EDITORIAL: ‘Design Thinking’ Grows Up: Introducing the WISE-Tech Design Process

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The next three projects in this issue of JASTE feature 3 students who, over a 4-week process, designed original, eco-friendly artifacts to reflect their understanding of the Ontario Grade 10 Academic Science curriculum. Larry Bencze developed this pedagogy in the 1990’s and has termed it WISE-Tech Design (Wellbeing for Individuals, Societies and Environments).

This new approach attempts to fuse the habits of mind of the classical design process, the rigor of the scientific method, and consideration of the science, technology, society and environmental (STSE) implications of invention.

A brief primer of the historically pivotal forces in design as a discipline follows and serves to highlight the important implications for science and design in education.

As far back as the 1920’s, design has been innately linked with industry and consumer consumption. Borrowing ideas from the bicycle industry (Millar 2013), General Motors CEO Alfred P. Sloan suggested annual cosmetic design changes to urge vehicle owners to purchase a new car each year, and break GM out of plateauing sales. Using this “Dynamic Obsolescence” strategy would allow GM to eclipse Ford as the dominant car manufacturer of the 1930s.

The great depression and World Wars shifted the perspective of many designers away from the roaring 20’s conspicuous consumption, toward bettering human living conditions and welfare. One such designer in the 1950’s was MIT’s Buckminster Fuller, who assembled ‘Design

Science’ teams, composed of experts from multiple

fields that tackled complex problems in fields like sustainability and architecture (Ben-Eli 2007). He described this process as:

“...the effective application of the principles of science to the conscious design of our total environment in order to help make the Earth’s finite resources meet the needs of all humanity without disrupting the ecological processes of the planet”

-Buckminster Fuller

A few years later in Scandinavia, Kristen Nygaard collaboratively involved workers, unions, and citizens to developing solutions and products. (Szczepanska 2019) This “Cooperative Design” approach lead to advancements in interface design and the development of object-oriented programming.

As the practice of design permeated through society, industrialists and corporations were able to systematize production. This type of ‘Design Thinking’ champions iteration, and rapid prototyping to churn out new products as quickly as possible. As a result, the utopian 1950’s design ideals like sustainability and egalitarianism are sacrificed, as products now have to incorporate 1920’s inspired planned obsolescence.

In the educational sphere "Design Thinking" is enjoying a period of explosive growth, piggybacking off the phenomenon of "star designers" like Johnny Ive, who have done much to popularize the notion of the design process. (Edson and Ernest, 2012) Most current design thinking in schools tends to follow a linear or circular process yielding a finished product at the end (See fig 1 and 2):

Fig1: Stanford Design Process

Figure 2: Ontario Tech Curriculum Grd 9 2009

Many components of these processes are familiar to teachers as they have rough analogs to classroom practices. (See Fig 3) 'Ideation' is similar to classroom 'Brainstorming', 'Choosing the Best Solution' is very similar to 'Critical Thinking' strategies.

Figure 4: Design process classroom analogs

In practice the constraints of classroom time make educational implementations of the design process difficult. Steps are skipped and there is often a need to get to prototyping as rapidly as possible. (Fig 4) These sorts of classroom 'design challenges' usually amount to poorly differentiated 30-minute bridge or tower building tasks, and do not provide an avenue for students to consider the wider applications of design, science or STSE issues.

WISE-Tech design pedagogy attempts to promote a deeper awareness of design, science and STSE issues over other classroom design strategies. Two major pedagogical innovations make this possible.

Figure 3: Design Process Shortcut

The first one is explicitly teaching students designed products often feature compromises between multiple factors. (Fig 6)

Figure 5: WiseTech Design Matrix

This Cause/Result matrix ties “Result” variables (commonly referred to as *dependent variables* in science) to “Cause variables (commonly referred to as *independent variables* in science). Through iterative experimentation students must modify “Cause” variables in their designs to create desired outcomes in their products. A student might discover that adding multiple dye types to their formulation of an eco-hair dye might yield a more natural colour but might also negatively affect shine and texture. (This is denoted by the green and red lines on Figure 5)

The creation of this matrix requires students to research, develop multiple ideas and critically think about how they interact. It is a prioritization of the steps outlined in Figure 4, that are traditionally skipped in school design challenges.

The second innovation is the inclusion of student identified STSE result variables as listed in green at the bottom of Fig 5, even though including those variables might have negative “cause” effects. Eg. Dyes having a low environmental

impact might not last as long as other more environmentally deleterious dyes. When looking student’s projects on the following pages,

consider how students had to prioritize design elements that took STSE issues into consideration when building their products.

To create his eco-parallettes on pg 36, Soliman El-Hamarnah fused classical woodworking with 3D printing. Adopting the collaborative value system of Kristen Nygaards’ Cooperative Design, he negotiated with his school’s

technology teacher to gain access to the wood shop, the science department to gain access to the 3D printer and with a fellow student to learn 3D modelling.

Just as Buckmeister Fuller’s focus was on sustainability in his ‘Design Science’ approach, the prioritization of responsible design choices and their impacts is visible in Avtar Judge’s candle holder on page 39. This student created a candle recycler for use in the developing world out of openly available waste cardboard and cans. This approach upcycles waste and helps reduces the carbon footprint.

Ecological responsibility, the gaining of new skills and the benefits of constant design iteration are especially visible in Naiha Ali’s Eco-Shoes on pg 42. By selecting an issue that was important to her, the low durability of shoes that are often made by workers who are exploited by multinationals, Naiha developed recyclable shoes that were custom fit to the wearer. In contrast to traditionally arbitrary school design challenges that only last for 40 minutes, Naiha has chosen to continue exploring biology, design and 3D design in the following year.

References

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The following pages feature WISE-Tech Designs presented in a format that displays student thinking at each stage. For a more fulsome description of the WISE-Tech Design process please consult the following video:

<https://youtu.be/GTw42R73sh8>