

Annotated Bibliography

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Annotated Bibliography

Auernhammer, J., & Roth, B. (2021). The origin and evolution of Stanford university's design thinking: From product design thinking in innovation management. *Journal of Product Innovation Management*, 38(6). 623 -644.

<https://onlinelibrary.wiley.com/doi/pdf/10.1111/jpim.12594>

This article by members of the Mechanical Engineering Design Group at Stanford University explores the history of design thinking (DT) from 1957 to 2005 as it relates to innovation management. Product innovation management personnel are the intended audience of this article. The authors address critiques of DT, namely a lack of clear structure and a concern that the philosophy lacks a strong theoretical basis. They argue that DT's humanistic approach to identifying problems and physically designing potential solutions offers a valuable, innovative schema that is firmly built on psychology and design theories. Data collection for this article was completed via a document analysis of Stanford University's official yearly catalog of degrees and courses in distinct timeframes. Key events in the history of DT are identified for: 1957 – 1964, 1965 – 1985, and 1986 – 2005. The authors include a final declaration that there are no conflicts of interest. This article serves as a valuable resource for my final capstone paper which focuses on the history and applications of design thinking as it relates to instructional design.

Earle, A.G., & Leyva-de la Hiz, D.I. (2021). The wicked problem of teaching about wicked problems: Design thinking and emerging technologies in sustainability education. *Management Learning*, 52(5). 581-603. DOI: 10.1177/1350507620974857

<https://journals.sagepub.com/doi/abs/10.1177/1350507620974857>

This article written by business school associates, intended for a managerial audience, proposes that the challenge of effectively preparing business school students to address sustainability issues might be supported by their proposed model that applies virtual reality technology into a design thinking framework. The exploratory learning practices integral to design thinking have not been traditionally incorporated into business school curricula, but the authors argue that such practices support the ability to address “wicked” sustainability problems that have multiple conflicting stakeholders and no clear solutions. They propose that the iterative cycling process of design thinking more accurately imitates real-life managerial business challenges than traditional business school methodologies. Virtual reality offers an opportunity to supplement fieldwork and encourages acquisition of deep empathy through perspective-taking roleplay, visualization, and gamified experiences. Radical solutions can be attempted without risk and timelines can be accelerated to predict outcomes. The authors cite research on design thinking curricula in multiple contexts and argue that, if technological barriers can be addressed, business schools could greatly benefit from tried and tested experience-based methods. The authors include a statement that they received no financial support for the research and authorship of this article. This article supports my final capstone paper, which focuses on potential applications of design thinking tenets.

Mueller, J.L., Dotson, M.E., Dietzel, J., Peters, J., Asturias, G., Cheatham, A., Krieger, M.,

Taylor, B., Broverman, S., & Ramanujam, N. (2020). Using human-centered design to connect engineering concepts to sustainable development goals. *Advances in Engineering Education*, 8(2). 1-24. https://csu-mb.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_crossref_primary_10_1826

[0 3 1 1113 36015&context=PC&vid=01CAL5_UMB:01CAL5_UMB&lang=en&search_scope=DN_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,Using%20human-centered%20design%20to%20connect%20engineering%20concepts%20to%20sustainable%20development%20goals](https://search.proquest.com/docview/111336015?context=PC&vid=01CAL5_UMB:01CAL5_UMB&lang=en&search_scope=DN_and_CI&adaptor=Primo%20Central&tab=Everything&query=any,contains,Using%20human-centered%20design%20to%20connect%20engineering%20concepts%20to%20sustainable%20development%20goals)

This article, written by associates from multiple universities for an engineering educator audience, describes an effort to apply a human-centered design-thinking framework to address the 2015 United Nation's General Assembly Sustainable Development Goals through a program called Ignite. Attended by Duke undergraduates, the Ignite program tasked students with the development of sustainable solutions to global night light access, an issue primarily impacting girls in energy-poor areas. In line with liberatory design tenets, engineering students were encouraged to exercise deep empathy, working with and not for, identified communities within the community's culture and geopolitical position. Central components included facilitation of community prototyping and testing of those prototypes to identify solutions. Data on this program was collected from the Duke University Institutional Review Board. A series of participant interviews and semi-structured focus groups were also conducted. Students of the Ignite program provided positive feedback, lauding the opportunity to physically address real-world problems directly with a community in need. The Ignite model is readily adaptable, and multiple iterations have followed in similar programs. Based on these results, the authors argue that liberatory, human-centered design tenets can be powerfully and practically applied to address community sustainability challenges. The authors acknowledge financial support from multiple Duke entities and personnel. This article supports my final capstone paper, which

addresses the possible areas in which design thinking and liberatory design tenets might be successfully implemented.

Tekaatt, J.L., Anacker, H., & Dumitrescu, R. (2021). The paradigm of design thinking and systems engineering in the design of cyber-physical systems: A systematic literature review. *2021 IEEE International Symposium on Systems Engineering (ISSE)*, 1-8, DOI: 10.1109/ISSE51541.2021.9582548.

<https://ieeexplore.ieee.org/abstract/document/9582548/authors#citations>

The transition from classical mechanics to mechatronic and cyber-physical systems in the field of engineering presents the need for a new, agile design framework. The authors of this article, associates of the Fraunhofer Research Institute for Mechatronic Systems Design IEM in Germany, completed a systematic literature review to gather data on how design thinking can be used in conjunction with classical systems engineering to address “wicked” – unpredictable, ambiguous – problems to guide an engineering audience. As defined by the design and innovation agency IDEO, design thinking’s purpose is to achieve customer satisfaction. This is done by observing and questioning customer behavior and iteratively testing prototyped solutions until a final product is selected. User-centered design is a unique and central aspect of this process. The emergence of model-based systems engineering represents a movement towards holistic solutions and provides an avenue for prototyping, which is critical to the design thinking process. The literature review results indicate that divergent design thinking can complement the convergent thinking of systems engineering, and that the symbiotic relationship between these two markedly different approaches carries the potential to flexibly address human problems empathetically and creatively. The authors argue that their systematic review offers

insight into how these approaches can be successfully merged to address conceptual design challenges flexibly with customers but note that no universal approach is provided. The authors state that their research was funded by the Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia within the Leading-Edge Cluster “Intelligent Technical Systems OstWestfalenLippe.” This article supports my final capstone paper, which addresses the history of design thinking and areas in which a design thinking approach may be successfully applied.

Altman, M., Huang, T.T.K., & Breland, J.Y. (2018). Design thinking in health care. *Preventing chronic disease*, 15(E117). <https://doi.org/10.5888/pcd15.180128>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6178900/>

The doctorate authors of this systematic literature review utilized online, peer-reviewed databases to identify literature that addresses the utility of design thinking (DT) in health care. This article was written for a professional public health audience. Twenty-four studies were identified and reviewed: 19 were deemed successful, 11 had mixed results, and one was unsuccessful. The authors argue that the application of DT tenets (empathetic, collaborative design via rapid prototyping that elicits user feedback) in medicine shows promise, but that further research is needed. Key features used to distinguish DT from other similar approaches included both empathy for the end-user and simple low-fidelity prototyping. All studies that directly compared DT to traditional interventions demonstrated increased satisfaction and improved outcomes with DT. However, most studies used small sample sizes, and none of them were randomized controlled trials. Difficulties particular to implementing design thinking in healthcare included balancing customers’ desires against healthy but unpalatable interventions,

healthcare provider resistance to brainstorming if evidence already existed, and high risks associated with low-fidelity prototyping where patients' lives are at risk. Examples of successful interventions in the reviewed studies demonstrate that DT can result in both physical interventions and technology-intensive ones. The acknowledgements of the article state that research was supported by the Department of Veterans Affairs (VA), Veterans Health Administration, and the Health Services Research and Development Service. One of the authors, Dr. Breland, is a career development awardee of the Palo Alto VA. This article supports my final capstone paper which addresses the areas in which design thinking tenets may be successfully applied.

Moganakrishnann, J.A.S., Namasivayam, S.N., & Ismail, N. (2018). Linking Liberatory Pedagogy to Engineering and Sustainable Development. *MATEC Web of Conferences*, 152, (04003). 1-11. <https://doi.org/10.1051/mateconf/201815204003>
https://www.matec-conferences.org/articles/mateconf/pdf/2018/11/mateconf_eureca2018_04003.pdf

This article, written by engineering school associates, aims to address how liberatory design practices might support sustainable development within an engineering education curriculum. The MATEC Web of Conferences, in which this article was published, is an open access series that archives publications related to materials science, engineering, and chemistry. The authors argue that, for engineering students to truly address sustainability problems, they must take action to grasp how powerful privilege results in oppression and lopsided dynamics. Critical pedagogy, introduced by Paulo Friere in 1968, supports liberatory design practices in engineering for communities as it calls for critical questioning of assumed power structures. An

example of a critical pedagogy approach towards feminism in thermodynamics engineering is presented – the authors cite the fact that the Eastern, female-invented bain-marie (double boiler) is not included in most courses on thermodynamics in lieu of Western, male discoveries. They argue that liberatory design practices that encourage empathetic understanding of client requirements and look beyond simple technical outcomes is needed for sustainable development engineering success. The authors provide the example of the necessity for engineers to communicate with aboriginal communities to determine if clean water concerns ought to be addressed with water access optimization or water treatment plans. The authors ultimately argue that linking liberatory pedagogy with sustainable development engineering will allow for reflexive, creative problem-solving to commence. No acknowledgements are included at the end of this article. This article supports my final capstone paper in that it addresses a field in which liberatory design thinking tenets might be applied.

Caroline, O. S., Fajarwati, A. A. S., Octarina, & Adriani, S. (2021). Implementation of Jepara wood carving patterns for wastra craftsmanship in Troso – A design thinking to create a sustainable creative industry. *IOP Conference Series. Earth and Environmental Science*, 729(1) <https://doi.org/10.1088/1755-1315/729/1/012089>

<https://www.proquest.com/docview/2518766623?pq-origsite=primo>

This article by affiliates of the Bina Nusantara University School of Design was written for an earth and environmental science researcher audience. The village of Troso, near Jepara in Indonesia is known for the creation of woven fabrics. Because of outside buyer demands they have yet to develop their own particular *wastra*, or characteristic woven pattern representative of local artisanship, instead imitating patterns from different regions. The five stages of the

Stanford d.school design thinking model – empathize, define, ideate, prototype, and test – are proposed as a possible framework around which a *wastra* might be created for the village of Troso. The writers of this article researched implementation of the first three stages (empathize, define, and ideate). They facilitated generation of *wastra* prototypes based on the classic Jepara wood carving pattern already well-established in the cultural community. The authors hope that continued community collaboration will ultimately result in selection of a *wastra* pattern that reflects local wisdom and celebrates their unique culture. The authors note that their research was supported by Rama Japara and Bina Nusantara University. This article supports my final capstone paper, which explores the many areas in which a design thinking framework might be implemented.