstly, the original name and the presence of the word support did not represent the centres aims of fostering and furthering the talents and confidence of those students who are not having difficulty with the lecture or lab

material. Secondly, as the centre would expand to support additional modules such as “*Databases*”, we didn’t want students to think they could only come in for support with “*programming*”. It was felt that the name “*Computer Science Centre*” was a more appropriate name going forward.

5.2 Increasing Opening Hours.

In prior years, the CSC opened for between 8-10 hours per week, usually on a Monday through Wednesday. The opening hours were increased to 14 hours for the 2019-2020 academic year coordinated by the tutors. On top of this, the hours were more spread out (in terms of days) and featured more blocks of time greater than one hour. From data gathered in previous years, those days with longer blocks tended to attract more students, with many of them staying for more than one hour.

5.3 Moving to a permanent location.

One of the main issues that arose from a 2019 survey of first year Computer Science students was that despite all the advertising undertaken and discussion of the centre in lectures, labs and on Moodle, 42% of students did not know where the CSC was located. Part of this issue stemmed from a change in location that was made between semesters. For the redevelopment plan, a permanent dedicated location would be used which would be exclusively used for support during the CSC’s opening hours.

5.4 Increasing module coverage.

In previous years, the CSC offered support and extra material for the first year CS modules (three when the centre opened and then four when first year was restructured and expanded) within our department. As part of the restructuring plan, the modules supported were expanded to include three second year modules and one higher diploma module, all of which would be coordinated by the two tutors.

5.5 Improving undergraduate tutor training.

Training has always been provided to the volunteer undergraduate tutors on effective teaching skills, but prior feedback has shown that some of them still feel unprepared when it comes to sitting down and working with a student. The previously developed training documentation and

training session approach was improved to include more advice regarding face-to-face interactions rather than just focusing on the “rules” of conduct. This training was organised and ran by the two tutors.

5.6 Student induction session.

In the past, students have been told about the CSC during their introductory lectures, as well as given reminders throughout the year via Moodle and email, but they have never been shown where the centre is located. To help combat the issue of students not knowing where the centre is, it was decided to run an induction session for first year students during the second week of semester one (in line with the first week of laboratory sessions). This induction session would involve the tutors showing the students the room where the CSC is located, advising them as to the services provided, showing them how to contact the CSC on social media and introducing them to some of the volunteer undergraduate tutors. As well as showing them the location, it was envisaged that this session would demystify what the centre is and what it does.

5.7 Increasing Social Media presence.

During the 2018-2019 academic year, a Twitter account was created for the CSC. The plan to enhance the CSC envisaged an increased usage of Twitter and to create a presence on both Instagram and Facebook. To encourage subscription to the CSC feeds, it was decided to run a competition for free lunches in the campus restaurant during the induction week (open to students who engaged with the CSC on these platforms).

5.8 Weekly competition questions.

To encourage further engagement with the CSC, it was decided that a coding competition would be run with weekly questions to challenge those students who wanted to further engage with CS. As an incentive, it was decided that both prizes (Arduino Uno's, Raspberry Pi's, University hoodies) and certificates would be offered to participants, and the questions would get increasingly difficult over the course of a semester. The tutors organised and ran these competitions and created and curated the questions.

5.9 Robocode competition participation.

As well as the weekly competition, Limerick Institute of Technology hosts an annual competition

for first year undergraduates around the concept of robots and AI design (Limerick IT, 2020). This utilises the tool Robocode using the Java programming language (the language used in MU) to build a digital robot to battle against other robots. MU has entered this competition in the past but has not done so for a number of years. As part of the enhancement of the CSC it was planned that this competition would be promoted to the first-year students with the aim of entering a team.

5.10 Extra practice questions.

One of the policies of the CSC has always been that students cannot receive help with the current week's laboratory assignment. This can make it challenging to teach concepts sometimes without referring to the assignments. To address this, the plan was for the tutors to create a repository of extra practice questions covering content like those in the assignments. With these available, undergraduate tutors would be able to work through an example using one of the practice questions before getting the student to give it another go. These extra practice questions would be created in blocks aligned with the main threshold concepts of each module.

5.11 Creation of “*Cheat Sheets*”

As well as the extra practice questions, we wanted materials that a student (or undergraduate tutor) could easily “*grab and go through*” to provide support in a concept. This would be achieved through the creation of cheat sheets which would be placed on literature stands in the CSC. These materials will hopefully encourage students to take more responsibility for their own learning in a self-directed approach as well as encouraging more collaboration between students. The tutors would oversee the creation of these in conjunction with the undergraduate tutors.

5.12 Increasing the amount of tutorials offered.

In previous academic years, tutorials have been run on an occasional basis. During this year, the aim was to increase this to a weekly basis. It was envisaged that each tutorial would be on a threshold concept or on revision material and would rotate between different modules to ensure good coverage over all supported modules. The concept covered in the tutorials will be selected by the students and would be delivered by the tutors.

During the first semester of 2020/21 this was introduced in the form of an (optional) weekly online tutorial. This tutorial was very highly attended with an average of 105 attendees each week. Initial feedback for these tutorials was very encouraging, with students finding it helped them make the concepts more concrete. These tutorials were previously less frequent and lightly attended when “*in person*” in the past.

5.13 Increasing advertising.

As well as augmenting the quality and quantity of posters advertising the CSC around the campus, it was also hoped to change the design of these posters frequently to keep them eye-catching. As part of the rebranding, it was also decided that professional banners would be designed which will stand outside the centre advertising its location and opening hours.

5.14 Email Interventions.

In previous academic years, a student in our first-year programming module would be able to see their results for the lab as they were working through questions, using our automated feedback system. A grade for each question would appear next to their submission every time the student looked at those questions. However, for those students who did not attend, or who were performing poorly in the module, there was no follow up notification until after in-class examinations took place, usually after six weeks and eleven weeks. It was decided that a new system would be trialled as part of the CSC redevelopment. Students would receive an email after every laboratory session telling them their grade. All students would receive a tailored email based on their grade, either encouraging them to attend the CSC to get help or to avail of some of the advanced material on offer.

The full details about each email type are as follows:

- If a student failed to attend a laboratory session, they would receive an email asking them to contact the teaching team to explain their absence and encouraging CSC attendance to help catch up with the material that they missed.
- If a student obtained less than 40%, they would be told that they must attend the CSC to catch up.
- If a student obtained between 41% and 50%, they would be encouraged to attend the CSC to help improve their understanding.

- If a student obtained between 51% and 70%, they would be asked to attend the CSC if they wanted clarification on anything from the laboratory session.
- If a student obtained over 71%, they would be encouraged to drop into the CSC to take a look at some advanced material / alternate projects to challenge themselves with.

The idea behind this intervention is to always keep the student informed of their progress, and to keep the CSC in their mind regardless of each individual students' circumstance.

6. COVID-19 Response.

After the redevelopment of the CSC and a successful first semester, hopes were high for continued success in the second semester. For the first few weeks, things continued as planned. Then, the COVID-19 pandemic struck and the CSC in its traditional form was locked down. The focus in the CSC switched to supporting the first-year undergraduate labs using Microsoft Teams. These labs were run through an online automated system for programming and Teams was used to answer questions from students. The students were informed of what the CSC was doing to support them in their labs in addition to answering all student queries via email and social media.

This change in methodology strongly influenced the numbers engaging with the CSC and our ability to connect with the students. Thankfully, a rapport had already been built up with many students up to this point. This made it a lot easier to maintain contact with the regular attendees and to ensure that they were managing the situation okay. Over the summer of 2020, work was undertaken to attempt to future proof this new "*online*" approach including adding elements to our Microsoft Teams page. These elements included internal links to our support videos, more engagement with students through frequent posts and a private discussion channel for quick communication between undergraduate tutors and the CSC coordinators. Building a rapport with our students has proven much more difficult in this environment, but we still do note several "*regulars*" participating.

7. Results and Outcomes.

This section will present the statistical data for the CSC, collected during the 2019-2020 academic year. It will mainly focus on the first semester, given that data for the second semester

is incomplete due to the COVID-19 pandemic. As there is no historical data for the second year and HDIP modules, which were supported for the first time this year, the focus in this paper will be on the first-year modules that have a history of being supported. Examination grades, the number of registered students, the number of visits, and some other anecdotal feedback will be discussed, and these results will also be compared and contrasted with the same period in the 2018 - 2019 academic year for clarity of success.

7.1 Quantitative Data.

Analysis of the CS161 (first semester core CS module) results for the CSC attendees was very encouraging in 2019-2020. Of the 322 students registered for the CS161 module, 93 (28.9%) attended the CSC at least once over the course of just one semester. The average number of visits per student was 5.24, with a standard deviation of 6.82. The average final mark for the module was 51.47%, while the average mark for those who attended the CSC at least once was 55.22% and the average for those who never attended the CSC was 49.95%.

It can be seen in Table 1, that when a t-test was run on this data a p-value of 0.054 was achieved; while it is not statistically different it is very close to being so, only 0.3% off. This data can be summarised as shown in Figure 2, where the population density graph for students who attended the CSC is slightly skewed to the right.

Table 1: T-Test for CS161 CSC Attendees vs. Non-Attendees (2019-2020).

	CSC Attendees	Non-Attendees
Mean	55.22	49.95
Sample Size	93	229
Standard Deviation	20.9	24.76
	P Value	0.054
		Statistically Similar

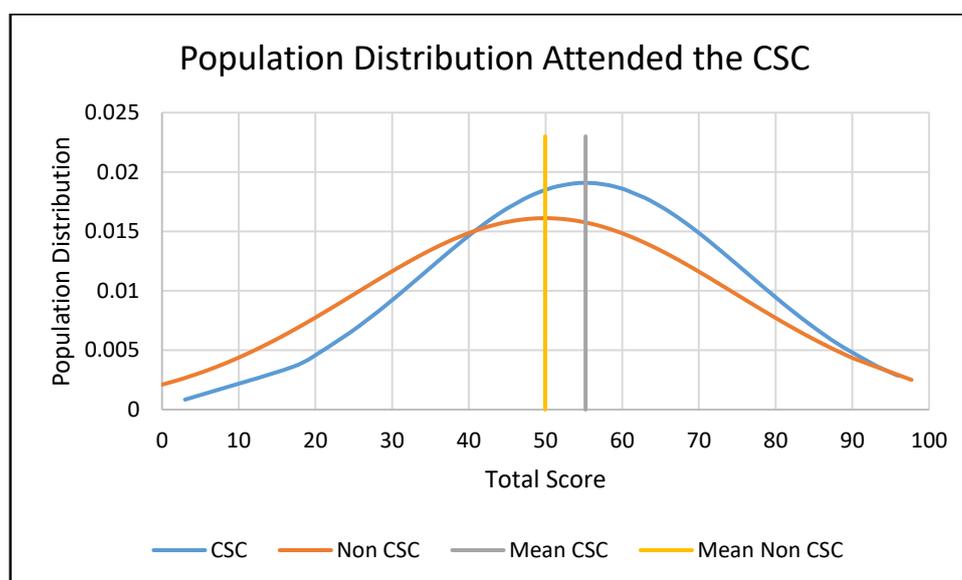
The examination grade figures improve when looking at a student who attended the CSC at least twice over the course of the module. Fifty-nine students (18.32% of the class) attended the CSC at least twice over the course of the module. The average mark for these students was 56.26% and for a student who attended once or who never attended was 50.40%. As can be observed in Table 2, a t-test on these students resulted in a p-value of 0.049. This infers that attending the CSC at least twice can statistically improve a student's result. This can also be

seen in Figure 3, where the population density graph for students who attended the CSC at least twice, is skewed to the right.

Table 2: T-Test for CS161 CSC attendees vs. 0 or 1 attendance (2019-2020).

	CSC Attendees	0 or 1 attendance
Mean	56.26	50.4
Sample Size	59	263
Standard Deviation	17.59	24.59
	P Value	0.049
		Statistically Different

Figure 2: Population distribution of CS161 results (2019-2020).



Another important quantitative metric is the overall number of visits to the centre. During the first semester, there was a total of 702 visits by 150 students. The number of student visits was up 800% on the same time in the previous year and the number of students registered was up 280% on the whole of the previous year. The breakdown of these visits across our opening weeks can be seen in Figure 4. It is important to note that 117 of the 702 visits are not represented on this graph as they occurred during an intensive three week higher diploma module which the CSC also supports. Furthermore, 76 of these visits were for second year modules. This leaves a total of 509 visits by 93 first year students during the semester (a visit increase of 578% on the same time in the previous year).

Figure 3: Population distribution of CS161 results for multiple attendances (2019-2020).

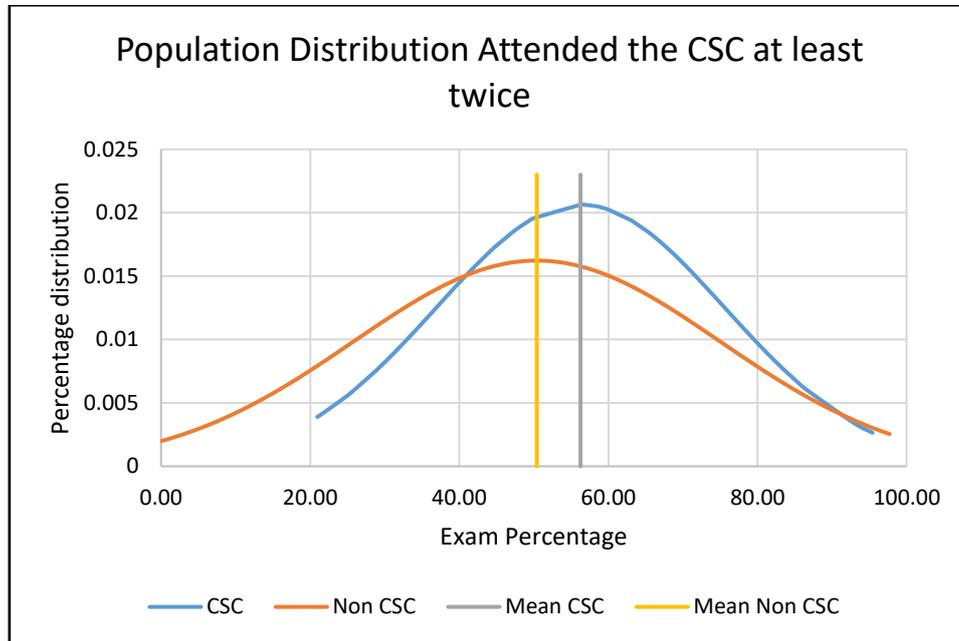
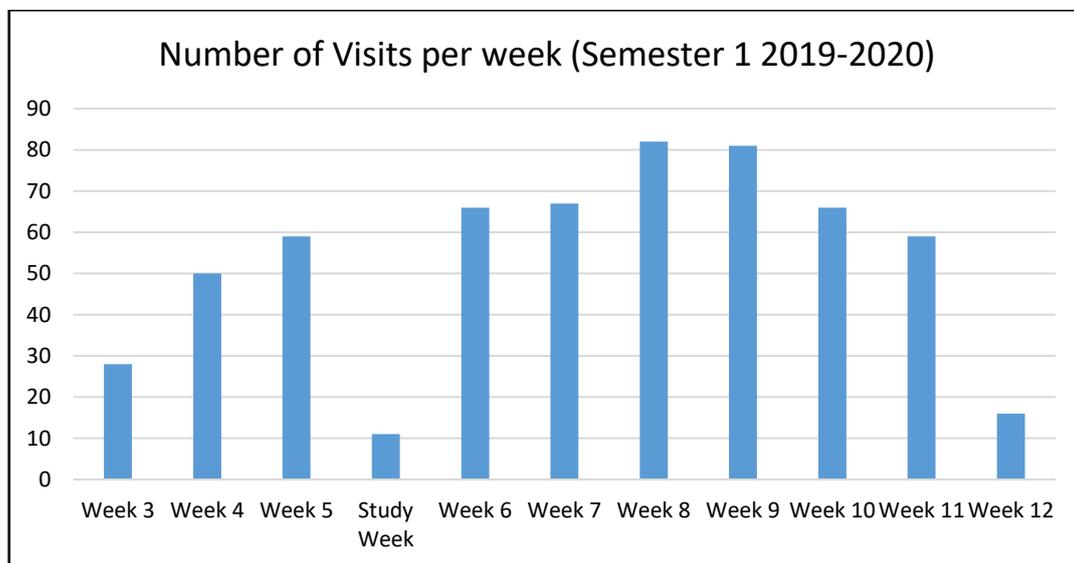


Figure 4: The breakdown of first semester visits (2019-2020).



Additionally, 265 visits occurred during the five-week period that the CSC managed to open in the second semester before the COVID-19 lockdown, 246 of which were by first year students. Thirty new students also registered with the CSC during this period. The number of visits were

trending upwards week-on-week and it looked like it would be another strong semester within the centre. Support was still provided online during the lockdown, but data was not collected on these engagements.

Overall, there was a total of 967 visits to the CSC in the 2019-2020 academic year. In the 2018-2019 academic year, there were only 121 visits. This is an improvement of 699%. If we limit our analysis to only visits by first year students (given that the second-year modules were not supported in 2018-2019), then there was a total of 755 visits in the 2019-2020 academic year. This is still an improvement of 524%. In 2018-2019, there was a total of 51 students registered with the CSC, compared with 180 students registered in 2019-2020, an increase of 253%. Once again, examining only first year student registrations, we had a total of 122 during 2019-2020. This remains an increase of 139%. It is safe to say that these increases were not due to chance and were due to the interventions put forth by the redevelopment plan. These are the kinds of numbers we hope to see going forwards, and furthermore we hope the increased engagement of students will lead to increased interested in volunteering as a tutor which in turn will lead to an even stronger talent pool of support staff for the students.

On the tutorials front, approximately six were ran during the first semester, as well as one exam revision tutorial in January. The average attendance for these tutorials was 15. For the exam tutorial, 77 students attended. The feedback for these tutorials was very positive. It was generally a similar cohort of students attending during the semester, giving a compounding advantage to them.

7.2 Qualitative Data.

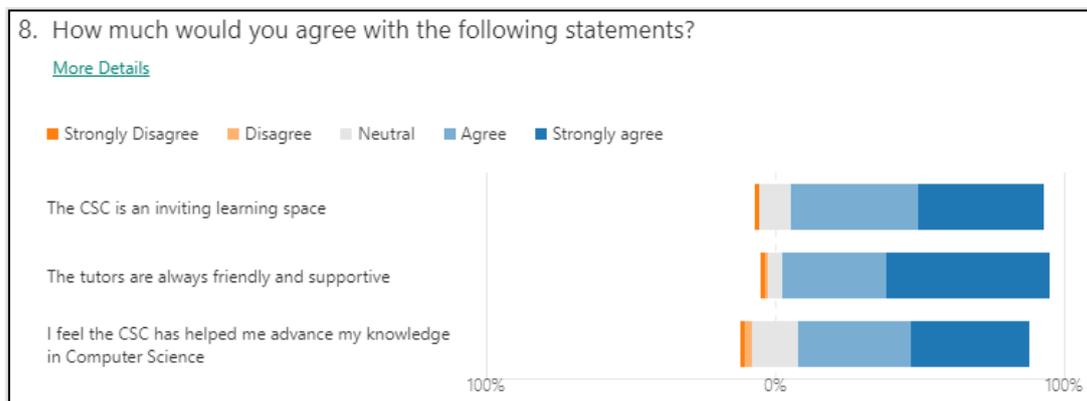
During the last full laboratory session for CS161 (at the end of semester one of 2019-2020), a survey was completed by the students in relation to the CSC. The feedback received was very positive, and a large improvement was observed in the results of a similar survey administered on the 2018-2019 students at the end of their second semester.

In total, 245 students completed this year's survey, compared with 175 from the previous year. Of the 245 students, 49% of them (120) claim to have attended the CSC during the semester. It is important to note that this figure is different from the one reported in the "*Quantitative Data*" section, which was 93. This figure is self-reported while the previous figure was based on the number of students who had signed into our online system. Some of the additional students

may not have signed in and / or may have attended the CSC for help with a different module or attended a tutorial where signing in was not mandatory. Some students may also have considered attending the induction day “*attending the CSC this semester*”. Either way, this was a very encouraging figure given that only 23% (41 out of 175) claimed to have attended in the previous survey, and that survey was based on a full year rather than just a single semester.

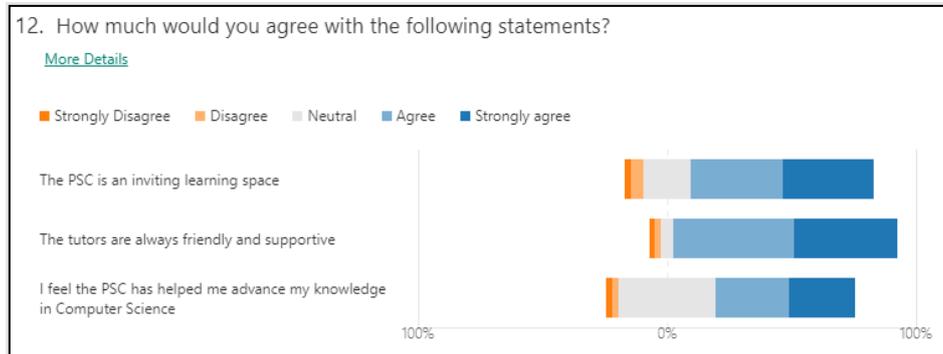
Of the students who attended the CSC in semester 1 of the academic year 2019-2020, 87.5% of them agreed or strongly agreed the CSC was an inviting learning space, 92.5% of the attending students agreed or strongly agreed the tutors were always friendly and supportive, and 80% of those attending agreed or strongly agreed the CSC helped them advance their knowledge in Computer Science. These findings can be seen in Figure 5. All these results are an improvement on the previous survey where 73.2% agreed or strongly agreed the CSC was an inviting learning space, 90.3% agreed or strongly agreed the tutors were always friendly and supportive and 56.1% agreed or strongly agreed that the CSC helped them advance their knowledge in Computer Science, as can be seen in Figure 6.

Figure 5: 2019-2020 survey results (statements).



Given the inclusion of the induction sessions for all first year-students at the start of the 2019-2020 academic year, an important metric was to determine how many students knew where the centre was located. In 2018-2019 only 58% of students knew this (78 of 134). This year, this value increased to 96% of students (235 of 245) with likely only those students who were absent on the induction day not knowing the location.

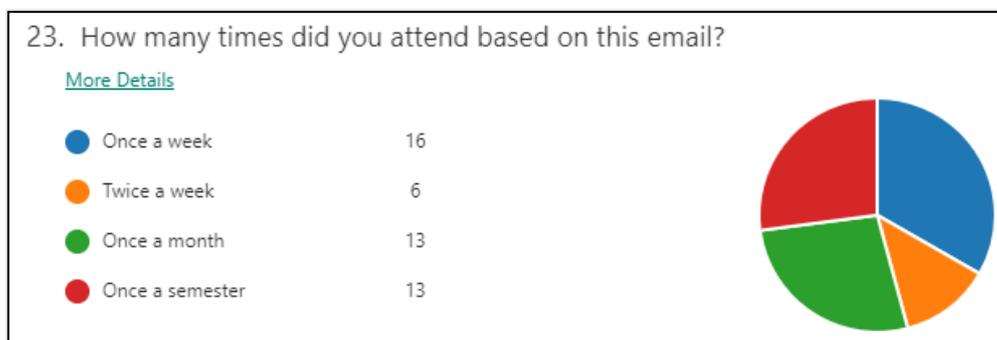
Figure 6: 2018-2019 survey results (statements).



The awareness of the social media presence of the CSC has also increased significantly, with 64% of this year’s first year students aware of them, compared with 10% in the previous survey. The CSC offers advanced material to challenge students, such as programming competitions, a hardware rental scheme and an opportunity to enter the Robocode competition. Of the students surveyed, 83% of them were aware of such advanced materials and supports. This is up from 27% in the previous survey.

Another incentive that was trialled during the first semester was weekly emails to students with their lab grade in it. Depending on the grade that a student received in their lab, they received an email suggesting to them to attend the CSC for different reasons, for example, to catch up on material, to clarify topics or to get advanced material. Ninety two percent of the first-year students surveyed were aware of the emails they were receiving. Of these students, 21% of them attended the CSC based on this email and 46% of those who attended, attended at least once a week, as seen in Figure 7.

Figure 7 : Number of visits resulting from emails.



The students were also asked “*What aspects of the CSC's services do you find unsatisfactory?*”. This question was asked to gauge what improvements could still be made to the CSC. The primary “complaint” which 47.3% of survey takers mentioned was the number of opening hours for the CSC. The opening hours had increased from 9 the previous year to 14 this semester, so this is not a bad complaint to receive. The potential for more opening hours will be examined but in general, there is an apex for room availability.

For most questions on the survey, the large increase in positive responses demonstrate that there was a completely different attitude towards the CSC in this academic year. These positive changes included more attendees, better outcomes and stronger engagement with the CSC. A lot of this engagement continued during the first half of semester two but unfortunately, the COVID-19 lockdown occurred midway through the semester damaging our ability to complete the perspective for the whole year. Even still, this is very encouraging data which we will aim to mirror and improve further during the 2020-2021 academic year.

7.3 Comparisons with other studies on the efficacy of student support services.

There have been many similar studies on the efficacy of student support services, across disciplines. In this section we will briefly discuss two such studies and determine if our results are comparable.

The Mathematics Support Centre (MSC) at Maynooth University has been in service since 2007. In a 2009 paper about the initial impact of this centre (Mac an Bhaird et al., 2009), it was found that the pass rate of students who visited the MSC more than once was 80%, while the pass rate of students who visited the MSC once or less was 63.5%. This aligns with the findings of this paper whereby we found that multiple visits to a support centre have a statistically significant impact on examination grades. This study also finds that a support service is important for “*at-risk*” students who might otherwise struggle to get through the module. This is an important target audience for us.

Similarly, Mahdi (2006) discusses the implementation of a “*Peer-Supported Learning Group*” in an Engineering course. Again, this paper concludes that students who attended multiple tutored sessions achieved significantly higher average grades in their end of semester exams. Their students also had similarly positive remarks about the sessions. In particular, the “*informal*

setting” and the ease of being able to ask questions a peer rather than an academic was highlighted by the students.

These results infer that support services are important across multiple disciplines. As educators we should be doing everything that we can to support early learners on their educational journey. Furthermore, it infers that our results are in line with similar studies and that the redevelopment of the CSC has been a success to date and encourages us to keep expanding and improving our services.

8. Conclusions and Ongoing Work.

In conclusion, the effect of hiring tutors and enacting a redevelopment plan has had a profound impact on the efficacy of the Computer Science Centre. The number of visits increased dramatically, and it was found that visiting multiple times led to a statistically significantly higher examination grade. Of those who did attend the CSC, most attended multiple times, with many making it a part of their study routine. This group of students were also more likely to get involved with things like competitions and tutorials, thus increasing their engagement levels with the material. Given the increase in engagement, and the increase in final grade, it is clear that such a service is a positive offering for our students. Additionally, the feedback from students was very positive. The redevelopment plan fixed a lot of the issues that existed in the centre in the past. The most telling sign will be if this growth continues into future academic years. In particular, will the number of attendees, the number of overall visits, the number of students applying to work at the centre as tutors and the overall grades of students who attend the centre increase?

As discussed in the “*COVID-19 Response*” section, the academic year of 2020-2021 has presented many challenges, previously unimaginable; these challenges will continue to be with us for the foreseeable future. We are facing the reality of first-year students not having any physical lectures for an entire year. This has needed some careful planning on how to help support these students as they transition to third level. Many of the implemented changes will be kept and some further emphasis will be put on engaging more students earlier and getting them involved in diverse ways (competitions, social media, tutorials, drop-in encouragement). Of course, there will be the added difficulty of the social distancing requirements post COVID-19. Over the coming months, plans will be implemented to ensure that there is no reduction in the quality of our services due to these requirements when we do return in person, with a

particular focus on creating strong online material and determining how to build a solid rapport with students who we may or may not have met face-to-face.

Finally, another major initiative that is in the planning stages is the creation of an Ireland wide effort to expand on the quality, effectiveness, and prevalence of support centres across all third level institutions. Currently, only a small number of dedicated Computer Science support centres exist across the country despite their success at some institutions. With this in mind, an application to the National Seminar Series for 2021 with the goal of running a workshop to discuss the existing centres and existing intervention methods under use, and to encourage further collaboration and communication between educators in the country to both better our supports and to have further supports to be established in locations that currently have none. This application was successful, and a very engaging workshop took place in March 2021. This workshop gave researchers and support centre managers a chance to see what others in the country are doing. We plan to make this an annual event, and to continue collaboration with other institutions. A discussion group has also been formed to this end to promote these centres nationally. Through continued developments within our own support centre, and collaborative engagements such as this workshop, we aim to increase the prevalence and pedagogical effect of such supports for programming students across Ireland.

Hopefully this paper has provided some insights on creating a Computer Science support centre and if you are interested in further discussing these ideas, please feel free to contact the authors.

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