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Connectivism as a pedagogical model within Industrial Design education

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Abstract

This paper will discuss how the connectivist theory has implications for teaching and learning within the field of Industrial Design. Connectivism is a relatively new learning theory [1], however its emergence within the field of e-learning and distributed learning networks are appropriate for a technical field such as Industrial Design. Examples within practise are discussed and potential options for inclusion within the course are proposed.

Connectivism is a pedagogical model devised by George Siemens and Stephen Downes [2] that promotes greater integration, diversity and distributed knowledge throughout networks. While the intent for this learning model was e-learning, many of the tenets — such as the agility it promotes in regards to instructional materials and techniques — can be applied to the scholarship of Industrial Design.

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1. Introduction

Industrial Design as a discipline is relatively new; its roots are within the traditional crafts industry, however its emergence came within the industrial revolution, wherein craft-based industries were mechanised and mass-produced [3]. Currently, Industrial Design processes are undergoing a revolution, specifically in relation to hobbyist-level 3D printing machines such as the Cube and Makerbot [4]. These machines — and the online ecosystem (such as Thingiverse or Shapeways) that feeds them with products — provide an interesting and exciting opportunity for digital learning within a broad, online context.

The connectivist learning theory can provide Industrial Design education the agility that the design and manufacturing industry as a whole requires. Where connectivist theory's greatest strength lies is the 'node' based distributed learning network. As Australia's manufacturing sector and specialist engineering expertise is experiencing a contraction, opportunities to compete in a global context utilising design within niche markets are increasing [5] – with the impetus on ensuring that existing local knowledge and capability is promoted and utilised fully. This however touches on creativity, which is an anticipated outcome on connectivism. In order to remain competitive an Industrial Designer needs to create something that people want to buy. To do this a creative response is required to meet the needs and desires of the client/consumer.

From an Industrial Design perspective, creativity pedagogy needs to address current issues in order to overcome creativity barriers for improving creativity in Industrial Design education: "Facilitating staff development, providing creativity in training to students, encouraging group work and building a creative learning environment"[6]. All of this will come if connectivism as a model is promoted to help wider the thinking of Industrial Design students, staff and course leaders.

2. Connectivism as a tool to broaden design thinking

2.1. Introduction

In an educational context, linking learning to emerging spheres of influence and ensuring a level of agility is of great benefit. Traditionally, Industrial Design education is taught in a studio/tutorial environment and is relatively quick to evolve to new demands placed upon it. The content of the Industrial Design is strongly influenced from external factors; from new manufacturing techniques — such as the emergence of 3D printers and the prevalence of Computer Numeric Controlled milling stations — to the growing needs of the marketplace and new industries. There is a strong need to ensure that learning outcomes and materials are up-to-date and in many cases, ahead of industry demands and requirements. Siemens [2] discusses the "half life" of knowledge as being approximately 10 years; within Industrial Design education and practice, this is an almost an unfathomable amount of time due to the rapid rate of development of aesthetics, production capabilities, advanced materials, processes and consumer desires. For example, a common product that is the fruit of the Industrial Design process is a mobile phone; the common lifespan is approximately two years (the common contract length), with some telecommunications companies offering shorter periods of time to ensure that the consumer always has the latest model [7]. While this mode of consumption is environmentally unsustainable, the embodied research and development into manufacturing techniques, materials and physical styling is constantly changing. Consumer interactions and the ecosystem that these products exist within (such as Apple's iTunes or Google's Play store) are constantly being updated, requiring the designer to be ahead of the curve in terms of understanding all of the available technologies and processes available to ensure the product has competitive advantage within the increasingly saturated market.

2.2. Engagement within the discipline

In an educational context, linking learning to emerging spheres of influence and ensuring a level of agility is of great benefit. Traditionally, Industrial Design education is taught in a studio/tutorial environment and is relatively quick to evolve to new demands placed upon it. The content of the Industrial Design is strongly influenced from external factors; from new manufacturing techniques — such as the emergence of 3D printers and the prevalence of Computer Numeric Controlled milling stations — to the growing needs of the marketplace and new industries. There is a strong need to ensure that learning outcomes and materials are up-to-date and in many cases, ahead of industry demands and requirements. Siemens [2] discusses the "half life" of knowledge as being approximately 10 years; within Industrial Design education and practice, this is an almost an unfathomable amount of time due to the rapid rate of development of aesthetics, production capabilities, advanced materials, processes and consumer desires. For example, a common product that is the fruit of the Industrial Design process is a mobile phone; the common lifespan is approximately two years (the common contract length), with some telecommunications companies offering shorter periods of time to ensure that the consumer always has the latest model [7]. While this mode of consumption is environmentally unsustainable, the embodied research and development into manufacturing techniques, materials and physical styling is constantly changing. Consumer interactions and the ecosystem that these products exist within (such as Apple's iTunes or Google's Play store) are constantly being updated, requiring the designer to be ahead of the curve in terms of understanding all of the available technologies and processes available to ensure the product has competitive advantage within the increasingly saturated market.

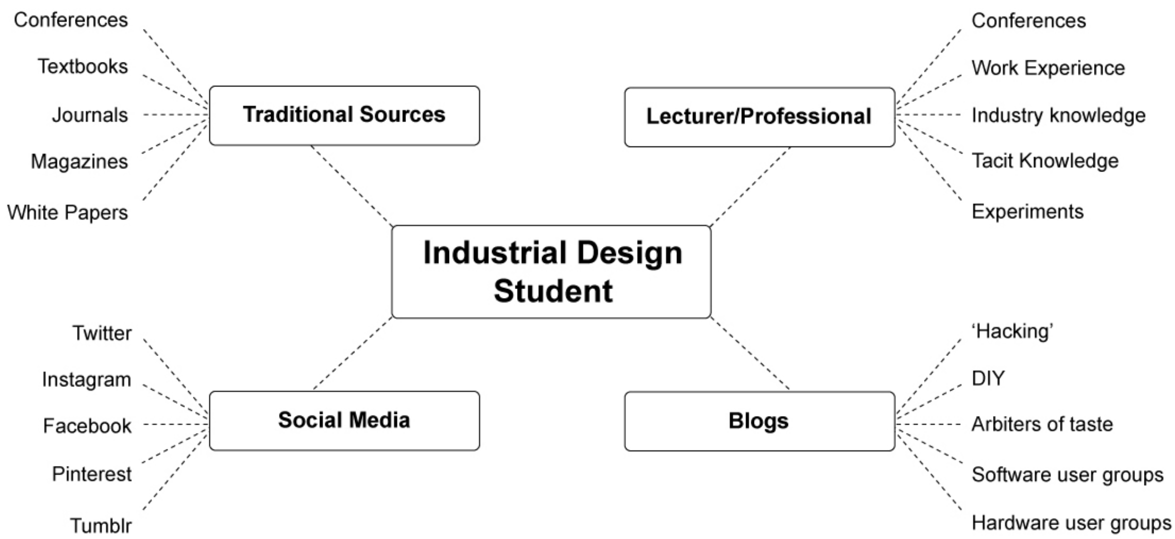

Fig. 1. Connectivist model within the context of an industrial design student.

By engaging with the tenets proposed by Siemens [2] in regards to distributed sources of knowledge (such as blogs from makers, DIY experimenters and design studios) and implementing these within the syllabus, a greater understanding of the field can be attained by the student. Textbooks — aside from ones that are quite general and give the student standards, such as screw threads, material thickness and anthropometric data, or have long standing theoretical context — can rapidly fall out of date and become rarely utilised, in favour of online journal articles by leading academics in the field. By ensuring many of the learning outcomes are based upon distributed and up-to-date — if not emerging and experimental — sources, teaching and learning within the discipline can achieve the agility and connectivity that the learning model strives for. One key principle of Siemens's theory is decision making on what to learn. Technical skills, such as software choice are very fluid, with packages becoming rapidly out of date and falling out of favour. To combat this, an assessment of industry partners is undertaken on a yearly basis and learning is tailored to suit this. On a more macro level, course focus is also assessed and responds to local and international trends. For example, environmentally conscious design and sustainability was previously a large component of the studio outcomes, however as this has become now embedded within the learning model of each studio, the overall focus has shifted more towards social innovation, advanced manufacturing and entrepreneurship. Sustainability should now be inherent in what an Industrial Designer does and from an educators point of view it is assumed that the importance of this is understood by all students. Whether this can be implemented or not is another question. To address this, a recent study from Kuys et. al. [8] surveyed Product Design Engineering graduates to better understand how their knowledge of sustainability learned during their undergraduate degree translated in their graduate position. One third of respondents for a question relating to this area said sustainability is rarely considered or applied in their current job. The reasoning given was a majority of the responses blamed cost implications, as well as many respondents were junior members of staff who are not in positions to influence change. This is obviously a concern but at least the tools are learned during someone's degree with the hope that these tools can be implemented when the opportunity presents itself. The same can be said for teaching Industrial Design connectivist learning models throughout their degree. It's not necessarily a matter of implementing something; it's a matter of understanding something with the knowledge of how to implement it when the opportunity presents itself.

2.3. Advantages and disadvantages of the model

One advantage that connectivism has for teaching is online engagement. Previously, Industrial Design students on exchange would need to scan large swathes of their sketch development or send static 2D images of prototypes. By engaging with emerging technologies, such as exporting CAD data into 3D PDF files or OBJ files, a lecturer can assess and assist in the development of the student's project, much as they would in a face-to-face tutorial. Furthermore, affordable 3D scanning technology, such as the Structure Sensor for the iPad allow for detailed visual scanning of three-dimensional data, complete with texture mapping. These files can then be emailed and viewed remotely, as well as printed utilising a low-cost 3D printer, such as a MakerBot or Cube.

In addition to the online classroom environment, the student's learning is augmented through the use of social media; posts are frequently uploaded to promote discussion in the classroom and to disseminate information that may not be directly relevant to in-class activities, yet is crucial to their learning and development within the field of Industrial Design. Increasingly, students will set up a Facebook group or similar to help discuss classroom topics and for assistance [9], as well as keeping informed of new trends within the discipline, such as live 'tweets' from design shows and events around the world.

While this is an emerging method that has much in terms of potential, there are disadvantages. 3D printing at a hobbyist level is quite affordable, however the process is very slow (with simple parts taking hours) and iterations can be wasteful. 3D PDFs — while incredibly useful at assisting, visualising and communicating form — can become bloated or corrupted, leading to irritation and confusion on both sides.

Siemens points out that when the connectivism theory was created *"...web 2.0 was just at the beginning of the hype cycle. Blogs, wikis, and RSS — now prominent terms at most educational conferences — were still the sandbox of learning technology geeks. Podcasting was not yet prominent. YouTube didn't exist. Google had not released its suite of web-based tools. Google Earth was not yet on the desktops of children and executives alike — each thrilled to view their house, school, or business in satellite images"* [10]. All of these technologies require a physical object or artefact to function, such as a tablet or smartphone and these have evolved in leaps and bounds to respond to the demands of the ecosystem and consumers.

In a design context, this is where the exciting developments happen and why this learning theory is appropriate for our discipline. We need to experiment with the latest technologies and ensure that we have the physical tools and spaces for our students to learn and develop products for markets and ecosystems that might not even exist, as opposed to simply responding to what is already out there and being behind the curve from the outset. By investigating and pooling educational resources and learning materials from all over the world — wherever they are being developed or experimented with — and embedding these within the student's experience, we're able to ensure that our students have the greatest possible advantage to compete in an increasingly competitive and strained marketplace.

3. Conclusion

In summary, connectivism as a model for the discipline of Industrial Design is not the only model that should be considered, but is certainly one that will help optimise the discipline by widening networks and learning from others who influence this field. To an extent, Industrial Designers already engage with this; ensuring that our capabilities as educators always pool its knowledge from far and wide while being agile in our course development and content, guaranteeing we are ahead of the curve. However, the field of Industrial Design is always moving at a rapid pace so it is important to not remain complacent. Where we could improve is through further engagement with emerging technologies, such as online learning and the various tools used to support these. Greater integration with 3D PDFs, wikis/blogs, newer forms of 3D printing and scanning and engaging with worldwide networks of innovators can only assist the students to be more entrepreneurial and creative in their approaches.

It is anticipated that if students can better understand the intricacies of their Industrial Design discipline and adapt connectivism as a tool to broaden design thinking, then the student has the knowledge to go onto being in a graduate position where they can apply this knowledge. The over-righting aim is to create broader thinkers with entrepreneurial skills to grow this discipline. We need more Industrial Design graduates to start their own companies that are profitable with the hope that they will be the employers of future graduates. If we are going to grow the field of Industrial Design —particularly in Australia but also globally — we need to educate students on how to do this. Connectivism opens up other avenues that are easy to pursue if given direction on how to do so. With the low cost of 3D printing and scanning and the online landscape of wikis/blogs etc., it is now affordable to create highly respected Industrial Design outcomes that can generate money. Batch production and 'one-offs' are now cheaper to produce than ever before giving independence to an Industrial Design graduate providing they have the correct tools, knowledge, dedication and ability to act on this. As mentioned, Industrial Design will always evolve at a rapid pace. It is important for Industrial Designers to stay 'ahead of the game' and take opportunities when they present, or better yet – create opportunities that aren't presented yet. Connectivsm as a pedagogical model in Industrial Design will help expand these areas by creating wider (and perhaps deeper) thinking in Industrial Design that will hopefully result in better products, systems or services to meet the needs and demands of the wider consumer market.

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