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Microsoft DreamSpace: A Catalyst for Education Change

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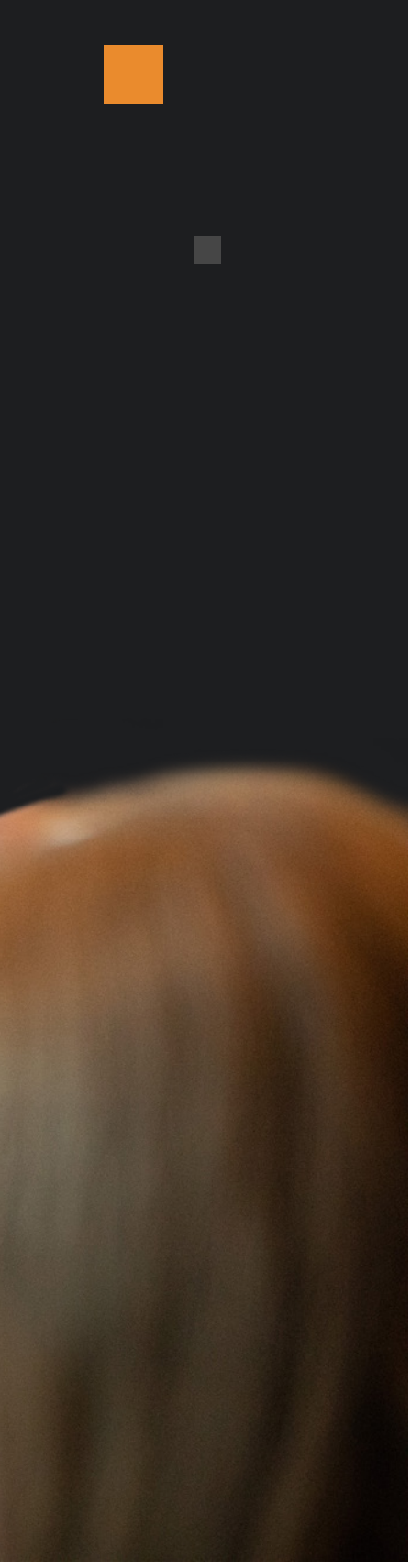

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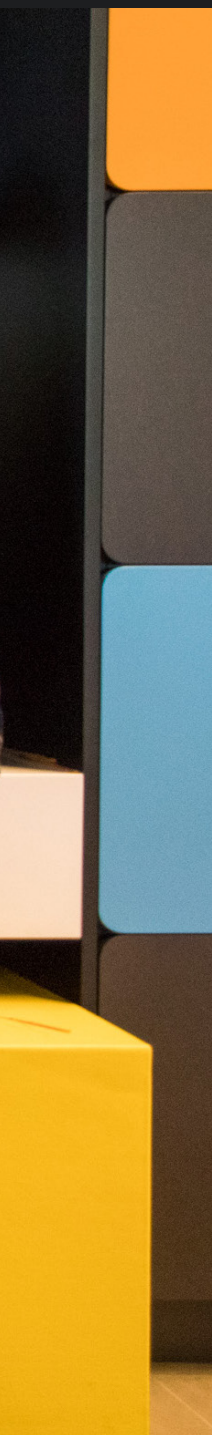


There is a widespread understanding that the jobs market has radically changed, that traditional education journeys – from primary to third level – do not adequately prepare students with the 21st century skill they will need for a fast-evolving workplace. There is consensus too among educationalists and policy makers about the solution, the need for a greater focus on transversal skills, such as critical and creative thinking, while at the same developing experiences with emerging technologies that will inform students' lives long into the future.

Microsoft DreamSpace was designed and developed with teachers as a practical and deliverable programme to include all elements of the solution. A survey of 38 teachers who have attended DreamSpace and 100 who had not attended DreamSpace since it opened in 2018, reveals tangible benefits from the experience:

- 22% felt they were more likely to promote critical thinking in their students
- 40% felt more likely to promote creativity and the creative use of technology
- 29% felt an increase in self-efficacy and their ability to implement tech in the classroom.

DreamSpace prompted a shift in their pedagogies, from endorsing self-directed learning to integrating 21st Century Skills into their teaching. For some teachers, it helped break down fears about using technology in the classroom.

By April 2020, 26,000 students have spent half a day at DreamSpace. Qualitative analysis of their experience reveals an enthusiasm for self-directed learning and a greater appreciation for more creative ways of developing skills. Many felt the collaborative environment was a flavour of what they might expect in the future workplace.

What makes DreamSpace different from other explorations of new pedagogies is that it provides a model that is transferable to existing education systems. Components of the programme directly address cultural and practical barriers to 21st Century Learning, in ways that can be easily emulated, replicated and further developed by stakeholders.

Overcoming Cultural Barriers

EMPOWERING TEACHERS TO TEACH 21ST CENTURY SKILLS

Challenge: Some teachers have difficulty embedding technology into the curriculum and feel their teaching education and professional development has left them ill-equipped to introduce 21st Century Skills. While teacher education has greatly improved, the focus on exam results means that more conservative pedagogies inevitably prevail, leaving little room for innovation.

Solution: DreamSpace encourages collaboration that can be applied to any subject area, where communication is more important than technology. Many sessions are screen-free, reminding teachers that 21st Century Skills are more about a mindset than a device. Tech tools support this, not lead it. Along the way, teachers become more comfortable with technology because they start to appreciate its role as an enabler for student-led learning.

IGNITING STEM LEARNING THOUGH PRACTICAL EXPERIENCE

Challenge: A concerted effort to encourage students to take STEM subjects by awarding extra point has not proved particularly successful. Worse, there has been very little extra uptake among girls (Education Indicators for Ireland, October 2019), and old stereotypes around subjects and gender remain.

Solution: By stimulating the imagination of students through practical problem-solving exercises and writing code, DreamSpace liberates STEM from subject-based textbooks and gender bias. With the programme located in the Microsoft building, students and teachers are encouraged to make real-world connections between STEM learning and STEM careers.

LEVELLING THE PLAYING FIELD FOR SPECIAL EDUCATION NEEDS (SEN) STUDENTS

Challenge: SEN students who struggle with literacy are inadvertently penalised by a system which places so much emphasis on subjects like English, History and Geography, and few schools have the resources to give them the special tuition they need.

Solution: By providing a more practical learning environment, DreamSpace encourages different skills. A focus on coding and STEM-based learning gives SEN students a chance to shine; it opens the door to a future that they might not previously have had sight of, and a career at a company like Microsoft where their strengths are precisely what is needed.

Overcoming Practical Barriers

FINDING TIME FOR NON-CURRICULAR ACTIVITY

Challenge: Curriculum overload can be detrimental to pedagogical innovation and the student experience. With pressure on teachers to meet the requirements of internal and external assessment, particular in secondary schools with the Junior and Leaving Cert cycles, the opportunity to explore transversal skills is limited.

Solution: DreamSpace engagement is currently built to fit two windows in the school journey. One is for senior primary school, ahead of the move to secondary school and choosing Junior Cert subjects. The other is in transition year, before the Leaving Cert cycle starts. The primary school window is recognised as a key time to stretch the boundaries of a young person's creativity; transition year is a last chance for non-curriculum activities and self-discovery before exam preparation takes over.

ACCESSING TECHNOLOGY IN A WAY THAT IS PRACTICAL AND AFFORDABLE

Challenge: The benefits of integrating technology into daily teacher practices are understood but funding the initial investment and then providing ongoing technical support has been prohibitively expensive for many schools. The inevitable consequence is that better resourced schools with proper management structures are often better equipped than non-fee paying schools in socially disadvantaged parts of the country.

Solution: Although technology is an element of DreamSpace, it is not fundamental. Sessions include unplugged activities, practical ways to develop coding concepts, critical thinking and creative storytelling without using screens. When technology is required, students are issued with affordable, entry-level tablets to access learning resources or tiny micro:bit micro-controllers to write code and explore digital creativity. Cost and complexity are kept to a minimum.

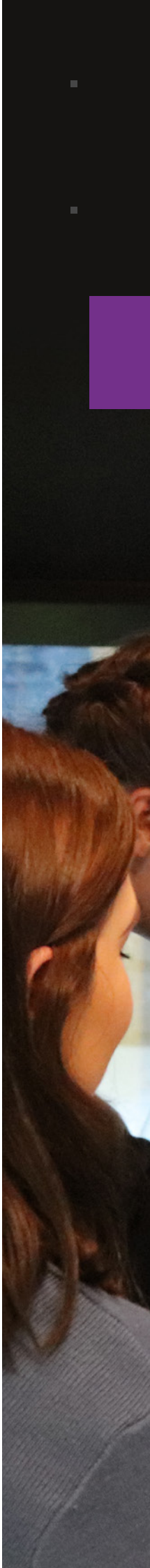
MAKING CLASSROOMS MORE FUN AND FLEXIBLE

Challenge: Traditional teaching practices are reinforced by physical spaces. Rows of desks with a teacher at the top of the class are a manifestation of pedagogies that are hard to change and unsuitable for learning 21st Century Skills. Collaboration, communication and self-directed learning demand a different kind of space.

Solution: A bright open area with moveable tables and chairs, DreamSpace encourages flexible and collaborative working, where students can quickly set up in teams for the duration of a task and change things around when it's complete. While it's difficult for schools to replicate the space at scale, many teachers who have taken the experience have sought to recreate the environment in at least one room.

Microsoft DreamSpace is a world's first, a living and breathing education space that gives teachers and students the opportunity to experience 21st century learning. By opening its doors to schools and pursuing best-practice student-centred teaching, and by addressing the specific challenges that schools face, DreamSpace has become a catalyst for real change.

To register to attend and to follow how DreamSpace progresses visit www.dreamspace.ie.



Introduction

Context to The Research

In recent decades, education has become recognised as being a strategic driver of social, economic and cultural development (Coolahan, 2003; Girvan, Conneely, Tangney, 2016). The education system has therefore been tasked with preparing young people to live and work in a rapidly changing society. Focus has shifted from the education system providing rigid paths to specific careers to the development and fostering of '21st Century Skills' which can be applied across a variety of contexts and settings (Ananiadou & Claro, 2009). A skills-based approach allows students to compete in competitive, and sometimes harsh economic environments.
The Lisbon Strategy (2000), placed personal and social fulfilment in the context of economic goals. Since the adoption of a competency-based education principals, many versions of the terms and competencies have been developed internationally. Key frameworks such as the UNESCO four pillars (1996), the OECD DeSeCo (2005) and the EU Key Competencies for Lifelong Learning (OECD, 2005) have identified specific skills or competencies that are fundamental including cognitive competencies, incorporating the ability to think critically and creatively and to use these skills to engage in self-improvement. In addition, these frameworks suggest that the modern learner also needs to be able to collaborate with their peers and to communicate effectively. Coupled with these skills is an overarching expectation that students can use suitable information and communications technology (ICT) in the context of these competencies.

There has therefore, been a growing recognition of the need for change in pedagogical practices so that teachers can provide students with the opportunities to develop the necessary skills to navigate the 21st century. As a result, several countries have reviewed their curriculums and related professional development offerings for new and existing teachers (Girvan, Conneely & Tangney, 2016). For example, in Ireland, reform of post-primary education has been underpinned by overlaying curriculum content with selected "Key Skills" identified by the National Council for Curriculum and Assessment (NCCA) (2009). These skills include, but are not limited to: information processing, critical and creative thinking, working with others, communicating and being personally effective (National Council for Curriculum and Assessment, 2009).

Unbox your Ambition

What is Microsoft DreamSpace?

DreamSpace at Microsoft Ireland aims to inspire students and teachers to see how technology can enhance education in exciting new ways, through immersive teaching and learning experiences, helping them to realise the full potential of what they can achieve.

DreamSpace uses technology as the medium to provide primary and secondary school students with practical, real-life skills which include critical thinking and problem solving. As well as developing practical skills, DreamSpace aims to be a catalyst for change by demonstrating to both students and teachers what's possible with technology, fostering creativity, shaping ambition and cultivating ideas. DreamSpace aims to foster such key skills as critical and creative thinking, working with others, communicating and being personally effective through the medium of information and communications technology (ICT).

Primary School Experience

The DreamSpace Primary School experience is designed to stretch the boundaries of their creativity. Through the use of innovative technologies, students will discover the world of tomorrow and imagine their place in it.

Transition Year Experience

For Transition Year students, this is a period of discovering their place in the world. Many are going to need some guidance and little inspiration on their journey. We've developed DreamSpace to be the place in which they can start to embrace their future potential.

The Present Study

The current research set out to strengthen the existing evidence base around 21st century teaching and learning practices by examining the impact that Microsoft DreamSpace has on teachers' use of technology in the classroom. DreamSpace provides students and teachers with immersive teaching and learning experiences; inspiring them to see how technology can enhance education, and in this way, helping them realise the full potential of what they can achieve. Through technology mediated learning DreamSpace provides primary and secondary school students with practical, real-life skills; including critical thinking and problem solving, supporting them to become digital natives. As well as imbuing them with hands-on skills, DreamSpace aims to be a catalyst for change by showing students and teachers what's possible with technology, helping to foster creativity, shape ambition and cultivate ideas.

The current research project aims to establish the impact that DreamSpace has on the development of these skills; asking the following research question:

1. How does participation in DreamSpace impact upon the development of participants' 21st Century Skills?
2. How does DreamSpace act as a catalyst for more creative use of technology within the education context of participants?
3. What are the barriers participants experience to implementing education change before, and following participation in DreamSpace?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Spark your Creativity

Research Methodology

In order to answer the research questions a mixed-method retrospective research design was employed. Mixed methods refer to a methodology of research that systematically integrates quantitative and qualitative data within a single investigation or sustained program of inquiry. The basic premise of this methodology is that such integration permits a more complete and synergistic utilization of data than do separate quantitative and qualitative data collection and analysis. There will be three phases of data collection, analysis and presentation.

Phase 1: March 2019 - April 2019 (Data Collection)

Phase one involved gaining ethical approval and developing a survey instrument which established participant's experience of DreamSpace, their current use of 21st Century teaching and learning practices. An interview/focus group schedule was developed which established the impact of participation, and how DreamSpace acted as a catalyst for change for teachers. It examined any barriers to change and what participants saw as being needed for the future. The online survey was distributed to the 300 teachers in 300 schools who have participated in DreamSpace, A selection of these teachers, who volunteered via the online survey, were invited to participate in focus groups/interviews.

Participants

Quantitative data was collected through an online survey which was distributed to approximately 300 teachers who had previously attended Microsoft DreamSpace. Fifty-four teachers responded to the invitation to complete the online survey, 38 of which completed the survey in full (n = 38). Approximately 28% of those responding taught in Designated Disadvantaged (DEIS) schools, with the remaining 72% hailing from non-DEIS schools. Approximately 45% of respondents taught in a primary school, with the remaining 55% teaching in secondary schools. The respondents had years teaching experience ranging from four to 34 years (M = 16.07 years). Of the 38 teachers who completed the online questionnaire, 33 respondents provided their contact details, volunteering to take part in an individual interview. After follow-up, 16 of these participants took part in a one-to-one interview relating to their experience of attending Microsoft DreamSpace (n = 16). These interviews also included focus groups with students in each of the participating teachers' schools. In total, six student focus groups were conducted (n = 88).

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You're Limitless

Survey instrument

Data was collected using an online survey instrument which was distributed to approximately 300 teachers who had previously attended Microsoft DreamSpace.

1. DEMOGRAPHIC INFORMATION

Participants were asked a number of questions relating to their demographic information including the type of school they taught in (Deis or non-Deis); what level they taught (Primary or Secondary); and their years teaching experience.

2. SELF-EFFICACY SCALE

Participants were asked a number of questions about their own perceived self-efficacy to how successfully and how effectively they integrate and implement technology into their daily teaching practices. The measure included statements relating to participants confidence to use technology as a teaching tool, and their confidence to develop lessons which integrated technology across the curriculum, for example. Statements were rated on a 5-Point Likert Scale (1, not very confident; 5, very confident).

3. CRITICAL THINKING

Participants were then asked several questions relating to how frequently they promote the use of Critical Thinking skills and activities amongst their students in their daily teaching practices. Statements were rated on a 5-Point Likert Scale (1, not very often; 5, everyday).

4. COLLABORATION AND GROUP WORK

Participants were then asked a number of questions relating to how frequently they encourage their students to work collaboratively and in group settings in their daily teaching practices. Statements were rated on a 5-Point Likert Scale (1, not very often; 5, everyday).

5. CREATIVITY AND CREATIVE USE OF TECHNOLOGY

Participants were then asked a number of questions relating to how frequently they promoted learning through creativity and the creative use of technology in their daily teaching practices. Statements were rated on a 5-Point Likert Scale (1, not very often; 5, everyday).

6. STUDENT USE OF TECHNOLOGY TO COMMUNICATE

Participants were then asked a number of questions relating to how frequently they promoted students use of technology to communicate and present ideas in their daily teaching practices. Statements were rated on a 5-Point Likert Scale (1, not very often; 5, everyday).

Phase 2: May 2019 - June 2019 (Data Analysis)

Analysis

A convergent design will be employed to compare findings from qualitative and quantitative data sources. This involves collecting both types of data at approximately the same time; and assessing information using parallel constructs for both types of data; separately analysing both types of data; and comparing results through procedures such as a side-by-side comparison in a discussion, or jointly displaying both forms of data. Data was collected using the validated 21st Century Skills measure (O'Sullivan et al, 2017). Descriptive analysis was employed to analyse the survey data; this included an examination of perceived changes in 21st Century Skills, confidence and the use of digital media. Participants in the present study's 21st Century Skills, confidence and the use of digital media will also be compared to that of a control group of teachers from a previous study (n = 100), who did not attend Microsoft DreamSpace. Thematic analysis was applied to interview and focus group data to identify themes around the impact of DreamSpace on future behaviour.

Phase 3: July 2019 (Dissemination of Results)

Phase three will include dissemination of the research findings. It is intended that the findings of this project will be shared throughout the process with the key stakeholders. Production of a report containing a brief literature review and analysis of data collected will be completed by July 2019 ready for stakeholder feedback.

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Findings

Results of Qualitative Data Analysis of Interviews with Teacher Participants

Quantitative data was collected through an online survey which was distributed to approximately 300 teachers who had previously attended Microsoft DreamSpace (n = 38). The tables which follow compare scores of those teachers who attended Microsoft DreamSpace on a number of measures relating to their 21st Century Skills, confidence, and their use of digital media in their daily practices, with a control groups of teachers who did not attend Microsoft DreamSpace (n = 100).

Participants were asked a number of questions relating to their own perceptions of their abilities to successfully and effectively integrate and implement technology into their daily teaching practices. Participants who attended Microsoft DreamSpace's self-efficacy scores were compared to the control group of teachers who had not attended DreamSpace. Those participants who had attended DreamSpace (m = 3.98), had higher self-efficacy scores than those who did not (m = 3.09). This difference was relatively small but would suggest that attendance of DreamSpace increased teachers' self-efficacy to effectively integrate and implement technology into their daily teaching practices (see Figure 1).

Participants were then asked a number of questions relating to how frequently they promote the use of Critical Thinking skills and activities amongst their students in their daily teaching practices. Participants who attended Microsoft DreamSpace's scores were compared to the control group of teachers who had not attended DreamSpace. Those participants who had attended DreamSpace (m = 3.42), more frequently promoted the use of Critical Thinking than those who did not (m = 2.80). This trend would suggest that attendance of DreamSpace increased the frequency of which teachers promoted the use of Critical Teaching skills and activities amongst their students in their daily practices (see Figure 2).

Self Efficacy to Implement Technology into Daily Practices

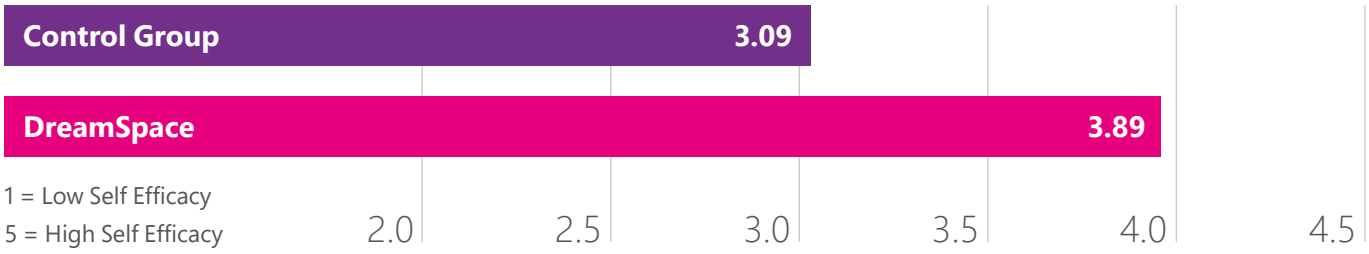

Figure 1: Participants' perceived self-efficacy to implement technology into their daily teaching practices.

Promote Critical Thinking in Daily Teaching Practices

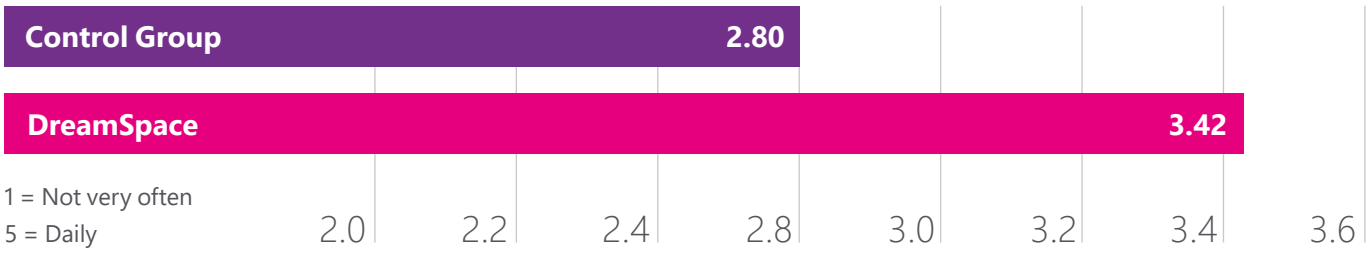

Figure 2: Participants' frequency in promoting Critical Thinking skills and activities.

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Participants were also asked a number of questions relating to how frequently they encourage their students to work collaboratively and in group settings in their daily teaching practices. Participants who attended Microsoft DreamSpace's scores were compared to the control group of teachers who had not attended DreamSpace. Those participants who had attended DreamSpace (m = 3.47), more frequently promoted group work and collaborative activities than those who did not (m = 2.77). This trend would suggest that attendance of DreamSpace promoted an increase in the frequency of which teachers encouraged their students to work collaboratively and in group settings in their daily teaching practices. (See Figure 3).

Participants were asked a number of questions relating to how frequently they promoted learning through creativity and the creative use of technology in their daily teaching practices. Participants who attended Microsoft DreamSpace's scores were compared to the control group of teachers who had not attended DreamSpace. Those participants who had attended DreamSpace (m = 3.61), more frequently encouraged learning through creativity and the creative use of technology than those who did not (m = 2.58). This trend would suggest that attendance of DreamSpace promoted an increase in the frequency of promotion of creative learning activities and the creative use of technology in their daily teaching practices (see Figure 4).

Lastly, participants were asked a number of questions relating to how frequently they promoted student use of technology to communicate and present ideas in their daily teaching practices. Participants who attended Microsoft DreamSpace's scores were compared to the control group of teachers who had not attended DreamSpace. Those participants who had attended DreamSpace (m = 3.49), more frequently encouraged students to use technology to communicate and present ideas, than those who did not (m = 2.54). This trend would suggest that attendance of DreamSpace promoted an increase in the frequency of promotion of student use of technology to communicate and present ideas (see Figure 5).

Promote Collaboration & Group Work in the Classroom

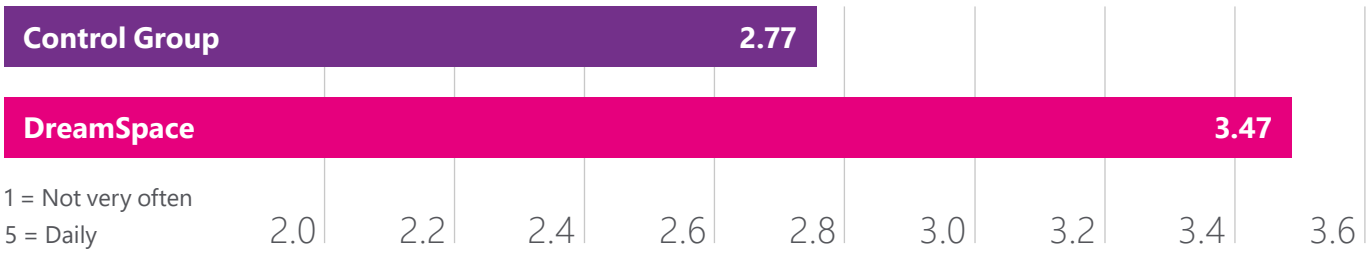

Figure 3: Participants' frequency in promoting Critical Thinking skills and activities.

Promote Creativity and Creative Use of Technology in the Classroom

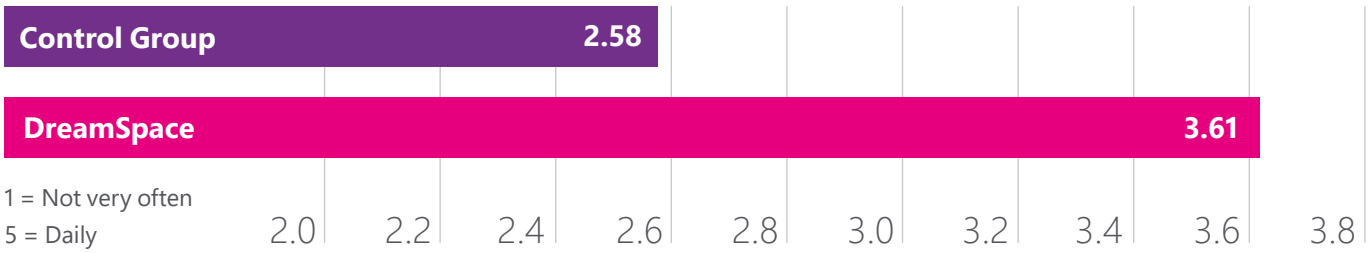

Figure 4: Participants' frequency in promoting creative learning activities and the creative use of technology.

Promoting Student Use of Technology to Communicate Ideas

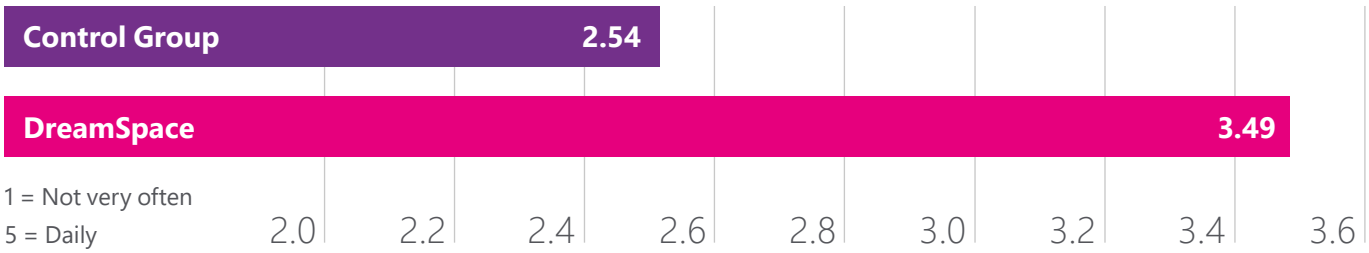

Figure 5: Participants' frequency in promoting student use of technology to communicate and present ideas.

Conclusions

Results of the quantitative analysis indicate that teachers who attended Microsoft DreamSpace rated higher on their self-efficacy to successfully and effectively integrate and implement technology into their daily teaching practices, than a control group of teachers who did not attend Microsoft DreamSpace. Similarly, teachers who attended Microsoft DreamSpace more frequently encouraged and integrated 21st Century Skills into their teaching pedagogies including Critical Thinking, Creativity, Collaboration and using technology to creatively Communicate ideas, when compared to a control group of teachers who had not attended Microsoft DreamSpace. These results indicate that DreamSpace is acting as a catalyst for education change, increasing the self-efficacy and abilities of teachers to integrate technology use into their daily practices, but also influencing their teaching pedagogies, to be more oriented towards key 21st Century Skills development.

Results of Qualitative Data Analysis

Thematic analysis was employed to analyse the qualitative data. Themes and patterns within the data were identified and coded, guided by the research questions. Initial codes were refined into themes. The resulting themes were discussed in relation to the research questions. The first set of themes presented relate to interviews conducted with the study's teacher participants (n = 16).

1 Barriers to Implementing Education Change Before, and Following Participation in DreamSpace:

(A) Practical Barriers

Over the course of interviews with the teachers who had attended Microsoft DreamSpace, a number of practical barriers to implementing technology into their daily teaching practices were highlighted.

FUNDING

Participants described a number of issues relating to availability of funding. For example, participants noted having limited access to resources as a result of not having adequate access to funding:

> "I suppose in terms of not having enough resources, as I said, I have 16 children in my classroom and I have 4 iPads. So if the junior room are using the iPads I can't use them at the same time. Whereas I suppose in terms of that, that would be one major barrier."

A number of issues relating to the actual process of accessing funding were also identified. Participants described funding processes which were often adhoc or sporadic in nature:

> "...it's the same across every school so a lot of where we're at, at the moment is it's up to the school themselves to be motivated to seek grants, to seek sponsorship, get companies involved, I mean it's a ridiculous scenario.."

Related to this, was the perception that applying for these fund was an extremely time consuming activity, which drew certain staff members away from their teaching roles. Concerns about the use of time put into applications for funding were further compounded by a lack of certainty as to whether applications would be successful and result in adequate funding being attained. This left some teachers uncertain of the value of spending so much time seeking out funds for technology:

> "...it was a detailed application to get funding and you don't even know what you're gonna get, and what you get will probably be minuscule so."

HARDWARE AND SOFTWARE ISSUES AND AVAILABILITY OF TECHNOLOGICAL SUPPORT

Participants also noted that hardware and software issues, compounded by a lack of access to technological support, acted a barrier to implementing technology into their daily teaching practices. Issues reported ranged from inadequate WIFI availability to a lack of devices (laptops, PCs, and iPads). This is exemplified by the following quote:

> "They don't have PCs in every classroom, they don't have full Wi-Fi around the building, so even if they had a kind of a bring your own device system within the school there isn't full Wi-Fi for them to connect."

TIME CONSTRAINTS

Hardware and software issues were also compounded by time constraints. Participants, particularly those who taught at primary level, reported curriculum overload as a huge barrier to implementing technology into their daily practices:

> "It's time is a constraint, when you have, all teachers will talk about an overloaded curriculum, and what we need to think about is ICT and programming, where in the curriculum does it fit?."

Teachers reported a frustration in that with a combination of curriculum overload, and often failing infrastructures, the easier and more time effective option was often to abandon the idea of implementing ICT and technology into their lessons for more traditional pedagogical practices:

> "Yeah and then you just go sod it I'm going back upstairs and teaching a history lesson because you know this is a waste of very valuable time."

AND

> "And that's going to, that's going to awh bloody hell, let's go back to chalk and talk." [Referring to technological difficulties]."

CONCERNS AND FEARS ABOUT TECHNOLOGY USE IN THE CLASSROOM

Participants noted a number of concerns and fears that they, or teachers they knew had expressed in relation to embedding technology into the classroom environment. Firstly, there were practical concerns around the safe use of devices in the classroom. Staff feared that students may be able to bypass safeguards or controls, and for example, access materials they should not be able to access during class time.

> "Well it is a problem, and it created nervousness as well with the staff because you're going well do they know how to bypass the controls…"

There was a perception amongst many participants, that students were more "au fait" with technology than staff members which created fear, and hesitance to use technology in the classroom. For some, they were concerned that their own skill levels and knowledge weren't up to scratch and therefore, could not impart any knowledge to their students:

> "And I think, as teachers, we can sometimes over estimate the student's skills with ICT. We assume because they kind of learn intuitively about ICT and they can use their phones and iPads as well and that they know how to use everything on the computer and iPad, but they don't actually they need a lot of guidance and teachers are fearful that they can't give that guidance."

Relating back to practical infrastructural issues, there was also a fear reported amongst participants about what happens when things go wrong. Teachers commonly noted the idea of "losing them [students]" if technological issues impacted on their ability to get a lesson up and running and completed promptly:

> "I think teachers fear change, they fear things going wrong when there is unreliable infrastructures there they think oh this is going to be a disaster, getting online it would be 15 minutes before you know it, there's not enough time to do the task."

(B) Cultural and Structural

Further to the practical barriers discussed above, teachers also noted a number of significant cultural and structural barriers to integrating technology into their daily teaching practices. These included a perceived lack of interest, or value of technology and ICT amongst some staff members, confidence and skills deficits, and difficulties with embedding technology into the curriculum in a purposeful and creative way.

LACK OF INTEREST FROM TEACHERS IN TECHNOLOGY

Participants reported a huge level of variance in the interest level in, and perceived value of technology amongst their colleagues.

> "Because there's some class teachers who are amazing with technology and some of them are quite reluctant to use any and that spectrum is huge."

Some teachers, who were particularly interested in embedding technology into their own practices, and across their schools reported feeling "out on their own", with very little buy in from other staff members.

> "There's nobody who kind of does anything or have an interest or really likes it."

LACK OF CONFIDENCE AND PERCEIVED LACK OF SKILLS

Some perceived this as being related to teacher training, and time since qualifying.

> "I'm old now but the younger generation of teachers are so motivated" [to integrate technology and ICT into their lessons]."

However, most reported that this variance generally came down to individual attitudes, and more often than not, the confidence to take on new forms of pedagogies and technology. Participants noted that due to a lack of confidence, and perceived skills deficit, many teachers were hesitant to get on boards with ICT and technology use.

> "And it's probably the lack of confidence, or what do I do with this? And I don't know whether they should just bring it into teacher training as a module, I don't know. But I definitely find them slightly conservative in their way of teaching. I would find that's the biggest struggle is to try and get them on board."

Some felt that their teacher training had let them down in terms of the ICT and technology skills, impacting on their ability to integrate technology into the curriculum, and again, resulting in a return to more traditional or "conservative" teaching pedagogies.

DIFFICULTY EMBEDDING TECHNOLOGY INTO THE CURRICULUM & USING TECHNOLOGY PURPOSEFULLY

Many of the participants noted that they were not in fact disinterested in integrating technology and ICT into their daily practices, but instead due to a lack of confidence and perceived skills deficit unable or unsure how best to embed technology into an already overloaded curriculum in a purposeful, collaborative or creative way. Participants noted the concern that despite there often being access to new forms of technology and hardware in many schools that the use of technology was often "superficial" or a tick the box exercise, rather than an activity to encourage creativity or collaborative skills:

> "Yeah, yeah. Or also you know, like what I often feel about is teachers using apps, now I would use apps but only if... for an actual purpose. So, it's very superficial use of technology say if someone is doing a maths lesson with the juniors in number and then just literally just get them to do an app... do you know what I mean?"

Participants confirmed that they often struggle to integrate technology in a purposeful way and trying to connect where ICT and technology fits, particularly in the context of an already overloaded curriculum:

> "I've tried to integrate it in with another subject. Like for example, if were using Scratch I'll put on a History theme so I can use it like OK we've done a lesson on Nelson Mandela, let's try and do a Scratch programme... Something along trying to integrate it in some way and that is probably the biggest, the overloaded curriculum, and where does programming fit into the curriculum. That's the problem."

This was further compounded by a perceived lack of support for teachers to actually embed and integrate the technology they did have access to, into their daily teaching practices:

> "And I think that element of it is really important because so often we see schools are like oh we're getting all this technology but you're just wondering how much support there is for the teachers to actually embed that within the classroom."

PERCEIVED LACK OF CPD OR TRAINING

Linked to participants' perceived inability to integrate technology in a purposeful way and connect where ICT and technology fits in the curriculum, was a perceived lack of CPD and training for teachers in ICT and technology. Some participants were very critical of this perceived lack of training, or CPD:

> "But even the CPD is so, there's the PDST which is the Professional Development Services for Teachers which is under the remit of the Department of Education but they don't although they employ they have a director of primary STEM I've never seen once a course offered by them."

Other participants were critical of the standards and content of the CPD and training which was available, criticising the relevancy of the content and who it was being pitched at:

> "I did a summer course, I did one a couple of years ago, and some of them just weren't great. Some of the content was very good, you could take some of the content from it. Some of the aspects, some of the modules, you were just like ah this is not relevant. You were just looking at lesson plans, and learning profiles. Maybe for a principal... but for class teachers... it'd be more beneficial to guide them on resources and places to go..."

Lastly, for some teachers, CPD and training was made difficult to access based on geographic location. Many noted that much of the courses on offer would run in Dublin, making it difficult for teachers from rural areas to attend:

> "I think CPD you have to code yourself and you know normally Saturdays or in Dublin you know there is a lot to think about..."

2 Factors Facilitating The Creative Use of Technology Within The Education Context of Participants:

THE PRACTICE OF CPD AND TRAINING HAPPENING INFORMALLY, SHARING OF RESOURCES AND SUPPORT:
When speaking about the training and support available to participants to integrate technology into their daily teaching practices, a common theme which became apparent was the practice amongst teachers of informally sharing resources and supports, and providing CPD and training to each other, within their schools. This would often result in the formation of teams, or groups of leaders who would train other teachers in ICT and technology, and offer support:

> "We've kind of created a team in school, who probably are the five or six teachers who have the best skills, so they are kind of the go to people, and they kind of run training for other teachers and show them this and that. So, we try to do something about it."

These teams would also form as a result of a number of highly motivated, and highly interested individuals coming together out of a shared desire to integrate and expand technology use in their schools. These groups would act as a place to share information and ideas, and disseminate this learning back to other teachers.

> "That's how it started in our school actually, I was kind of into and a couple of others as well. And two other teachers came in from another school and so that's why we're trying to build up this kind of team of people then and we kind of meet and share ideas and that is really important."

Participants also moved outside of their school environment to make links with other teachers, who shared a similar vision, and interest in technology. This created networks of support:

> "Oh completely. Especially cos we're engaging with informal professional development all the time. So I'm on Twitter so there's like a network of MIE experts. We have our own group in Ireland. We're constantly coming back to each other like oh what do you think of that, any issues, you know there's great support."

Microsoft

Supercharge your Ideas

KNOWING HOW TO EMBED TECHNOLOGY PURPOSEFULLY INTO THE CURRICULUM: Despite the fact that many participants noted difficulty using technology in a purposeful way, and embedding ICT into the curriculum, there were many examples of participants who had a vision for how technology could be used in this way. These participants were more likely to embed technology across the curriculum and integrate ICT into a wide variety of subjects. For example:

> "I've tried to integrate it in with another subject. Like for example, if were using Scratch I'll put on a History theme so I can use it like OK we've done a lesson on Nelson Mandela, let's try and do a Scratch programme."

These participants saw technology and ICT, not as a separate subject, but as something which could be complimentary to all areas of the curriculum, and across all subjects:

> "...a lot of that is still restricted to computer labs and I think the sooner, I never bring my students to our computer room in fact we're closing our computer room because our students aren't going there anymore, I think as soon as you kind of compartmentalise and say IT is in the computer room I think that is when you, when there's a problem."

AND

> "Well I like to use it as much as I can, right across the curricular so I don't see it as a separate."

As well as this, these participants were able to see that technology could not only be used in superficial ways, but would be used to facilitate creativity and collaboration in learning.

> "...the real beauty of technology is when you get it starting to create."

THE ROLE OF KEY STAFF AND MANAGEMENT WHO "HAVE AN INTEREST"

Across most interviews, participants highlighted the importance of individual members of management and other key staff members in promoting technology use in their schools for example, providing training, sourcing funding, and promoting its use. Often, owing to a lack of internal or external technological support staff, individual staff members would become involved in key support roles such as providing technological support. As the staff were usually also full time teaching staff, it was often difficult for them to fulfil all these roles:

> "... there's a teacher on staff and she's in charge of the chrome books but she's in class and she can't come over and explain to me why the internet connection is slow or whatever, so it can be."

Key staff members were also highlighted as extremely important in terms of applying for, and securing funding for their individual schools. These highly motivated individuals would take this on, on top of their teaching roles, in order to get the best equipment and hardware they could for staff and students in their schools:

> "Well there is a fairly good grant that covers equipment, it includes a lot form filling but you can get it. Yeah the real problem is the staff to oversee it all and make sure, and our IT [x] she is the one who organised ... and anything she can get for us any support she can get she get."

Participants also highlighted the importance of leadership on the matter of implementing and integrating technology within their schools. Many highlighted that without this kind of leadership, particularly from management, little would happen in this area:

> "Yeah that's kind of a leadership issue too, you know it's you need somebody at the top who is really driving it [integration of technology use]."

3 The Impacts of Attending Microsoft DreamSpace?

INCREASED CONFIDENCE IN BOTH STAFF AND STUDENTS

A common theme which became apparent in interviews with participants was the role that attending Microsoft DreamSpace had in increasing the confidence of both staff and students. This was observed in a number of ways. For example, those participants who had previously been nervous of using technology in the classroom due to a perceived skills deficit, gained the confidence to believe that they could purposefully use technology in their everyday teaching practices:

> "Oh definitely, yeah definitely. Before this when you heard the word coding it just really scared you. You know that you would have the skills to do it yeah, I seen how easy it was that day you know to do it so it is something that we do want to bring into the school."

Similarly, many teachers described how the experience gave them a confidence to just "give it a go", and realise that they did not always have to have all the answers for their students. After observing how their students worked creatively and collaboratively on the day at DreamSpace, they were confident to trust their students to learn in this way once they returned to school:

> "I'd say personally in terms of confidence I wouldn't say I'm more technologically competent than I was but what I do have is the competence to trust the kids to do it and to problem solve and to give things a shot and move things on... but definitely in terms of it being such a positive experience in giving us the motivation to do it, a lot of the time if you want to do it you'll figure it out then the confidence comes, but yeah I mean it boosted my confidence in terms of enabling it, rather than actually teaching it."

Across the board, the teacher participants noted the positive impact that attending DreamSpace had on their students' levels of confidence. They noted that all levels of ability and interest were catered for on the day, making it a positive experience for every child in attendance, increasing their confidence and self-belief.

> "I think also the confidence that they did, that the gained from it, that you know sometimes coding and technology some would feel like that's beyond them or it's not within their grasp but I think we had every kind of ability on our trip to DreamSpace... and right across the board a confidence and I suppose just the belief that they took the belief in themselves that they took away, we would have seen that, and even the class teachers would have seen it. We just found that for them it was a very special day."

IMPACT ON SEN STUDENTS

An interesting, and possibly unexpected discovery which emerged from the interviews with participants was the impact that attending Microsoft DreamSpace had on students with Special Educational Needs (SEN), or students who were described as being "less academic". Teachers noted that they saw coding and programming as an outlet and opportunity for these young people to excel, and subsequently used programming more in the classroom after attending DreamSpace:

> "Often a child who struggle in other aspects, we find kids who are weak at English, are also kind of poor at History and Geography cos they don't have the literacy skill, but it doesn't necessarily transfer to the programming. They're not any weaker at that. They can be strong at it. So it gives them another outlet as well, or it doesn't mean they're not creative."

Attending DreamSpace was seen as giving the students a chance to shine out and be leaders on projects, something which they rarely had the opportunity to do in school. This provided these students with a huge confidence boost, which was observed by their teachers.

> "It does give them confidence. In fact, as I was walking there, I passed off a child and that's why it stuck out to me, a child who struggles in school, but she was fantastic on that day. She was really good, and she kind of nearly led the group which is great to see as well cos she generally wouldn't."

Participants noted that the experience of attending DreamSpace, helped these students to see that intelligence can come in many forms, giving them a place to channel their skills and creativity, and again increasing their confidence.

> "Big time. Huge boost to their confidence. You were talking about dyslexia there a minute ago, one of the boys you know he's, his literacy scores would be catastrophic most of the time and I know it's not a good reflection, an accurate reflection of his intelligence I know that but this was a possibility for him to prove yeah I have trouble reading the words or writing the words but I'll show you how we get this Microbit to you know make a Pacman game you know no bother, and it's brilliant."

Microsoft

Create your Future

CHANGES IN TEACHING PEDAGOGIES INCLUDING INCREASES IN GROUP WORK AND COLLABORATION

Participants noted that attending Microsoft DreamSpace had an impact on their teaching style. At DreamSpace, they noted the capacity of their students to work in a creative and collaborative way with little formal instruction. After visiting DreamSpace, the participants had a greater value for explorative and creative learning, and greater belief in students' capacity to work in this way:

> "They did two little projects by themselves and they were fantastic. With very little training on it. We were talking about it afterwards and saying that was probably the biggest. That we don't give them enough credit for what they can do, particularly in relation to programming. The three teachers did it as well and they were better than we were, so we weren't giving them enough credit for what they could do and that definitely made an impact. And just allow them to be creative as well so."

Participants described how attending DreamSpace demonstrated for them how to implement technology into their teaching in a more integrated and purposeful way. For many, they did not necessarily focus on the technology skills they learned but in fact, the teaching methodology:

> "I suppose what I did learn was the teaching methodology more how to teach it as opposed to... I would have been fairly au fait with the technology part... but it was more how I implement it from a teaching perspective."

Participants also noted that they were more likely to encourage group work and collaborative learning after seeing how positively students worked together on the day in DreamSpace:

> "I think the collaboration as well. That was another good thing. They worked in groups and they didn't pick their groups, they were in different groups. Some people were stronger, some people were quieter. They all worked really well together, and that was because of the forum they had. The creative aspect you know, so they all worked really well together."

Not only this, but teacher participants also noted that students themselves were more open to working in groups and collaboratively after attending DreamSpace. Attending DreamSpace encouraged them to be more open to working this way, as they had a new found understanding that this is how people work in real life, and that this is how workplaces of the future will be oriented:

> "So yeah that was a big thing, so I suppose collaborative learning, group learning, we had a huge issue here at the start of the year about collaboration because 6th class they all have their little gangs and they don't want to be out of their gang and they don't want to do a project with the guy at the other side of the classroom, but I had been trying to say to them guys you're going to have to open up a little bit but the girls at DreamSpace made that point so effectively that since we came back from DreamSpace they don't moan if I say you know so and so go into a group with so and so, they get that its life. The way they're going to have to collaborate and work with each other on projects."

RAISING ASPIRATIONS

All participants noted during their interviews, the impact that attending DreamSpace had on their participant's aspirations. The visit was seen as impacting on students' future orientations, making them think about the types of environments they would one day work in. The students all had positive perceptions of Microsoft as a work environment, with many hoping that they could someday work there:

> "Oh yeah well they all want to go back and work in Microsoft and in DreamSpace you know like that's, whereas I think some of them, and I suppose they all kind of that's the other thing that they'd say you know 'I'm doing something now', 'I'm going to work in a job that nobody knows about now' it hasn't been… that was the type of buzz they got from it that was mentioned on the day that there was so many jobs that hadn't been created yet and you could be working in it I think they took that away from it that creativity that they could be a bit more imaginative."

The teacher participants also noted that attending DreamSpace had highlighted the importance of particular 21st Century Skills to their students. For example, after visiting DreamSpace, students had a greater understanding and appreciation for the need to develop skills such as leadership and communication, and their relevance to the future workforce:

> "I'm also a trained guidance councillor, so I would be obviously interested in future careers and development of soft skills and transferable skills and I was delighted when we went to DreamSpace because there was a huge emphasis on that, on actually on the promotion of skills of leadership, of communication, that a lot of kids take for granted and they think they can learn them and not important but actually they're so, so important in a company like Microsoft which I think is great for them to hear that. The main reason I suppose is from obviously my interest in science and in technology but also as a guidance councillor in terms of preparing our students here for the future workforce really that's there and a lot of jobs that maybe don't exist at the moment and they don't have anything to encourage those skills that are relevant for them to participate in things like it."

Several teachers also noted that attending DreamSpace also impacted on female students aspirations to work in STEM type roles. Many teachers noted that the female students in their schools were focused on "traditionally female" careers such as teaching and nursing. However, attending DreamSpace exposed them to technology and STEM, and provided them with a positive experience of both:

> "Uhm, and there were two or three students that would never think, those students were girls funnily enough, and they were really catching on really quickly. And one of them who would never really shown interest in technology was saying she thought it was really good. You know, from that side, I thought the technology they were using and the coding was good for the kids definitely."

NEW INITIATIVES OR TRAINING WHICH EMERGED AS A RESULT OF ATTENDING DREAMSPACE:
First and foremost, after attending DreamSpace, participants described how they were taking the activities and learning from the day back into their own classrooms. Teachers described how there was now a greater focus in their teaching practices on activities such as programming and they were trying out the activities which the students had taken part in on the day:

> "We did an activity with micro bits so I think the first most frequent question after the trip was when are we getting them so that's something I'm looking into at the moment getting micro bits for us and the program and that was the general feedback the students gave."

Participants also described a change of attitude to, and interest in implementing technology into their schools amongst staff members as a result of having attending DreamSpace. Teachers who had previously felt out on their own in terms of promoting technology use and integration in their schools now noticed more buy-in and positive attitudes from other members of staff:

> "Yeah, now, but what I would say is that this year in particular, possibly because of maybe our visit to DreamSpace … that teachers have become more involved, that it is kind of integrated into the classroom a little bit more…so the buzz that we brought back from it I think was quite infectious… but I think there is a little bit more awareness and not so much maybe of involvement in but I suppose an awareness maybe and a little bit more interest, so that I do think now when I come in with one of my hair brain ideas, it's kind of I suppose it's taken on board a little bit more…"

Participants also noted there was a lot more interest in certain technology or STEM related initiatives in their school after attending DreamSpace, particularly in terms of coding or programming clubs. Some schools had recently created coding clubs, and those that had already had them, noticed an increase in interest to join:

> "...got more applicants to join the coding club...I think when we went up to DreamSpace I had maybe 12 or 15 in the coding club and I've 25 now and I've a waiting list of about 20... yeah so it kind of I think that's where I suppose I would have seen the momentum growing."

Attending DreamSpace had also inspired many of the participants to get involved in new forms of CPD and training. Many of the teachers were encouraged to upskill as a result of visiting DreamSpace, so that they could integrate the types of activities they were exposed to on the day, into their own teaching. For example:

> "Yeah I did one in Monaghan Education Centre, it was through Microsoft as well with the Lego..."

Conclusions

The present research sought to strengthen the existing evidence base around 21st century teaching and learning practices by examining the impact that Microsoft DreamSpace had on teachers' use of technology, and skill based teaching pedagogies in the classroom. DreamSpace provided the teachers in the present study with an immersive teaching and learning experience. This was shown to inspire them to see how technology can enhance education, helping them realise the full potential of what they can achieve in the classroom with the help of technology. DreamSpace was found to be a catalyst for change by showing teachers what's possible with technology, helping to foster creativity, shape ambition and cultivate ideas.

After visiting DreamSpace, teachers demonstrated a change in their pedagogies, becoming more likely to endorse explorative self-directed learning, and to promote learning amongst their students through group work and collaboration. They were also more likely to integrate other key 21st Century Skills into their teaching pedagogies including critical thinking and the creative use of technology. The teachers also noted that attending Microsoft DreamSpace broke down the fears surrounding technology use in the classroom for both staff and students alike by increasing their confidence to "give it a go". Further to this, many noted how attendance of DreamSpace was particularly impactful for SEN students, providing them with an opportunity to shine and take the lead. A knock-on effect of all of this, was a raise in student aspirations, particularly in relation to working in STEM career paths in the future. As a result, schools saw an up take in STEM related activities and initiatives which in turn encouraged many teachers to upskill through further CPD and training to meet this demand.

Analysis of interviews with teachers also revealed a number of barriers which teachers face day-to-day when attempting to implement and integrate STEM, and particularly technology use into their daily practices. These ranged from practical (e.g. time constraints, funding, technological issues) to cultural and structural (e.g. lack of interest, lack of confidence, and perceived lack of support to upskill). However, in most cases these difficulties were mediated by a few key facilitators. These included the willingness of teachers to support and work together to integrate technology into their schools; the vision and ability of some teachers to see the wider picture with technology use and to integrate it into the curriculum purposefully and creatively; and the role of key staff members who were passionate about, and interested in the integration of technology into their school environments. This often required teachers to juggle many roles, outside of their everyday teaching ones, however, this was something they were happy to do, as they had a vision for how technology can enhance education, and help students to realise the full potential of what they can achieve.

Microsoft

Qualitative Data Analysis of Interviews with Students:

Interviews also included focus groups with a number of students in each of the participating teachers' schools. In total, six student focus groups were conducted (n = 88). Thematic analysis was employed to analyse this data. Themes and patterns within the data were identified and coded, guided by the research questions. Initial codes were refined into themes.

1 Influence of Visiting DreamSpace on Attitudes to Creative and Collaborative Working Styles:

Interviews with students who had attended Microsoft DreamSpace revealed the impact that visiting DreamSpace had on their ability and desire to learn in an exploratory and creative way, and also to work effectively in groups and in collaboration with others.

LEARNING IN AN EXPLORATORY AND CREATIVE WAY

The students who attended DreamSpace demonstrated a greater appreciation for the need to learn and work in an exploratory and creative way. The students particularly endorsed having the "freedom" to direct their own learning:

> "I think the best bit about DreamSpace was the coding. Especially that you had freedom to do whatever you want instead of guides and you had to do something and there was an objective, I liked how you had freedom to do anything."

Students who visit Microsoft DreamSpace saw connections between the ways they worked at DreamSpace and how people work in real life, for example, at Microsoft, again highlighting the importance and relevance of having the "freedom" to direct and manage their own work:

> "When other people think of like working with computers they think of like sitting at a desk and just spending their whole day on their computer doing what someone else tells you but like at Microsoft DreamSpace you can like if your with another person and they like you then you can kind of do whatever you want, your free to do anything."

GROUP WORK AND COLLABORATION:
Students who visited DreamSpace were aware of the value of group work and collaboration, not only at DreamSpace, but also in school and again, how this relates to work after school.

Students understood that the way individuals and organisations work, and the key skills that you need to work in today's working environment are changing, and that group work and collaboration are now key 21st Century Skills:

> "Yeah that would be really important as I said the jobs opening up we have to work as a team instead of just in closed off spaces, we needed to be more able to communicate with each other and I think that helps so."

These students saw connections between the way they worked at DreamSpace and how people work in real life, for example, at Microsoft. The students were able to see the benefits of working in this way, after visiting Microsoft DreamSpace and how this can contribute to the generation of new ideas and better working outcomes:

> "Yeah I think it's coming in a lot more like you see it with Microsoft and with Google and stuff like that it's a lot more relaxed workspace and people work together and collaborate and it makes people work better as well, work harder and they get better results."

2 Influence of Visiting DreamSpace on Future Orientations, and in Raising Aspirations:

THE IMPACT OF VISITING THE MICROSOFT OFFICE AND EXPERIENCING ITS WORK ENVIRONMENT

The students' in the present study made many observations about the Microsoft Office and "how awesome the workspace was." The students noted that the Microsoft Office was not what they had assumed it would be like, previously thinking that offices were "stuffy", but was in fact an open and positive place to be with lots of amenities for staff:

> "Yeah being around it looked like it was a really nice place to work in like you see all the restaurants all the places to eat gyms spas I think they had they made it a really good work environment for them."

The students also had an appreciation for the fact that the work environment had a focus on the well-being of its staff, through a flexible working environment and provision of amenities:

> "I like the way that there work was serious but if you were tired or something of doing your work you could take a break without your boss or something getting angry at you and like not giving out to you if you go to, if you're really stressed out and you go to the yoga room he won't get annoyed at you."

Relating back to the theme of working in an explorative and creative way, students appreciated the perceived freedom that staff had to manage their own time and work:

> "They said like you have your own office but you don't have to stay there you can work wherever you want as long as you finish your job"

After visiting Microsoft DreamSpace, and the Microsoft Office, the students demonstrated a knowledge that working environments are changing, and the way we work is changing, with more focus on worker autonomy. They demonstrated an appreciation that in the future, they may work in roles where they will have such autonomy, but also that this autonomy comes with responsibility:

> "Because they're kind of trusting you to like, you can take a break but get the work done. Don't take most the day as a break they're kind of trusting you to take a reasonable amount of time."

STUDENT'S RECOGNITION OF DIVERSITY IN THE MICROSOFT WORK ENVIRONMENT

The students who visited Microsoft DreamSpace observed the diverse staff in the Microsoft Office. This gave them an appreciation of the fact, that regardless of ability or difference, you could go on to work in large organisations like Microsoft, and be treated equally:

> "I liked how it didn't matter if someone is deaf or blind they could still work there."

The students were aware as a result, that working environments are becoming increasingly diverse and that they will be working with a diverse range of people in their future working environments:

> "Yeah I like the type of people you could be paired up with someone from a different country or with a disability or..."

They were especially impressed with just how many different cultures and nationalities worked at Microsoft, and how this was celebrated as a positive attribute to the company, further illustrating the fact that the working environments they will one day work in, are becoming increasingly diverse:

> "One when we there they mentioned there was like something like 70 or something different nationalities that work there."

> "Yeah it is like very open with people there were flags everywhere which I though was school because it shows all the different type of nationalities working in the place."

RAISING ASPIRATIONS

As highlighted by the teacher participants, the students also noted the impact that visiting Microsoft DreamSpace had on their career aspirations. For example, for students who had already been considering careers in STEM, their interest in this area was further developed and secured as a possible career path to consider in the future:

> "It was always kind of in the back of my head because you know were always innovating so we have like a lot of new technology careers opening up, but that definitely kind of put it there on my list of stuff."

For others, the visit to DreamSpace opened up new opportunities to them, and led them to consider a future in STEM type career paths for the first time:

> "It opens your mind kind of to more options that you wouldn't have thought of."

This was particularly noted by female participants, who cited a lack of encouragement for them to even consider STEM career paths:

> "Because no one really knew much about it... we weren't really encouraged [girls to think about STEM as a career path]."

They noted feeling like they were encouraged to pursue career paths traditionally considered as female including "Primary teaching... teaching, nursing, cooking." with little focus on careers in STEM. They were particularly encouraged by the visit to DreamSpace noting that it raised their aspirations as females to at least consider role in STEM for the first time, with just a little bit of encouragement and focus on how this could be a suitable and possible career path for them:

> "[previously] Weren't encouraged ... and like you'd always hear about the big male CEOs, but the CEO of Microsoft is a woman like and you never really hear much about that."

DreamSpace

3 Other Impacts of Visiting DreamSpace and Feedback from Students:

GREATER AWARENESS OF THE WIDER IMPACT OF TECHNOLOGY USE:
The students who had attended Microsoft DreamSpace noted that they had learned a lot more on the day than just coding. After DreamSpace, they had a greater appreciation and awareness of the wider societal and personal impacts of technology use. The students understood both the hugely positive impacts that technology can have, as well as the potential pitfalls and dangers associated with it:

> "I learned to stay safe on the internet an about the online cookies."

> "We were watching a video on how Microsoft or technology helps people."

> "I learned that technology can be good and bad at the same time because it can be, it can be good for people with disabilities, and it can be bad if people get addicted to it."

STUDENT RECOMMENDATIONS
Overall, student feedback on their experiences of attending Microsoft DreamSpace was overwhelmingly positive. All students reported having a positive experience on the day, and the desire to visit DreamSpace again. The general consensus was that the only recommendation they would make to change the DreamSpace experience was that they wanted to see more. The day had opened the students' eyes to what working in a large global organisation like Microsoft was like, and they were eager to know more:

> "I'd like to see what's kind of inside an Xbox or something, just kind of the technology involved in it and how you make it."

> "Yeah I would like to see more of the office, see how they work together yeah."

> "So it be interesting to actually meet people… would you be interesting in doing say like work experience days or like."

Conclusions

The present research sought to strengthen the existing evidence base around 21st century teaching and learning practices by examining the impact that Microsoft DreamSpace had on development of students' 21st Century Skills. DreamSpace provided students in the present study with an immersive teaching and learning experience. This was shown to inspire them to see how technology can enhance education, helping them realise the full potential of what they can achieve through technology. Through technology mediated learning DreamSpace provided students with practical, real-life skills; including critical thinking and problem solving through exploratory and creative learning experiences. DreamSpace was found to be a catalyst for change by demonstrating to students what's possible with technology, thus helping to foster creativity, shape ambition and cultivate ideas.

After attending Microsoft DreamSpace, students demonstrated a greater appreciation for the need to learn and work in an exploratory and creative way. Students particularly endorsed having the "freedom" to direct their own learning. They were able to draw connections between how they worked at DreamSpace and how people work in real life, for example, at Microsoft, highlighting the importance and relevance of having the "freedom" to direct and manage their own work. The same can be said for their ability to work collaboratively and in groups. After DreamSpace, students were more aware of the value of group work and collaboration, not only at DreamSpace, but also in school, and again, how this relates to work after school. They demonstrated an understanding that the way individuals and organisations work, and the key skills that you need to work in today's working environment are changing. In this way, we can observe that attending Microsoft DreamSpace impacted on the development of the students' 21st Century Skills, fostering creativity through self-directed and collaborative learning.

Results of qualitative analysis also demonstrated the impact attendance of DreamSpace had on the students' future orientations, and in raising their aspirations. After visiting Microsoft DreamSpace, and the Microsoft Office, the students demonstrated a knowledge that working environments, and the way we work are changing, with more focus on worker autonomy and self-directed work. They demonstrated an appreciation that in the future, the roles they work in may be very different to how they are now. Attending DreamSpace also imbued them with a greater knowledge and understanding of diversity in the workforce and how this can contribute to the cultivation of ideas. As highlighted by the teacher participants, the students also noted the impact that visiting Microsoft DreamSpace had on their career aspirations. For example, for students who had already been considering careers in STEM, their interest in this area was further developed. For others, the visit to DreamSpace opened new opportunities to them and led them to consider a future in STEM type career paths for the first time. This was particularly evident in female participants, who noted that they were more likely to be encouraged to consider "traditionally female" roles. Visiting DreamSpace opened their eyes to the world of possibilities they could access, particularly in relation to STEM related career paths in the future.

Again, DreamSpace was found to be a catalyst for education change. Attending DreamSpace demonstrated to students what's possible with technology, through fostering of key 21st Century Skills such as creativity and collaboration, in turn helping to cultivating new ideas. DreamSpace also shaped ambitions, opening a world of creativity and career possibilities to students, impacting on their future orientations, sparking interest in and raising aspirations to pursue STEM related career paths in the future.


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Discussion

As we know, education is now rapidly becoming a key strategic driver of social, economic and cultural development (Coolahan, 2003; Girvan, Conneely, Tangney, 2016). As a result of this, the education system now has to prepare young people to live and work in a rapidly changing society (Quinn, 2012).

The education system is now expected to provide what have become known as '21st Century Skills' which can be applied across a variety of contexts rather than the previous models of providing rigid paths to specific careers (Ananiadou & Claro, 2009).

These skill-based approaches allow students to compete in competitive, and sometimes harsh economic environments. In Ireland, for example, reform of post-primary education has been underpinned by overlaying curriculum content with selected "Key Skills" identified by the National Council for Curriculum and Assessment (NCCA) (2009). These skills include, but are not limited to: information processing, critical and creative thinking, working with others, communicating and being personally effective (National Council for Curriculum and Assessment, 2009). To this effect, Microsoft Ireland developed the DreamSpace, as an interactive learning experience, which aims to imbue students with such skills, and influence the teaching pedagogies of teachers, to be more directed towards the development of 21st Century Skills. As a result of attendance, participants were more likely to use and endorse teaching pedagogies which led to the development of key 21st Century Skills, in line with those identified in previously identified frameworks (Delores, 1996; OECD, 2005; NCCA, 2009). Teachers who attended DreamSpace were more likely to endorse explorative self-directed learning, and to promote learning amongst their students through group work and collaboration. They were also more likely to integrate other key 21st Century Skills into their teaching pedagogies including critical thinking and the creative use of technology. Teachers themselves noted that attending Microsoft DreamSpace broke down fears surrounding technology use by both staff and students alike by increasing their confidence. As a result, there was an observed increase in student aspirations, particularly in relation to working in STEM career paths in the future, with an up take in STEM related activities and initiatives which in turn encouraged many teachers to upskill through further CPD and training to meet this demand.

Analysis of interviews with teachers also revealed a number of barriers which teachers face day-to-day when attempting to implement and integrate STEM, and particularly technology use into their daily practices. These ranged from practical to cultural and structural. However, in most cases these difficulties were mediated by some key facilitators. These included the willingness of teachers to support each other, and work together; the vision and ability of some teachers to see the wider picture with technology use and to integrate it into the curriculum purposefully and creatively; and the role of key staff members who were passionate about, and interested in the integration of technology into their school environments.

In conclusion, results indicate that DreamSpace is acting as a catalyst for education change, by increasing the self-efficacy and abilities of teachers to integrate technology use into their daily practices. Attendance of DreamSpace was also found to influence their teaching pedagogies, to be more oriented towards key 21st Century Skills. In the same way, through technology mediated learning, DreamSpace provides students with practical real-life skills including critical thinking and problem solving through exploratory and creative learning experiences. In this way, DreamSpace was again found to be a catalyst for change by demonstrating to students what's possible with technology, thus helping to foster creativity, shape ambition and cultivate ideas.

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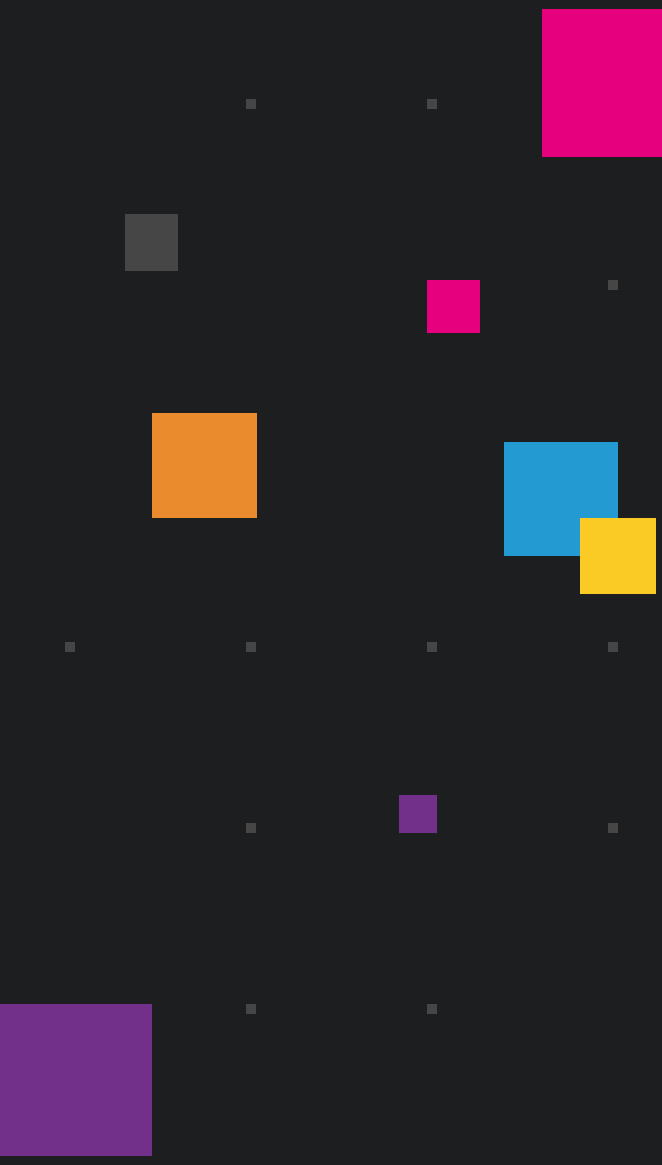

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