Design Education for Sustainability: Identifying Opportunities in Ireland’s Second Level Education System

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Abstract: Design Education for Sustainability has the potential to accelerate and encourage education that contributes to the 2030 Sustainable Development Agenda. (1) Arguably the potential of Design Education for Sustainability remains underutilized in Ireland’s second level education system. (2) This article reports on findings conducted as part of a research project which examines Education for Sustainable Development in Irish secondary school Design Education subjects. The research draws on data gathered through critical ethnographic interviews with teachers in practice. (3) The findings explored in this article are the barriers faced by educators in relation to the further integration of Education for Sustainable Development in Ireland’s Design Education subjects. These findings offer a unique insight into the realities of educators in progressing towards Design Education for Sustainability. (4) In identifying the challenges, this article offers a starting point to tackle the barriers associated with integrating sustainability in Design Education within the Irish second level education system. (5) The article concludes by identifying how these barriers can be tackled head on in order to progressively integrate Education for Sustainable Development in Design Education subjects.

Keywords: design education; technology education; post-primary; critical realism; SDGs; sustainability; education for sustainable development

1. Introduction

Design Education for Sustainability has a significant role to play in progressively moving towards a sustainable future. This article begins with a brief discussion of the literature in the areas of Design Education and Education for Sustainable Development.

The risk of exceeding planetary boundaries has become a major concern for the security of our Earth Systems, which provide a safe operating space for humanity [1–4]. The importance of this planetary boundaries framework is evident in the development of policies such as the ‘EU Green Deal’, which aims to make Europe carbon neutral by 2050 and gives clear recognition that operating within a planetary boundaries framework is key for a more sustainable planet [5]. Additionally, the wider policy agenda of the Irish Environmental Protection Agency places strong emphasis on the pressing need for a sustainable environment [6].

Furthermore, the UNESCO #ESDfor2030 agenda offers a roadmap which seeks to strengthen the role of education in securing a sustainable future [7]. The roadmap places emphases on the Sustainable Development Goals (SDGs) as it suggests that education is central to their achievement [7]. It is evident that research in the area of Design Education and Education for Sustainable Development should be concerned with progressing towards a sustainable future within a planetary boundaries framing.

2. Design Education and Education for Sustainable Development

In the roadmap #ESDfor2030, priority action area 3 recognizes that educators have a significant role to play in supporting societal transformations for a sustainable future [7].
Education for Sustainable Development supports educators in this role as it strives to enable students to be “potential creative problem solvers” regarding sustainable development [8] (p. 2). UNESCO similarly acknowledges these capabilities highlighting the importance of the “creative and innovative minds” of young people as key actors needed to address sustainability challenges [9] (p. 9).

Education for Sustainable Development is somewhat similar to that of Education for Environmental Citizenship. Research has been conducted that explores Education for Environmental Citizenship and Education for Sustainability in a European context. Such as the European Network for Environmental Citizenship, the main objective is to promote Education for Environmental Citizenship through European and international collaboration [10]. Framing Education for Sustainable Development from a planetary boundaries perspective supports a shift in focus towards holistic education that encompasses ecological integrity for a more sustainable future. Recently Kopnina has cautioned against unreflective acceptance of SDGs in education suggesting this runs the risk of maintaining the status quo [11]. They argue for increased critical discussion in education, which “stresses ecological integrity for the future of both human and nonhuman species” [11] (p. 9). Meaningful Education for Sustainable Development could provide a critical lens through philosophies such as economic de-growth, cradle to cradle and the circular economy. Such actions are reflected in Glavić’s acknowledgement that Education for Sustainable Development provides a long-term effective way to achieve social transformation and increase environmental awareness [12].

Design Education in particular has the potential to embed deeper elements of Education for Sustainable Development and create students who are equipped to address the ‘wicked problems’ raised by complex sustainability challenges faced globally [13]. There has been much discussion surrounding this potential of Education for Sustainable Development in Design Education [14]. For instance, over a decade ago, it was suggested that problem solving [15] and creativity and environmental sustainability through eco-design [16] offered opportunities for Education for Sustainable Development in Design Education. A framework was also proposed based on data collected in France, Russia and Australia which aided in the systematic design of Education for Sustainable Development curricula [17]. Within that decade teachers’ perceptions of sustainability in the context of the sustainable design awards were investigated in England, Wales and the Netherlands [18]. Calls were also made for Design Education that embraced lifecycle thinking and moved beyond ‘tinkering’ with classroom practices [19]. Additionally, the ‘frame of mind’ approach as suggested by Bonnett [20] was adapted in transformative pedagogies, which have been suggested as an approach to greater sustainability in Design Education [21].

More recently, Education for Sustainable Development in Design Education has remained a relevant topic in the field as evidenced through international conferences such as ‘Technology Education for the Future: A Play on Sustainability’ PATT27 [22] and books including ‘Environment, Ethics and Cultures: Design and Technology Education’s Contribution to Sustainable Global Futures’ [23] and more recently, in an Irish context ‘Teaching Climate Change in Primary Schools: An Interdisciplinary Approach’ [24]. With the introduction of SDGs, there have also been increasing calls for Design Education to support their implementation given the subjects’ focus on creativity and problem solving [25].

However, Education for Sustainable Development in Design Education is not without critique. Design education places creativity and innovation at its core; activities that are undertaken in Design Education strive to build technological capability and develop innovative problem solvers through design. Nevertheless, caution is suggested where design activities act in a “current paradigm of thoughtless production and consumption” [26] (p. 128). Petrina has suggested that our current design practices are not sustainable and that when we teach design and technological problem solving, we “invariably neglect the interconnectedness of products” with our cultural and natural ecologies [27] (p. 208). Also suggested is that our entire process of “capitalist design” and our over consumption and production are no longer justifiable [27] (p. 212). Such arguments are why Baynes...
cautions that “designerly thinking—is one of the most dangerous of all human characteristics!” given the potential costs of personal, social or environmental damage [28] (p. 18). More recently, Knutsson critiqued Education for Sustainable Development in Design Education suggesting that an eco-innovative curriculum needs to interrogate the outlook of a sustainable future and that space should be made for critical and system focused perspectives [29].

Education for Sustainable Development and Irish Design Education

Ireland’s Design Education subjects are offered at the Junior Cycle (lower secondary) and Leaving Cycle (upper secondary) school system. There are a total of four subjects offered at Junior Cycle (Applied Technology, Wood Technology, Graphics and Engineering) and four parent subjects offered at Leaving Cycle (Technology, Construction Studies, Design Communication Graphics and Engineering). Table 1 illustrates the unique aim of each Design Education subject offered in Ireland.

In an Irish context, there has been limited research in relation to Design Education and Education for Sustainable Development. McGarr has commented on a lack of critical integration of Education for Sustainable Development in Design Education at Leaving Cycle Technology [30]. Recently McGarr and Lynch drew on the work of Elshof ‘new path’ [19], Pavlova ‘weak anthropocentrism’ [17] and Knutsson ‘radical reconceptualisation’ [29] to critique Junior Cycle Irish Design Education subjects and their ability to encourage Education for Sustainable Development given recent curricula reforms [31]. Further, McGarr and Lynch note that references to sustainability within the curricula are what they term a “symbolic acknowledgement” [31] (p. 8). They highlight that the subject specifications acknowledge sustainability and have also designated specific learning outcomes that encompass sustainability, but caution that without a definition of the construct of sustainability these references become an “empty signifier” [31] (p. 12).

While there has been limited research in relation to Education for Sustainable Development in Irish secondary school Design Education (e.g., [30,31]) it is worth noting that much of this research is narrowed to an examination of curricula reform and the integration of Education for Sustainable Development in that context. Despite research regarding the perception and practice of Irish secondary school design teachers towards sustainability [32], there remains a notable absence of critical research in an Irish setting that investigates the practices of Design Education teachers and the real-world integration of Education for Sustainable Development in the subjects. This article contributes to the wider academic conversation as it examines the practical barriers faced by teachers of Design Education subjects in Ireland.

The last three decades have seen a continuous evolution of educational policy in Ireland with a recent example of ‘The National Strategy on Education for Sustainable Development in Ireland 2014–2020’ [33]. The strategy notes that it seeks to equip students with the necessary knowledge, skills and values to become engaged citizens who take action for a more sustainable future [34]. The latest review of Ireland’s National Strategy on Education for Sustainable Development highlights that there has been progress made by organizations to embed Education for Sustainable Development in the curricula. However, the report emphasizes there is a “lack of system-wide awareness of the strategy” and that “further action must be taken to communicate, raise awareness of and embed ESD” [35] (p. 44).
Table 1. Irish Design Education Subjects (t4). Adapted from Leahy and Phelan [36] (p. 384).

| Junior Cycle Subject | Year Comenced | Subject Aim (Minimum 200 h over Three Years) |
|----------------------|---------------|---------------------------------------------|
| Applied Technology (AT) | 2019 replaced–Technology (1989) | “Applied Technology focuses on developing students’ understanding of, and skills in, the application and impact of technologies in the world around them. This will be achieved through three inter-connected contextual strands: [1] Principles and practices, [2] Energy and control and [3] Technology and society” [37] (p. 9). Assessed by the State Examination Commission at common level to be first examined in 2022 consisting of a project (70%) and written examination (30%). |
| Wood Technology (WT) | 2019 replaced–Materials Technology Wood (1992) | “Wood Technology focuses on developing students’ understanding of, and skills in, the applications and impact of using wood as a resource in the world around them. This will be achieved through three inter-connected contextual strands: [1] Principles and practices, [2] Design thinking and [3] Wood science and materials” [38] (p. 9). Assessed by the State Examination Commission at common level to be first examined in 2022 consisting of a project (70%) and written examination (30%). |
| Graphics (GR) | 2019 replaced–Technical Graphics (1992) | “Graphics focuses on developing students’ understanding of and skills in the applications and impact of technologies in the world around them. These will be achieved through three inter-connected contextual strands: [1] 2D graphics, [2] 3D graphics and [3] Applied graphics” [39] (p. 9). Assessed by the State Examination Commission at common level to be first examined in 2022 consisting of a project (30%) and written examination (70%). |
| Engineering (En) | 2019 replaced–Metalwork (1992) | “Engineering focuses on developing students’ understanding of, and skills in, the applications and impact of technologies in the world around them. This will be achieved through three inter-connected contextual strands: [1] Processes and principles, [2] Design application and [3] Mechatronics” [40] (p. 9). Assessed by the State Examination Commission at common level to be first examined in 2022 consisting of a project (70%) and a written examination (30%). |

| Senior Cycle Subject | Year Comenced | Subject Aim (Minimum 180 h over Two Years) |
|----------------------|---------------|---------------------------------------------|
| Technology (T) | 2007 | “Technology emphasises the use of knowledge, its practical application to real-life situations, and the interaction between thinking and doing . . . The course encourages practical activities and the production of artefacts and systems as solutions to identified problems or briefs. Students taking this course should develop their problem-solving skills and a sense of responsibility for their own learning, and become self-directed, creative and autonomous learners, thus laying the foundation for lifelong learning” [41] (p. 3). Assessed by the State Examination Commission at two levels, higher level and ordinary level, consisting of a project (50%) and a written examination (50%). |
| Construction Studies (CS) | 1984 | Construction Studies has been designed to, among other things, “introduce pupils to the knowledge and skills involved in construction technology and construction materials and practices; through theoretical study and integrated practical projects” [42] (p. 1). Assessed by the State Examination Commission at two levels, higher level and ordinary level (pre COVID-19 pandemic criteria), consisting of a project (25% HL) (30% OL), a practical examination (25% HL) (30% OL) and a written examination (50% HL) (40% OL). |
Senior Cycle Subject | Year Commenced | Subject Aim (Minimum 180 h over Two Years)
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Design Communication Graphics (DCG) | 2007 | Design and Communication Graphics “makes a unique contribution to the student’s cognitive and practical skills development. These skills include graphacy/graphic communication, creative problem solving, spatial abilities/visualisation, design capabilities, computer graphics and CAD modelling. The creative and decision-making capabilities of students in the activities associated with design, are developed through three principal areas of study: [1] design and communication graphics, [2] plane and descriptive geometries and [3] applied graphics” [43] (p. 1). Assessed by the State Examination Commission at two levels, higher level and ordinary level, consisting of a project (40%) and a written examination (60%).
Engineering (EN) | 1985 | Engineering “represents a study of a wide range of mechanical engineering materials, processes and technological applications integrated with the acquisition of the manipulative skills and techniques necessary for practical resourcefulness, creativity and design realisation in the execution of work” [44] (p. 1). Assessed by the State Examination Commission at two levels, higher level and ordinary level (pre COVID-19 pandemic criteria), consisting of a project (25% HL) (30% OL), a practical examination (25% HL) (30% OL) and a written examination (50% HL) (40% OL).

Within these subjects that come under the umbrella of Design Education in an Irish context, there has been an “epistemological shift towards design activity” [36] (p. 376). With this shift there has been an increase in promoting design and developing designerly thinking among students, which offers scope for increased Education for Sustainable Development. Despite this potential, it is suggested that in an Irish context, Design Education curricula have integrated Education for Sustainable Development to an extent, but by and large the integration remains tokenistic and that the subjects’ design-and-make pedagogies continue to focus on a product paradigm driven by consumerism [31]. Stables, however, notes that the designers are not the sole culprits in developing a consumerist product driven society but rather are collaborators in a system that produces products for “desires and wants rather than needs” [45] (p. 21). There remains therefore, much potential in Irish Design Education to encourage students to be creative innovators who have the curiosity to challenge sustainability problems and question norms. These students are the key to developing a consumer society that favors cradle to cradle and circular economy philosophies.

With research ranging from transformative pedagogies to eco-design approaches it would be fair to say there is limited consensus among academics in this field. Additionally, this conversation remains “largely confined to the echo-chambers” of Design Education with McGarr and Lynch calling for new conversations that raise “much more fundamental questions about human existence and the education of young people at a time in the end of the Anthropocene” [31] (p. 6). This article contributes to such calls for new conversations in exploring how Design Education can support a sustainable future by considering the realities of Education for Sustainable Development and the barriers that educators face in practice.

3. Methodology and Research Design

The results reported in this article are part of a broader research project that adopts a critical realist perspective as the paradigmatic approach. However, it is worth noting that for the purpose of this article, the results focus on critical ethnographic interviews that relate to the barriers faced by teachers.

Critical realism has been applied to education research and to a diverse range of research fields including ecology, economics and law [46]. Critical realism is an appropriate methodology for the research given that it is a useful approach for analyzing social prob-
lems and identifying possible solutions [47]. This is particularly the case in this research as it seeks to analyze barriers faced by teachers and suggest opportunities for meaningful integration of Education for Sustainable Development in Irish Design Education subjects.

Critical realism is not renowned for its methodological approach. Fletcher, points to Yeung [48] and Oliver [49] who note that “some researchers have lamented the ‘lack of methodological development’ on the application of critical realism” [47] (p. 181). Despite such observations, it remains necessary to select a methodological approach which is in keeping with the critical realist paradigm. Withell and Haigh highlight the importance of making thoughtful decisions regarding research design to ensure coherence with critical realist perspectives on the overall research objectives [50]. The research therefore adopts the work of Corson [51] who sets out Bhaskar’s ‘logic of scientific discovery’ [52,53] in what Corson calls Bhaskar’s ‘conception of discovery’. This ‘conception of discovery’ is the methodological approach on which the research draws to remain aligned with the critical realist perspective.

3.1. Methods

The research question aimed to critically investigate the perceptions and practice of design educators regarding Education for Sustainable Development. In keeping with the critical realist methodology, a multi-method approach to data collection was adopted in keeping with the ‘conception of discovery’ as set out by Corson [51]. Such a multi-method approach is in line with critical realism as suggested by Withell and Haigh who comment that critical realists “contend that a mix of data types including qualitative and quantitative . . . may well be required to address particular research questions” [50] (p. 322). Research methods in the form of inquiry-based surveys and critical ethnographic interviews generated both quantitative and qualitative data.

3.2. Data Collection

Data relating to the critical ethnographic interviews were collected pre COVID-19 pandemic in situ via face-to-face conversations with participants. The interviews were designed to have a ‘conversational’ style to avoid the participant feeling like they were engaged in an ‘interrogation’. Although these interviews were described as ‘conversational’ they still gathered in-depth data. As noted by Webb and Webb “an in-depth interview is a ‘conversation with a purpose’” [54] (p. 130).

Interviews ranged from 30–55 min depending on the participant’s schedule. However, interviews were generally 45 min in keeping with the school timetable. Maintaining a critical ethnographic approach, the researcher was afforded the opportunity to spend time in the school environment with each participant also.

The interviews adopted a structure suggested by Spradley and followed a distinct critical ethnographic interview style along with key structuring questions [55]. The interviews were comprised of five parts: grand tour questions; details through questions; experience questions; narrative-like questions; and concluding questions [55]. Additionally, other forms of critical ethnography have influenced the research, such as the use of critical reflections and critical field annotations which align with the dialectical avenue of critical realism.

3.3. Participant Recruitment

Participants were recruited for the critical ethnographic interviews through an opt-in option during the inquiry-based surveys. However, further recruitment was aided through the use of social media and in addition, ‘snowball’ recruitment of participants was also used. Lastly, upon visiting teachers in situ oftentimes more teachers from the school’s Design Department would also volunteer to take part in the research. As the interviews were conducted in 17 secondary schools around Ireland with ranging demographic backgrounds ‘snowball’ recruitment was extremely effective. In total, n = 26 practicing teachers were interviewed with experience ranging from less than one-year teaching to 20–years plus.
3.4. Data Analysis

Participants’ data were analyzed using the work of Braun and Clarke [56] in order to provide structure during the analysis process. As noted by Fletcher, critical realists during the data analysis stage look for tendencies as “rough trends or broken patterns in empirical data” known as “demi-regularities”, representing the beginning of the abduction and reduction stages of analysis [47] (p. 185). Braun and Clarke set out six phases for conducting a thematic analysis [56]. Although their model provides guidance for thematic analysis generally, it has been adapted to identify demi-regularities particularly in relation to the empirical data collected during the critical ethnographic interviews.

The process of analysis began with transcriptions as they are viewed as essential in the reporting of the research [57]. Therefore, transcription was completed by the researcher as this process allowed the researcher to have a clear understanding of the data prior to analysis acting as the familiarization phase (1). The researcher generated initial codes from the data in phase (2) with the help of graphical illustrations. This was an important part of the analysis process as the use of sketches and visual mind maps generated by the researcher to reflect on the results, aided in the generation of initial codes. This was closely followed by codes generated using NVivo™ which offered the power to manage those codes with more clarity. The researcher began searching for themes in phase (3) by generating memos and annotations during the analysis process. They aided the researcher to organize thoughts, collate data and search for potential emerging themes. Having identified a number of early themes, phase (4) initiated the review process. The researcher reviewed the emerging themes to ensure coherence across the data codes and overall dataset. The defining and naming of themes, phase (5), optimized field notes and illustrations. The field notes aided in the analysis process as they gave the researcher a vivid image of the discussion that occurred during the interview acting as a familiarization tool helping the researcher to define and name each individual theme. Finally, phase (6) required the production of a report which detailed the completed thematic analysis [56].

4. Results

The interview data suggest that practitioners face multiple barriers in relation to the further integration of Education for Sustainable Development in Irish Design Education subjects. The results illustrated in this section emerge from the data in two distinct forms. The first finding describes a demi-regularity (theme) extrapolated from the interview data through thematic analysis. The second finding outlines the barriers specifically identified by participants during the interviews.

4.1. Knowledge and Understanding of Education for Sustainable Development

The first barrier emerging as a demi-regularity relates to participants’ knowledge and understanding of Education for Sustainable Development. Participants were asked to describe what sustainable development meant to them in an educational context with all responses (n = 26) categorized into one of three categories: superficial, average, or in-depth (Figure 1).

![Figure 1. Knowledge and understanding spectrum.](image)

Participants (n = 12) who reflected a superficial understanding provided answers which tended to focus in a narrow sense on the material and recycling elements of the topic. Building on this superficial focus, the second category, which comprised many of the remaining participants (n = 11), indicated an average understanding. For example,
descriptions in this category tended to not only refer to materials/recycling but also encompassed the additional recognition that the purpose of this material focus was for the wellbeing of future generations and the planet.

Finally, a select number of participants (n = 3) demonstrated a more in-depth understanding. These descriptions tended to be even broader than the previous categories, looking beyond a sole focus on materials/recycling to the future of the overall ecosystem and within this, included an acknowledgement of the role of social and economic institutions.

Sample participant answers regarding the meaning of sustainable development in an educational context are detailed in Table 2 which illustrates the superficial (n = 12), average (n = 11) and in-depth (n = 3) categories.

Table 2. Participants’ knowledge and understanding of Education for Sustainable Development.

| Categories  | Quotations Detailing Examples                                                                 | Number of Respondents in Category (n=) |
|------------|-----------------------------------------------------------------------------------------------|---------------------------------------|
| Superficial| “You’re not being creative, but you’re being conscious about your actions, when it comes to the environment when it comes to materials. And, like that if you’re going with a plastic bottle to a bin, there’s a recycling bin on your left, there’s a general waste bin [beside it]. Being sustainable is that you’re conscious of your actions. So you know, that plastic bottle has to go into the recycling bin.” (I_16) “Using natural resources that are recyclable. Is, what I would say.” (I_21) | n = 12                                 |
| Average    | “To think about, what we’re actually using now, that might impact on the future.” (I_11) “Sustainability is everything. I suppose. If we don’t sustain. Obviously, environmentally wise, we don’t sustain our natural resources that we have. Plastic is made from oil, oil is running out, oil prices are going up. Take that. But just at an ethical level. If we don’t set an example for our kids about sustainability.” (I_24) | n = 11                                 |
| In-depth   | “So obviously, there’s a few that would be like the very, the surface of sustainability where you have your reduce, reuse, recycle. And that’s the lesson everyone learns in primary school . . . However, personally ones that I would gravitate towards to more, would be design for future generations. And that’s something that would be quite important to me when they think of sustainability. Because I think that, in years gone by, that when a lot of products or even in terms of the working world, the systems and infrastructures we have, the design of them that maybe didn’t consider, the impact that [it] would have on future generations. So that would be something that would stand out quite a bit for me.” (I_26) | n = 3                                  |

4.2. Education for Sustainable Development Barriers Identified by Participants

Participants identified three primary barriers regarding their experience in seeking to integrate Education for Sustainable Development within their practice. First, they do not feel equipped with the necessary knowledge. Second, assessment is a main driver in terms of what they teach. Third, time constraints are also a limiting factor in the extent to which they incorporate Education for Sustainable Development.

4.2.1. Not Equipped or Supported

The first barrier identified by participants was that they do not feel equipped to integrate Education for Sustainable Development into their teaching. For instance, participant I_15 when discussing Education for Sustainable Development commented “no, because again, we’re not equipped to deal with it”. Elaborating on this point, they described how it would be unfair to both teachers and students to integrate it into the subjects’ design briefs given their level of unpreparedness:

“So it’s easy to say that it is lovely. But, if I can’t give these lads the tools then to deal with that, then it’s a bit of a waste . . . So like, it’s not fair to say “Oh, yeah we’ll change it because we’ll actually, put [sustainability] in that brief there and we will make them do it.” No, it’s not the same, they have to get the resources” (I_15).
A lack of external support was also highlighted in the absence of professional development for Education for Sustainable Development in Design Education. For example, participant I_01 suggested there is a lack of professional development (in-service) in the area “oh, definitely not. No. I think, they are, they tick the box, but like, have you ever heard of any in-service about sustainable development? I haven’t”.

4.2.2. The Influence of Assessment

The second barrier identified by participants is that teaching and learning is geared towards assessment (practical and written) and in turn, the content of the assessment itself influences the integration of Education for Sustainable Development in their practice. This suggests that where sustainability is only a small element of the assessment, Education for Sustainable Development is explored with a similar level of brevity in the classroom. For instance, participant I_10 indicates that in previous years sustainability is generally a short question or incorporated at the end of a long question in the written assessment:

“The sustainability question you know. Again the sustainable energies and resources and stuff like that. And there is a nice question in it and we try and go over it as much as we can. But again they are only short questions, or the end of long questions” (I_10).

This sentiment was echoed by participant I_07 who questioned the connection between the emphasis on sustainability in the assessment and in the classroom “but again, how much they value it [sustainability] in terms of assessment … and I suppose that message has to correlate between the assessment that you’re giving to the students, to know the importance of sustainability?”. Similarly, participant I_08 indicated that they take their cue about the need to integrate Education for Sustainable Development into their teaching based on its level of inclusion in the assessments set by the State Examination Commission, going so far as to suggest that they would be doing their students “an injustice” to spend time incorporating Education for Sustainable Development in their practice if it was not included in the State Examination:

“I wouldn’t, because I’d be doing my lads an injustice as well. Because at the end of the day, these lads in front of me are human beings that want to get somewhere in their lives as well. So just because I think that we should be talking about sustainability and all the rest. And looking at that, unless it’s on the Leaving Cert, you know, I’m doing them an injustice, to be talking about that or waffling on about that [sustainability] for ages. And whereas they’re not really getting what they need from me” (I_08).

A final point to note in relation to the influence of assessment on Education for Sustainable Development was identified by participant I_28 who referred to the “absolutely daft” State Examination Commission rule regarding the use of recycled products in student projects “year on year the state exams come out with a Leaving Cert paper that says recycled products, must not be used or there will be marks taken off”. While this rule exists to ensure no projects are resubmitted from previous years and passed off as another student’s work, the participant felt that the language of the rule referring to “modified” or “recycled projects” precluded them from reusing even the smallest mechatronic components in a new project [58] (p. 2).

4.2.3. Time Constraints

The final barrier identified by participants is that time is a key factor in their integration of Education for Sustainable Development in practice. For instance, participant I_04 discusses this connection between time, assessment and the scope to explore Education for Sustainable Development “because in a two year cycle, you don’t, have a whole lot of time to do stuff [such as sustainability] that isn’t part of the assessment, and at the end of the day your students think about points”.

Participant I_06 similarly emphasizes the already overcrowded curricula suggesting that they do not have the time to focus on Education for Sustainable Development in their teaching:
"No, no sustainability projects. Where would you get the time? Where would you get the time? It’s jam packed. I thought I’d be able to do all this. And, I thought I would have time to do everything. I haven’t got a second. Haven’t got a second, to add anything new into it”.

5. Discussion

The previous section identified some of the barriers faced by educators in relation to the integration of Education for Sustainable Development in Ireland’s Design Education subjects. Namely, teachers are on a spectrum of knowledge and understanding related to Education for Sustainable Development ranging from superficial to in-depth. Teachers also emphasized that they are not equipped, are constrained by the assessment content, and are limited in time, all of which hinder their ability to integrate Education for Sustainable Development into their practice. These findings add to the wider European and international conversation by offering a unique insight into the realities that educators face in progressing towards Design Education for Sustainability. Having identified these challenges, this discussion draws on international literature to explore opportunities to tackle the barriers head on in order to progressively integrate Education for Sustainable Development in Design Education subjects. It begins by discussing the opportunities to equip teachers with the relevant knowledge and understanding regarding Education for Sustainable Development. This section then turns to consider the opportunities associated with assessment that meaningfully encompasses Education for Sustainable Development which should help to alleviate some of the time constraints faced by teachers in their practice.

5.1. Opportunities to Equip Teachers with Increased Knowledge and Understanding

Teachers’ knowledge and understanding in relation to Education for Sustainable Development links to teachers being equipped with the necessary knowledge and skills to tackle the complexities of Education for Sustainable Development. This finding is not to say that there is a causal link between the level of knowledge and understanding of teachers and their practice in integrating Education for Sustainable Development. However, it follows that if participants do not feel equipped to integrate Education for Sustainable Development into their teaching, then increasing their level of knowledge and understanding may help to provide them with the confidence to do so. This suggestion is supported by the finding that participants’ knowledge and understanding of Education for Sustainable Development ranged from superficial to in-depth suggesting there is room for improvement. There is an opportunity to increase focus on equipping teachers to integrate Education for Sustainable Development in two cohorts. The first cohort would be in initial teacher education, which has already seen increased focus on Education for Sustainable Development through a development education agenda [59]. The second cohort of practicing teachers would benefit from meaningful continued professional development focusing on providing subject specific Education for Sustainable Development.

One reason for the finding that some participants displayed a superficial level of knowledge and understanding may be due to a “combination of misinformation and disinformation” which can lead to the creation of new norms and perceptions resulting in design for unsustainable behavior [60] (p. 5). For example, participant I_17 suggested that they would avoid using recycled aluminum due to its loss of machinable properties. They further stated that they were “chatting to a few teachers . . . we’re all thinking the same thing. The quality of aluminium and the turning of aluminium that is being used for lathe work, it is getting harder and harder to machine because, it’s being more recycled. It loses machine ability, as it’s recycled”. They further suggested that they would be cautious to use other recycled materials due to similar concerns regarding material properties. However, such thinking is a misconception as aluminium structures are easily dismantled and recycled with “no loss in quality” [61] (p. 3104). This misconception surrounding the quality of recycled material is indicative of a gap in the level of knowledge and understanding concerning Education for Sustainable Development.
Svensson and von Otter conducted interviews with Swedish teachers to investigate their perceptions of sustainable development as part of technology education. Their findings suggested that a critical approach to technology and sustainable development was not evident in their research interviews and they further suggested that there was a need for more knowledge among technology teachers regarding sustainable development [62]. This finding is consistent with the results of this research regarding the knowledge of Design Education teachers in an Irish context and further supports the opportunity for increasing teachers’ knowledge and understanding regarding Education for Sustainable Development. Additionally, in an Irish design context McMahon and Bhamra suggest that “designers now need to be equipped with the skills and knowledge that will enable them to participate in the global move towards a sustainable future” [63] (p. 595). The same can be said for design educators at second level who have the opportunity to increase the integration of Education for Sustainable Development in Design Education subjects. However, the results of this research suggest that many participants do not feel equipped for such a task. There is a need to develop teachers’ knowledge and understanding regarding Education for Sustainable Development.

Meaningful professional development provides an opportunity to improve teachers’ knowledge and understanding in a subject specific way. It can also help to empower educators to act as formative agents of change [64]. Alternative design frameworks, such as transition design and circular design philosophies, have been previously suggested as opportunities for sustainable Design Education [65,66]. The circular economy gained momentum with the Ellen MacArthur Foundation [67] providing resources and professional development to teachers while encouraging them to “participate actively in the development of thinking and teaching in this area” [66] (p. 258). Similar opportunities may be available within the Irish education system to work in conjunction with relevant stakeholders such as the Environmental Protection Agency and the Department of Education and Skills. It is worth noting that in response to Junior Cycle reform there has been an expansion in specifically designed ‘Professional Learning Experience’ events aimed at upskilling teachers in relation to the new curricula which includes an increased focus on sustainability. However, none of the teachers interviewed had received any form of professional development regarding Education for Sustainable Development in relation to either Junior Cycle reforms or traditional Leaving Cycle subjects. Thus, again illustrating the opportunity to equip teachers with a greater level of knowledge and understanding in relation to Education for Sustainable Development.

5.2. Opportunities to Address Constraints Associated with Assessment and Time

This section discusses the opportunities associated with assessment that meaningfully encompasses Education for Sustainable Development, which should help to alleviate some of the time constraints faced by teachers in their practice. As detailed in the results section, participants identified both assessment content and time constraints as barriers to the further integration of Education for Sustainable Development in their practice. As such, these are two distinct barriers and this discussion is not to suggest that all of the time limitations identified by participants are a result of assessments which fail to integrate sustainability holistically. Rather, this discussion explores one opportunity, in the form of assessment which holistically integrates Education for Sustainable Development, in the hopes that such a shift could help to alleviate some of the limitations dictated by current assessment models and teacher time constraints.

An opportunity therefore lies in moving away from assessment (both practical and written) that promotes a product paradigm to one which more deeply integrates Education for Sustainable Development. As previously noted by participant I_08, “unless it’s on the Leaving Cert, you know, I’m doing them an injustice”. Comments such as these indicate the reality for many participants that assessment is a critical driving force in the extent to which they embed Education for Sustainable Development. (For an indication of the
weight given to the practical and written assessments of each Design Education subject in Ireland’s second level education system see Table 1).

In order to achieve more meaningful integration of Education for Sustainable Development in Design Education assessments, it would also be necessary to consider the extent to which Education for Sustainable Development is reflected in the subjects’ curricula. It has been suggested from an Environmental Citizenship perspective that in order to promote environmental literacy and environmentally responsible behavior curricula need to integrate and actively “promote social engagement programs and incorporate service learning modules” [68] (p. 92). The challenge would be the inclusion of such elements in the curricula as Pitt and Heinemeyer note “the lack of flexibility in many nations’ school curricula and assessment systems, and the dominance of a ‘do a bit less harm’ approach to sustainability by teachers” are obstacles to the exploration of circular design thinking in schools [66] (p. 259). A similar point is echoed by participant I_26 who stated that “the curriculum is quite a busy, complicated area itself, and with so much areas of learning to get covered. I’d feel that maybe I don’t get to put as much emphasis on sustainable development, as I would like to” (I_26). It has been suggested that curricula need de-cluttering and doing so should involve a shift in emphasis from “knowledge and skills” to “attitudes and engagement” [26] (p. 127). Such a shift to de-clutter Design Education curricula in an Irish context could also offer an opportunity for a holistic incorporation of Education for Sustainable Development.

Ireland’s education system is changing at Junior Cycle, which has seen the introduction of classroom-based assessments [69]. Such assessments may afford teachers the opportunity to integrate Education for Sustainable Development in a way which also helps to address some of the limitations identified by participants regarding assessment and time constraints. In this context, for example, participant I_02 identified scope for greater inclusion of sustainability in project work:

“I think design is huge and within that area of design there’s definite scope for pedagogical development of sustainability in design. And I think . . . as current educators in Technology, I think we’re starting to be aware of that, more and more, [and] include that more and more in our, I suppose project work that we will do” (I_02).

This scope for increased Design Education for Sustainability in assessment, particularly in project design, aligns with the call by Stevens et al. that “new design challenges must be geared towards solving global issues” [70] (p. 17). Thinking more broadly about the purpose of design challenges, and the types of design challenges teachers adopt in their classroom and assessments also, creates room for a more meaningful integration of Education for Sustainable Development, particularly given the potential of design. Such design challenges are also reflective of UNESCO’s call to fully integrate Education for Sustainable Development and SDGs into learning environments [7]. Critically utilizing SDGs is an opportunity to provide teachers with a common goal and an approach to Design Education where designerly thinking provokes thought and encourages critical thinking. Such a holistic approach to the integration of Education for Sustainable Development in assessment could help to alleviate some of the limitations identified by participants in the form of current assessment models and teacher time constraints.

6. Conclusions

Design Education for Sustainability has a significant role to play in progressively moving towards a sustainable future. However, the potential of Design Education for Sustainability remains predominately underutilized in second level education systems.

This article seeks to contribute to the European and International discussion in Design Education through an exploration of the barriers faced by educators in relation to the integration of Education for Sustainable Development in Ireland’s Design Education subjects. The first barrier relates to participants’ knowledge and understanding of Education for Sustainable Development which ranges from superficial, average, to in-depth. The second barrier relates to those obstacles identified by participants in their experience
as they seek to integrate Education for Sustainable Development within their practice. First, they do not feel equipped with the necessary knowledge. Second, assessment is a main driver in terms of what they teach. Third, time constraints are also a limiting factor in the extent to which they incorporate Education for Sustainable Development. These findings not only offer a unique insight into the realities that educators face in progressing towards Design Education for Sustainability but also a way forward as opportunities to tackle these barriers associated with integrating Education for Sustainable Development in Design Education. McLaren observes that while much has been written about Design Education for Sustainability, “the majority seem to focus on the why things should change, not necessarily the how to affect change” in Design Education [71] (p. 149); this article contributes to the Design Education for Sustainability conversation as to how change could be affected by exploring the opportunities raised in the barriers identified in this research. First, it is suggested that there is a need to equip teachers with the relevant knowledge and understanding regarding Education for Sustainable Development. Second, there is scope to provide Design Education assessment that meaningfully encompasses Education for Sustainable Development, which should help to alleviate some of the time constraints faced by teachers in their practice. There is no one silver bullet to improved Design Education for Sustainability, but recognizing the barriers faced by teachers in practice offers a starting point to identify opportunities which may lead to the increased integration of Education for Sustainable Development in Design Education.

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