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Sustainability in supply chain management: using drawings to understand undergraduates' perceptions of sustainability

Sharon Feeney and John Hogan
Faculty of Business, Technological University Dublin, Dublin, Ireland

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Abstract

Purpose – This paper presents an interpretation of freehand drawings produced by supply chain management undergraduates in response to the question: "What is sustainability?" Having to explain sustainability pictorially forced students to distill what the essence of sustainability meant to them and provided insights into how they perceived sustainability and their roles in achieving sustainability in the context of supply chain management.

Design/methodology/approach – Students were asked to draw and answer the question "What is sustainability?" These drawings were discussed/interpreted in class. All drawings were initially examined quantitatively, before a sample of four were selected for presentation here.

Findings – Freehand drawing can be used as part of a critical pedagogy to create a visual representation to bypass cognitive verbal processing routes. This allows students to produce clear, more critical and inclusive images of their understanding of a topic regardless of their vocabulary.

Practical implications – The authors offer this as a model for educators seeking alternative methods for engaging with sustainability and for creating a learning environment where students can develop their capacity for critical self-reflection.

Originality/value – This study shows how a collaborative learning experience facilitates learners demonstrating their level of understanding of sustainability.

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Keywords Sustainability, Drawing, Freehand, Critical pedagogy, Learner-centered, Supply chain management

Paper type Research paper

Introduction

Here we examine how a small sample of supply chain management students conceived of sustainability through their generation of freehand drawings. In recent years, many Irish higher education institutions (HEIs) have reimagined their missions to incorporate the Sustainable Development Goals (SDGs) of the United Nations (UN) (United Nations, 2015). HEIs can no longer focus exclusively on teaching and research, but now embrace the wider purpose of developing students' civic responsibility and preparing them to be conscious of the need for sustainable business practices (Feeney and Hogan, 2017; Feeney and Hogan, 2022). This requires students gain a deeper understanding of the meaning and principles of sustainability.

Sustainability has been defined as one of humanity's most urgent challenges, according to the 2030 Agenda for Sustainable Development and the SDGs (United Nations, 2015). The

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UN's Brundtland (1987, p. 24) report defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". Today, there is a global effort to meet the SDGs, but the increasing uncertainty regarding economic, environmental and social threats creates additional challenges.

Freehand drawing, as a visual elicitation technique, permits learners grasp that there are multiple ways to understand and analyse any issue (Feeney and Hogan, 2020; Feeney *et al.*, 2015). Therefore, the drawing exercise serves as a useful aid to facilitate learners' conceptualisation of their understanding of the topic and permits us examine their output. This approach is not hindered by a lack of verbal reasoning, vocabulary, language, or inhibitions regarding differences of opinion (Meyer, 1991). The intention in using this approach was to initiate a learner-directed situation that enabled them to utilise a more active, self-managed and critically reflexive stance (Rose, 2008), the outputs of which could be discussed, compared and contrasted. In addition, the drawing exercise and the subsequent discussion of themes and meanings are helpful in raising learners' awareness of sustainability.

The utility of visual representation

The visual has assumed a culturally central position in the modern world. Consequently, visual representation occupies a "central role in promoting and facilitating the formation, reflection and inflection of what we 'take for granted' about the world" (Slutskaya *et al.*, 2012, p. 17). However, despite its ubiquity, the visual is still largely missing from university classrooms.

Employing visual techniques encourages a more vibrant exploration of a phenomenon and challenges conventional wisdom (Parker, 2009). It functions as "a catalyst, helping them [learners] to articulate feelings that had been implicit and were hard to define" (Zuboff, 1988, p. 141), raises participants' voices through allowing them set the agenda and own the discussion (Warren, 2005) and creates a "third space" in the classroom (Parker, 2009).

Visual methods can help learners access information and sometimes even previously unrecognised insights and embodied and tacit knowledge of their relational and situated experiences (Butler-Kisber and Poldma, 2010). Drawings encourage active participation in the learning process and the integration of visual with verbal data provides a useful form of triangulation (Flick, 2018). Where a professor would prefer not to impose a cognitive framework on learners the use of visual instruments seems ideal (Meyer, 1991).

Using drawings as critical pedagogy

Arts based learning presents a more holistic way of understanding the world than "the traditional tools of logic and rationality" (Page and Gaggiotti, 2012, p. 74) or what Heron and Reason (1997) refer to as propositional knowledge. Drawing has been of interest to psychologists for over a century. Most studies on the use of drawings focus on understanding the behavioural patterns of children, and as a way of providing observations and questions (Brooks, 2004; Spiteri, 2022; Thomas and Jolley, 1998). However, drawings have also been employed as a method of data collection Brooks (2004), Merriman and Guerin (2006), Gernhardt *et al.* (2015) and a pedagogic tool (Donnelly and Hogan, 2013; Feeney and Hogan, 2022). Page and Gaggiotti (2012, p. 74) proffer that visual representation "offers a relatively new medium for critical inquiry that accesses modalities of knowing that are sensory, aesthetic, affective, embodied and that cannot be reduced to the propositional."

Therefore, the visual, hand drawing, can constitute part of a critical pedagogy and generate critical thinking. Critical pedagogy is context-specific and descriptive, it critically

analyses the world (Monchinski, 2008). We wish to offer learners, through freehand drawing, an educational experience that challenges them to develop their own critical stances and to subsequently express their views in group discussions (Barnett, 1997).

Sustainability in Irish higher education

While pollution and degradation of the environment are not new phenomenon, they remained local/regional issues until the 20th century, when awareness arose as to the global nature of environmental problems. In this context sustainability is a broad policy concept encompassing three main areas: environmental, economic and social (Purvis *et al.*, 2019). Robertson (2017, p. 3) defines sustainability as "a diverse, interdisciplinary field focused on identifying how human culture and all living systems of the biosphere can endure and thrive into the long-term future." The idea of sustainability has become a global norm as it was adopted and pursued by people and organisations across the planet (Pfister *et al.*, 2016).

The curriculum model used in business schools has been criticised for concentrating on the shareholder-value orientated governance of capitalist organisations (Matten and Moon, 2004). Company success is now starting to go beyond profit and shareholder value, to include wider stakeholder needs and benefitting society (Luyckx *et al.*, 2022). Business sustainability encompasses activities that generate financial and nonfinancial sustainability that affect stakeholders (Ikram, 2022). Sustainable businesses try to mitigate their effects on the environment and society. "Business sustainability for organisations means not only providing products and services that satisfy the customer without jeopardizing the environment, but also operating in a socially responsible manner" (Rezaee, 2015, p. 1).

Ireland is an interesting case when considering sustainability in higher education. The 1997 Universities Act sets out a range of objectives, including promotion of the cultural and social life, supporting economic and social development and disseminating the outcomes of research to the public (McInerney and Carney, 2012). In addition, the potential of HEIs to promote and advance ideals around social cohesion and European and global citizenship has also been prioritised (see Biesta, 2009; Commission of the European Communities, 2006; Feeney, 2014; Feeney and Horan, 2015). This has been reinforced by representatives from HEIs who recognise that their role goes beyond the creation of workers and includes a wider responsibility for cultural, social and civic development (See Biesta, 2009; European University Association, 2005). In this context many Irish universities adopted the UN SDGs as a core pillar of their strategic plans. Sustainability in Irish higher education encompasses a range of approaches to developing graduate skills, interests and the participation of students, staff and institutional management (Gonzalez-Perez *et al.*, 2007).

Research design

Given the potential of freehand drawing as a route for enhancing our understanding of students' conceptualisation of sustainability, we crafted an intervention for students in their final year of study. Whereas much of the previous research using visual techniques has examined the creative products of young children (Gernhardt *et al.*, 2015; Hall, 2015; Hawkins, 2002; Wilson and Wilson, 1987), we are engaging with adult learners.

We discuss how our participants were selected, the process by which they created their drawings and provided explanations of what they drew, along with details on how the in-class discussion was conducted. Finally, we explain how the drawings were assessed for both explicit and implicit themes.

Participant selection

Here we are seeking to add to the extant literature on sustainability and to the literature on the use of freehand drawing as a teaching method that can stimulate a critical stance. The students participating in this study were attending an Irish university and pursuing an honours degree in supply chain management. The class comprised of 42, most were Irish citizens aged between 21 and 24 years, and the majority were males.

Creating the drawings

No prior readings were assigned. The drawing exercise was undertaken as part of a guest lecture, with no module credit/assessment assigned. Student participation was voluntary with no penalty for non-participation. Also, drawings were submitted at the end of class on a voluntary and anonymous basis for facilitating research and publication by the authors of this paper.

At the commencement of the class, we provided each student with an A4 sheet of paper, with instructions on one side stating: "Through a drawing answer the following question: What is Sustainability?" the other said: "Now, in your own words, describe/explain what you have drawn." Students could use whatever drawing instruments they liked and could draw whatever they liked.

We gave 10 minutes to create the drawings. A few participants expressed concern that they could not draw well, but we reassured them that such an ability was irrelevant. This put their concerns to rest and they participated. We then asked the students to turn the sheet over and address the instruction on the reverse for 5 minutes. Following this, students returned their drawings and these formed part of the class.

Each drawing was projected on a screen and the class discussed their collective interpretation of what its creator was saying. We used a flipchart to capture their insights, prompting them to elaborate any assumptions. We spent about 90 seconds per drawing to keep the room energised and affixed the flipchart sheets to the classroom walls.

The class concluded with a 20 minute-min session opening the floor to reflection/discussion, asking what the exercise told us about perspectives and assumptions relating to sustainability, about what we notice and pay attention to, what we ignore and what we take for granted. Such a guided group discussion advances reflection, position taking and critical collective sense making. The lecturer seeks to strategically engage with and instruct the learners in, classroom conversation while deepening their understanding of the content considered, in this case content related to sustainability in supply chain management (Walsh and Sattes, 2015). This sees a redefining of the roles and responsibilities of faculty and learners, requiring that faculty invert their self-understanding as educators (Barnett, 1997, p. 112), moving from "sage on the stage" to essentially "guide on the side". For learners, it means assuming responsibility for their learning. With faculty and learners, in the guided discussion context, recognising the contestability of all knowledge claims, a learning space can be created. This is an environment that encourages learners to engage in critical commentary (Dehler *et al.*, 2004), which can produce a more open and creative intellectual environment (Allison *et al.*, 2012). Students move from conveying an understanding of extant theories to theorising their own experience within the context of the broad array of understandings to which they are exposed.

Assessing the drawings

Drawings can constitute ambiguous and subjective data. Little guidance exists when it comes to analysing freehand drawings for meaning (Sharp, 2009). Up to now drawing has been a minimally explored methodology that has had few models of good practice (Bland, 2012). Nevertheless, Bland (2018) recommends that reading of visual data should be

conducted in the presence of a written explanation/description of the work provided by its creator. This way visual data can be comprehended as a kind of text (Horn, 1998). This is to assist the validity of the observers' interpretations of the drawings. "The authenticity of visual analysis can be established through triangulation with written text" (Bland, 2012, p. 239).

The images the students produced were assessed on three levels, as will be seen with the sampled images set out below. The images were assessed by the participants themselves, as after they created their drawing they wrote about what they had created; they were assessed by the participants collectively during the in-class discussion; and finally, by the authors of the paper. As interpretation plays a part in gaining meaning from images, the reporting of that interpretation involves thick description (Polgar and Thomas, 2008).

The learners' written explanations help ensure their intended message could be understood as their images were analysed. This is an important addition to the data, as it is possible to misinterpret/over-interpret drawings (Bland, 2018). Our interactions with images are never neutral, as viewers we bring our own experiences, interests and prejudices to any interpretation (Hall, 2015). These written explanations were recorded in a spreadsheet.

The participants, as a class, brought a collective interpretation to each image as they appeared for 90 seconds on the classroom screen. This was the groups' collective understanding of what they were seeing in those images. All of the themes that the class mentioned as being present in the images were recorded in a spreadsheet.

Finally, borrowing from Gernhardt *et al.* (2015), the images alone were examined by both authors. Much like with the collective group, we did not seek to distinguish between major and minor themes. If we perceived a theme as present, then we recorded it in a spreadsheet. We often perceived more than one theme per drawing. As a result, with each drawing, there exists both the explicit theme(s) that their creator ascribes to the image(s) that they drew and the implicit theme(s) that the class collectively and finally the authors of the paper, perceived.

What the drawings tell us about the participants' understanding of sustainability

As Barthes (1968) points out, in examining drawings, it is possible to identify both denotation, a picture's literal meaning and connotation, a picture's suggestive meaning in the mind of the observer. In determining the themes of the students' drawings (42 in all), we relied upon both denotation and connotation with the themes emanating from the explicit written content that the creators ascribed to their drawings along with the implicit meanings that were ascribed to those same images by the class collectively and by the authors of this paper. In essence, the themes were a result of combining data from all three understandings of the images (creators, class, authors). Using this approach, we identified a total of 7 themes (see Table 1). Table 1 also shows the frequency with which each of these

Theme*	Total (n = 42)
Climate change/Global warming	22
Renewable energy	21
Electric vehicles	12
Buy local, reduce transport	11
Sustainable living: balance between work/life/family/leisure	5
Eco-system, global dependencies	3
Working together/cooperation	3

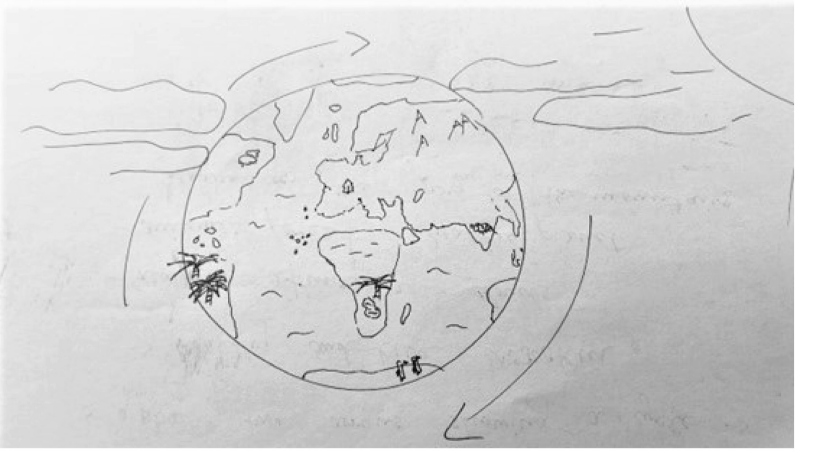
Note(s): Some drawings contain more than one theme, N = 42
Source(s): Created by the authors

Table 1.
Frequency of themes in drawings

themes were present in the drawings. The themes of "renewable energy", "climate change" and "electric transport" were most represented.

Learner drawings

Each drawing presented below is followed by the written narrative provided by the learner as an explanation of their illustration, the collective interpretation of the drawing by the class and finally our description. While we gathered 42 drawings, we present just a sample here, to illustrate the clusters of ideas we found as well as the utility of the approach set out. That said, we recognise that using only a sample of the drawings and considering them representative of all the drawings raises questions about the validity and generalisability of the findings (Dean, 2015). Consequently, we make no such claims.



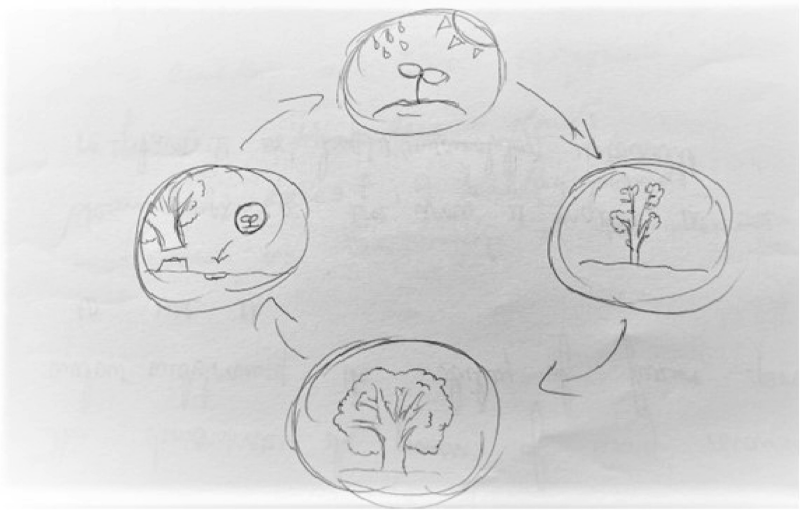
Source(s): Created by anonymous participant in study

Figure 1.
Student drawing sample 1

Learner's narrative: This is a globe with two arrows showing a cycle. There is a healthy and live ecosystem, there is a reality atmosphere which is represented by clouds; there are animals and forest representing a healthy planet, and there is snow on top of mountains showing balance.

Collective interpretation: Learners debated whether, or not, all parts of the globe are really interdependent. The drawing led to a discussion about climate change and the reduction of ice caps, global warming, etc.

Our description: Figure 1 shows a globe with some landmarks. The globe is surrounded by clouds and encompassing arrows showing the interconnectedness of life. It is a single eco-system where actions in one area have an impact on another.



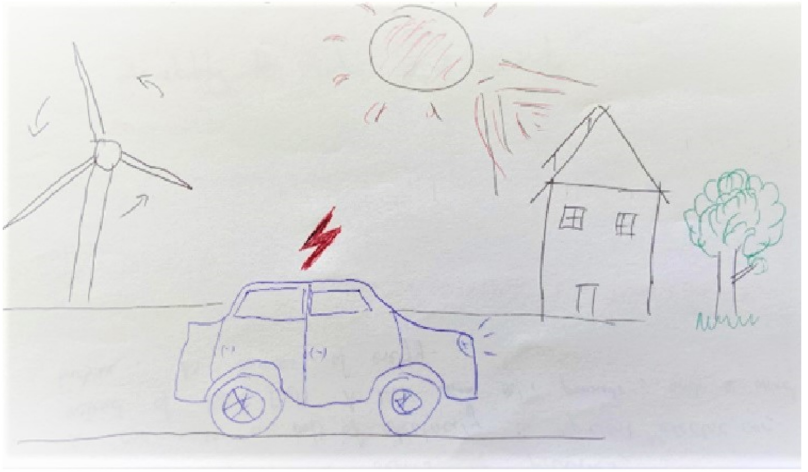
Source(s): Created by anonymous participant in study

Figure 2.
Student drawing sample 2

Learner's narrative: This demonstrates the process of using resources without withdrawing the ability of future generations to use it. We plant a tree, grow it, mature it, use it and plant a new one to replace the old. This keeps it sustainable.

Collective interpretation: There was interest in businesses planting trees as sustainable practice. Some learners saw this as a cynical attempt at gaining "green credentials" rather than investing in eradicating plastics and other non-compostable products in packaging and transportation.

Our description: Figure 2 depicts 4 stages in the life-cycle of a tree. The top of the figure represents the planting and feeding of a seedling, the second picture shows the tree growing, and the third picture shows a mature tree. The fourth picture shows the tree being cut down, but there is an arrow back to the first picture, and so the cycle continues. This drawing, with its narrative component, possesses a storytelling element (Hall, 2008).



Source(s): Created by anonymous participant in study

Figure 3.
Student drawing sample 3

Learner's narrative: I have drawn a series of pictures – a car with a bolt of electricity to represent an electric car instead of fossil fuels. A house with solar panels, and a wind turbine as sources of electricity.

Collective interpretation: Much of the debate centred on how environmentally friendly and sustainable electric cars are. An issue was whether individuals should own cars, rather than move towards car sharing whereby they pay to use a car for their journey or use public transport. There was disagreement about whether the manufacture of batteries and other components for electric vehicles could be deemed more sustainable than the manufacture of other types of cars.

Our description: Figure 3, with its detailed illustration, exists within the storytelling approach proposed by Hall (2008). The drawing depicts a windmill generating renewable energy, an electric car (presumably powered by renewable energy), a house with solar panels being powered by the sun and a tree growing in the background.

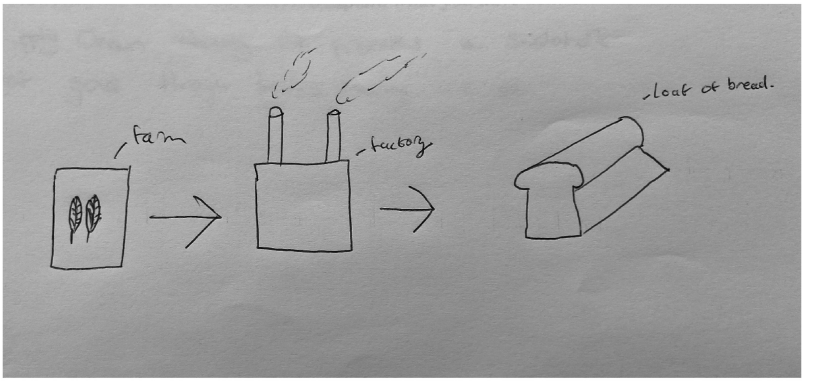


Figure 4.
Student drawing sample 4

Source(s): Created by anonymous participant in study

Learner's narrative: I have drawn a farm with arrows pointing to a factory which points towards a loaf of bread. The farm is the sustainable part.

Collective interpretation: The discussion focused on the importance of supporting farms to create produce for the local community. Food poverty, the rising cost of food and food production more generally were touched upon. Finally, there was recognition of the need to source produce locally rather than from far away.

Our description: Figure 4 shows stages in the development of a product. Again, this drawing fits within the storytelling approach, with its narrative structure (Hall, 2008). The drawing starts with wheat grown in a farm before moving to a factory (presumably to be ground into flour) and then depicting a loaf of bread.

What the sampled themes and their in-class discussions told us

Being supply chain management students, it is not surprising that transport and electric vehicles (Figure 3) were considered to represent sustainability. Many students presented concerns about climate change/global warming (22 drawings) and renewable energy (21 drawings) (see Table 1). Some of these drawings overlapped in depicting climate change and renewable energy. Other students presented drawings on the importance of sourcing materials, food and produce locally (Figure 4). However, work/life/study balance was also considered an important feature of understanding sustainability, with sustainable work practices featuring prominently in 5 drawings. Working together/cooperation (3 drawings) were also regarded as important aspects of sustainability (see Table 1).

We found that all of the drawings were similar in using a narrative approach. Although often basic and superficial, when we pressed the learners in their interpretation of their drawings during the in-class discussion, they began to question their own and others', conjectures. There is a narrative journey taken in discussing drawings, where drawings constitute a narrative springboard (Wright, 2007). "By facilitating and holding a safe, listening space, the researcher enables the participant(s) to story, narrate or dialogue with the image(s), thus allowing layers of meanings and significance to emerge" (Leitch, 2008, p. 54). Our approach of image production, followed by guided group discussion, can promote reflexive engagement to produce varied viewpoints as we ensure that all voices are heard and not just those who dominate classroom discussion, thus "enabling their multiple voices to be better represented/performed through the technique of "native image making"" (Warren, 2005, p. 861). In allowing learners convey visually what can be challenging to verbalise, drawings permit us participate in a dialectical interaction wherein we can complicate their understanding and develop their aptitude for critical self-reflection. Freehand drawing helps to empower and emancipate students whose unique insights might otherwise be hidden. Additionally, in allowing participants to also write about what they draw, an element of ambiguity present in children's drawings can be avoided here, thus providing us with an additional source of data as to what the image creator was imbuing their image with.

At the end of the exercise some learners discovered that they had a good basic appreciation of sustainability. Clearly, learners had an interpretation of what sustainability means, but struggled when trying to contextualise that meaning into everyday experience, particularly at the level of individual responsibility. Nevertheless, they recognised that by cooperating in critically examining each other's drawings, they were able to identify aspects of, and nuances in, their understanding.

Pedagogical implications

Our use of drawings, and the interpretation that occurs as part of the in-class discussion, can go some way towards generating a sophisticated understanding of the world (Dehler *et al.*, 2004), "where students can challenge prevailing assumptions" (Smith, 2003, p. 21). Freehand drawing, employed in conjunction with image interpretation and discussion, can promote reflexive engagement to produce varied viewpoints. The process of drawing elucidates further the preconceived ideas about sustainability, providing a foundation upon which to build critique (Thomson, 2008). In so doing we are creating a learning space where all are on the same epistemological ground.

The approach here seeks to surmount the long-term bias in instructional pedagogies toward oversimplification (Dehler *et al.*, 2004, p. 168) and queries propositional knowledge (Heron and Reason, 1997), as it allows students to appreciate multiple ways to comprehend, contest and analyse issues pertaining to sustainability. Our use of freehand drawing, therefore, is intended to address the calls by Bartunek *et al.* (1983) for "developing complicated understanding" and by Dehler *et al.* (2004) for "creating richer complexities" in critical thinking that serve to question what is presented as "the one true way" (Stepanovich, 2009, p. 726).

Our use of images possesses great value, as they have the potential to encode significant quantities of information (Ridley and Rogers, 2010, p. 2). As we saw in the sampled images, there was the explicit meaning participants assigned to what they had drawn when they wrote about their drawings. However, there was also the implicit meaning that the class, and the authors also, interpreted into each image. Sometimes this interpretation was similar to what participants said their drawing represented, while at other times it was at variance. In seeking to create a space for nuance and ambiguity in the classroom, through the use of drawings, we complicate students' understanding through moving away from certainty towards an acceptance of ambiguity and paradox, complexity rather than simplicity (Zohar, 1997, p. 9). The realisation that the drawings

demonstrate more than one meaning gives real world examples for students to understand the complexity of ascribing a single, narrow meaning to socially constructed terminology.

Limitations of the study

A limitation of this study is that it is a small-n study with only 42 participants and all from the same class. Nothing in the findings can be generalised to a wider population. The students were given just 15 minutes to generate and describe their drawings, more time might have allowed for more detailed images and explanations; also each image was screen projected for just 90 seconds during the group discussion phase – more time might have allowed for more detailed consideration. Additionally, only a very small number of the drawings produced can be examined in detail in the paper.

Whether dealing with qualitative or quantitative approaches all research involves subjective judgements (Denzin *et al.*, 2006). This is particularly evident when dealing with drawings, as images can be ambiguous, are open to misinterpretation and visual language is not always instantaneously understandable (Bland, 2018; Horn, 1998). The result inevitably is subjective approaches to data analysis (Bland, 2012). Indeed, our decision to focus in depth on only four of the images collected was subjective.

That the students were adults who provided written explanations of their drawings was important in clarifying what they took their images to mean, even if not obvious to third-party observers. Written descriptions of drawings constitute essential sources of triangulation in avoiding errors of interpretation (Darbyshire *et al.*, 2005).

Conclusion

In employing student generated freehand drawings to facilitate a dialectical exchange with and between students about sustainability, we sought to cultivate their capacity for critical self-reflection. This enabled the students to put into visuals a level of comprehension that might be difficult to articulate in words. The presentation of information visually enabled students to access unrecognised insights and make sense of complex issues by employing a whole of brain approach to assessing information. Students, through freehand drawing and employing the higher order thinking integral to visualisation, can define their knowledge of a topic that is universally understandable and rich in complex content.

The drawings enable us to understand that "through their ambiguity, visuals open up complexity" and "generate richer thinking and expression, otherwise curtailed by power relations and contextual custom" (Davison *et al.*, 2012, p. 8). Such a "performative approach to the visual", as offered by freehand drawing, "explicitly invite[s] multiple and reflexive engagements with our own incomplete, open-ended and maybe paradoxical written performance in order to make audible the alternative readings and voices" (Steyaert *et al.*, 2012, p. 49).

That the students discuss the drawings as a group, in which every voice is heard, encourages interpretations from multiple perspectives and gives students and professors an opportunity to challenge theories/presumptions/beliefs. This approach can raise questions about what is being viewed and aids reflection on the wider context. The objective of such critical pedagogies should be to produce learners capable of self-reflection and willing to question widely held beliefs. This approach also challenges staff to reflect on their roles in the structures of society, how they reproduce these, and, along with their students, it asks that they contest the dominant social structures.

The advantage of using freehand drawing to achieve collaborative learning is that it is a projective technique to embody the students' experience of sustainability that is available for reflection and sense making by themselves and others (Broussine, 2008). The "output of artistic endeavours allows participants to reveal inner thoughts and feelings that may not be

accessible through more conventional developmental modes" (Taylor and Ladkin, 2009, p. 56). Through creating drawings and making them available as a means of accessing tacit knowledge about sustainability, meaning is assigned by the individuals who create the drawings and the audience who interpret them (Rose, 2008). In producing and offering data for analysis, freehand drawing requires collaboration between creators and observers (Warren, 2005).

We found there was an awareness of sustainability amongst the participants. This is hardly surprising given the recent public scrutiny and debate on sustainability issues in corporate organisations in Ireland, particularly in the logistics and supply chain sector, and the HEI's incorporation of SDGs into their missions. The findings of our study suggest there is still some work to do in building sustainable competencies and enthusiasm in students.

Many implications can be taken from this study. Describing sustainability pictorially forced participants to think about what sustainability is, for them, at its essence. The images they produced showed that they absorbed a significant amount of knowledge and understanding of sustainability from their environs. With Waltz (1979) defining theory as a picture that is mentally formed of a bounded realm, the students were, through their drawings, creating their own theories of sustainability. But, there is the need for further support and encouragement of students to participate in creating a culture of "engaged scholarship" to facilitate further partnership, collaboration, knowledge sharing and knowledge transfer, as well as sharing of resources between the academic and business communities.

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Corresponding author
John Hogan can be contacted at: john.hogan@tudublin.ie

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