ARTS & SCIENCE – UNDERSTANDING THE WORLD THROUGH MULTIPLE LENSES

Silja Suntola, Adeel Tariq & Muhammad Ashfaq

In this article, we propose that the balance between arts and science has shifted heavily to stressing science at the cost of human sciences or art. Science is regarded as offering "the truth" by being exact and objective, without humane feelings or opinions disrupting the drawing of conclusions. The perception of art again has slipped to be thought of as "something that artists do," away from our everyday reality and certainly away from what we call knowledge. STEAM is the research and education field that integrates Arts into scientific STEM disciplines (Science, Technology, Engineering, Mathematics). The goal of the STEAM approach is not to teach scientists to "play the artist" or artists to "play the scientist" but to unite artists and scientists, their research and their visions, to understand – and change – the world. The aim of this article is to introduce the rationale behind STEAM-thinking and what it means for education.

Introduction

Arts and Science might sound rather like two opposing forces more than two complementary modes of investigation or anything else. However, this segregation is a fairly new phenomenon that grew stronger during the Enlightenment. It was the time when the church was separated from the state, and different sectors of science evolved and developed into

Suntola, S., Tariq, A. & Ashfaq, M. 2024. Arts & science – understanding the world through multiple lenses. Teoksessa Rajahonka, M. & Haapaniemi, H. (toim.) Luovia menetelmiä ja älykkäitä ratkaisuja. Digitaalisen talouden vahvuusalajulkaisu 2023. Mikkeli: Kaakkois-Suomen ammattikorkeakoulu, 125–135. https://urn.fi/URN:ISBN:978-952-344-568-0

different schools of thought, theories, and disciplines. New technologies and tools enabled far greater accuracy in observing the natural order from biology and physics to astronomy. Science took giant leaps forward. Different disciplines were born over time, enabling the specialization of scientists into a particular field of inquiry.

Our Western society has yet again taken huge leaps forward, powered by the opportunities that digitalization and globalization have enabled. After the industrial revolution and the development of the global economy, where most goods are produced in countries with low labor and material costs, Western countries have become increasingly dependent on innovative services and products that are immaterial by nature. Digital technology allows for an unseen amount of new information produced, marketed and sold each minute. The ease and near-instantaneous nature of digital distribution has irrevocably changed our lives.

Being in awe in the face of the incredible advances we have made in science, we can see it provides unforeseen tools and new instruments through which to practice their art. And to let these visions once again inspire scientists to think of how to realize the possible visions of how life could be. And thus complete the creative process – to start another creative cycle anew (Introducing the (A) in STEM Processes 2022).

Meanwhile, we all live in the midst of an accelerating information overload in an increasingly complex global economy while facing critical global challenges, including climate change and the environment. Further, the increased developments in technology and overall wellbeing worldwide have not been able to stop wars, humanitarian crises, injustice, and inequality. With the best of tools, we still need an inner and shared leadership within us to strive for a more just and beautiful tomorrow.

> *Designing options worthy of implementation calls for levels of inspiration, creativity, and a passionate commitment to beauty that, until recently, have been more the province of artists and artistic processes than the domain of most managers. The time is right for the artistic imagination of each of us to co-create the leadership that the world most needs and deserves. (Adler 2011.)*

In recent years, the role of art has been revived as a new way to solve problems and conduct research. Visual artists, performers, poets, and

musicians engage in real-world exploration and shaping (Robbins & Sandberg 2023). Since artists accept chaos and wonder as necessary conditions for creativity, they are regarded as role models for imagination and invention (Bozic & Olsson 2013; Medlock 2015).

The value the arts can offer to innovation management, entrepreneurial learning, and STEM education has been proved by EU-funded projects like *STEAMProcess – Innovating the transition process from STEM to STEAM approach in science, teaching and training* and *ArtIST (Art, Entrepreneurship, Innovation and Science)* (see also, Robbins & Sandberg 2023; Schnugg 2019). Therefore, we have highlighted the essential role of art integration into STEM education as STEAM to provide a balanced and novel method to approach problems and enhance the effectiveness of our education.

> *The aim of art is to represent not the outward appearances of things but their inward significance. – Aristotle*

Frameworks on the nature of creativity

What is the role of art in education? What does it mean in relation to creativity?

There is certainly no lack of identifying creativity as a core skill in businesses or the public sector. But for some reason, we have still been unable to draw the line between arts, culture, and creativity, even within education. As part of the STEAMProcess project, frameworks were built to identify the relation between art and creativity to help shed light on nature and, hence, the relevance of art and art-based doing and knowing.

A descriptive analysis comparing the essence of science, engineering, and art-based knowledge was conducted in the *Guide on Research and Innovation Strategies for Smart Specialization* (Foray et al. 2012). Science-based knowledge is described as analytical, deductive, and based on models. Engineering-based knowledge is applying or combining existing knowledge in new ways. Art-based knowledge is symbolic, based on creative processes and creating meaning, desire, aesthetic qualities, and symbols. (Foray et al. 2012.)

Howard Gardner and the Multiple Intelligence Theory

Another framework that can help to understand the nature of creativity is Howard Gardner's well-known theory of multiple intelligences. He divides our different intelligences into 7–9 categories based on how we receive and process the information. It provokes thoughts about how we use our different bodily senses to learn and know.

In Frames of Mind: The Theory of Multiple Intelligences (1983) and its follow-up publications, Howard Gardner proposed eight abilities manifesting multiple intelligences. People do not have just an intellectual capacity but many kinds of intelligence, including musical, interpersonal, spatial-visual, and linguistic intelligence. While a person might be particularly strong in a specific area, they most likely possesses a range of abilities. For example, an individual might be strong in verbal, musical, and naturalistic intelligence (Introducing the (A) in STEM Processes 2022; Porvari et al. 2022).

Multiple intelligences theory is divided into a pie diagram with eight slices (Figure 1).

Figure 1. Multiple intelligences theory by Howard Gardner. (Image from STEAM Process Erasmus+ project by Henna Suortti)

Bodily and intuitive knowledge

Our human body has several incredibly sophisticated sensors that constantly collect information about our surroundings. We have five senses through which different kinds of information are gathered before forwarding it to the processing systems in our brains. Much of this happens simultaneously without us being particularly aware of it. We might be aware of the space or environment we are in, sounds, and smells if we pay specific attention to the information received, unless some of the information sounds an alarm and demands our attention because of observations that might require us to do some action. This all happens simultaneously, without us having to do anything separately. Our sensory and bodily knowledge center is a multitasker. On the other hand, our logical thinking process is linear by nature; we can only process one piece of information at a time.

In our Western world, where science has come to dominate our quest for the truth, we have similarly come to value information processed in our logical thinking processes as a basis for what we regard as "real" information. If this information is proved by logical scientific processes, it can become "true" as well.

An interesting angle to this line of thought is the notion of intuition. Many would brush off the mere existence of intuition and see it more suitable to the horoscope section of the tabloids. A noted researcher on intuition and its role in creative processes is Asta Raami, who wrote her PhD in 2015 in Arts, specializing in the skills of inventors to use their intuition. According to her, most of us want to be seen as rational people. Still, we constantly make decisions based on intuition, coating them with rational reasoning. She uses an example by cognition scientists, who had calculated that the process of buying a house solely based on rationale and reasoning would require 6,6 billion bits of processing and would take four years. She sees intuition as a valuable tool that can complement our rationale in valuable ways and is a crucial element in creative processes. (Hakaniemi 2023.)

Design Thinking

According to Amabile (1988), creativity is intended as the generation of novel and useful ideas by an individual or small group of individuals working together. Innovation is highlighted as essential for corporations to gain a competitive advantage (Tariq et al., 2023). The existing litera-

ture has mentioned creativity and innovation as reasons people use the design thinking approach (Micheli et al. 2019). Particularly, several elements of design thinking, such as prototyping, experimentation methods, and abductive logic, have been recognized as essential ways to produce innovative ideas (Deserti & Rizzo 2014; Micheli et al. 2019). Furthermore, researchers have proposed the effectiveness of design thinking in creating innovative solutions for corporations and society (Micheli et al. 2019; Qaiser et al. 2021; Syed et al. 2021).

Though design thinking is pivotal for creative solutions, it suffers from certain shortcomings that necessitate further the incorporation of art thinking in the academic and industrial realms. In a hallmark letter, Robbins and Sandberg (2023) highlighted three main shortcomings of design thinking: 1) Corporate innovators are trying to define design thinking, while designers resist since doing so would make their methodology less effective. Design thinking is viewed as an oversimplified and unsubstantiated idea by certain academics (Magistretti et al. 2021; Robbins & Sandberg 2023); 2) due to its emphasis on co-creation with clients, design thinking frequently results in gradual innovations, potentially limiting daring, transformative ideas; and 3) even among experienced practitioners, design thinking can be frustrating due to the inherent ambiguity and uncertainty (Glen et al. 2014; Robbins & Sandberg 2023). Thus, when a company decides it needs more creativity, design thinking is frequently the first thing it does. Nonetheless, it seems that three decades of design thought have not radicalized innovation (Robbins & Sandberg, 2023).

Art Thinking – a new sensemaking and creativity approach

Due to design thinking's limitations, "art thinking" has evolved as a brand-new innovation paradigm that draws on creative activities and is positioned as a sense-making methodology as it necessitates a fundamental change in terms of both culture and mindset (Robbins & Sandberg 2023). In order to identify problems and find solutions that entail changing an organization's core norms, rules, and aims, art thinking is crucial as it requires a thorough exploration of the artistic mindset via art-based learning and art-science partnership (Robbins & Sandberg 2023). Double loop learning challenges an organization's underlying presumptions. The ability of double loop learning to pose fundamental queries, discover novel information, and implement systemic changes is very consistent with an organization's transition to art thinking. (Robbins & Sandberg 2023.) Moreover, art thinking has the potential to introduce

radical ideas that have the ability to successfully disrupt existing markets or create new ones, opening up the possibility of fresh, uncontested market possibilities at the beginning of the innovation process (Leifer 2000) as cited by (Robbins & Sandberg 2023). Thus, organizations can effectively utilize art thinking to introduce transformative ideas in the innovation process (Robbins & Sandberg 2023).

From STEM to STEAM

This article utilizes outputs and results from two Erasmus+-funded projects, STEAMProcess and ArtIST. The STEAMProcess project aimed to foster disruptive innovation for research and science, promoting the use of artistic soft skills in science and technology. The project aimed to support programs integrating the arts into STEM curricula and cross-sectorial projects blending the arts with STEM disciplines. In practice, the project produced four concrete outputs:

1. Publication "Introducing the (A) in the STEAM Process," consisting of a framework and cases on the STEAM approach in different contexts.
2. STEAM Methodology Handbook provides methods and tools for artists and scientists to work together.
3. STEAM Facilitator's Guide is aimed at higher education teachers or other facilitators in STEAM projects.
4. STEAM Process Game is a fun and educational tool for training students and STEM professionals in artistic skills.

To understand the significance of art integration into STEM teaching and especially enhancing its effectiveness for innovation and entrepreneurship, the ArtIST team conducted several workshops with academics, practitioners, and policymakers. The main purpose of these workshops was to provide an improved understanding of STEAM methodology and its value in solving wicked problems in the challenging era. The ArtIST team, based on several iterations, designed a survey to collect feedback from the workshop participants at the EU level. The survey was mainly focused on two questions:

1. Before the workshop, were you familiar with STEAM pedagogy or the idea of incorporating "Arts" into current STEM education?
2. Do you think that incorporating the STEAM method into educational policy will help the industrial sector train talent with 21st-century skills?

The survey responses showed that most workshop participants (72.7%) had little to no understanding of STEAM pedagogy, as opposed to 27.3% who demonstrated familiarity with it. These findings demonstrate the need to intensify efforts to raise STEAM pedagogy awareness to integrate it into present teaching methods. Moreover, 91.9% agree that STEAM methodology will surely assist the industrial sector in developing personnel with 21st-century capabilities, compared to 9.1% who think otherwise. According to the findings, it could be argued that STEAM education promotes critical thinking, creativity, problem-solving, teamwork, and bringing education in line with business expectations, stimulating innovation and increasing diversity. Both the industrial sector and education benefit from this.

The idea of incorporating STEAM into educational policy is a constructive move that synchronizes education with the demands of the industrial sector of the twenty-first century. It equips students with a broad range of skills, encourages creativity, and champions diversity—all of which are essential for the industry's future expansion and success in a constantly changing world.

Conclusion

Assessing something as being true or false, good or bad, desirable or undesirable, is ever-so more complex in today's society. Besides, we are fully dependent on the instruments and tools through which we gather our data (including our human bodies as our main instrument); we are inherently affected by individual and/or common beliefs, capabilities, and learned ways to see and interpret the world around us. Many would argue that science has replaced other belief systems in our Western world. Separating religion from the state certainly had a profound influence on our society and current belief systems, notably raising the role of science in our societies, but are we missing something?

We come back to the main notion and role of ourselves as human beings, to whom the deepest mysteries of our world and humanity remain enigmas that neither art nor science can answer in the end. Thus, the integration of art thinking or STEAM approaches carries significant importance not only to solving complex challenges but also to introducing transformative ideas. Art thinking, which entails an investigation of the artistic mindset through art-based learning and art-science collaboration, is essential for identifying and resolving organizational issues by alter-

ing core norms, and the compatibility between double loop learning's capacity for fundamental inquiries and systemic changes aligns with the shift to art thinking (Robbins & Sandberg 2023). Moreover, embedding art skills at different educational levels with different designs could facilitate the introduction of innovative teaching practices and prepare a talented skill force for future dynamic challenges.

It is urgent that we learn to see and understand ourselves and the world around us not through single lenses or simplified solutions but by embracing different ways of knowing. We call for arts and humanities to be included in tackling complex challenges and wicked problems – as well as leadership to enable diverse and holistic perspectives and solutions for our planet together.

Education is an excellent place to start.

Read more about the projects:

- STEAM Process (2020-2022). Erasmus+ project, co-funded by the European Union. STEAMProcess – Innovating the transition process from STEM to STEAM approach in science, teaching and training - Xamk
- ArtIST (2020-2023). Erasmus+ project, co-funded by the European Union. ArtIST – Integrated Interdisciplinary Education Module on Art, Entrepreneurship, Innovation and Science. LUT Kouvola Unit - Lappeenranta-Lahti University of Technology, Finland. European Commission Erasmus+ Programme. 2023. Project reference: 612898-EPP-1-2019-1-FI-EPPKA3-PI_FORWARD. https://www.artistandinnovation.eu/

REFERENCES

Adler, N. 2011. Leading Beautifully: The Creative Economy and Beyond. Journal of Management Inquiry 20(3), 208–221. DOI:10.1177/1056492611409292

Amabile, T.M. 1988. A model of creativity and innovation in organizations. Research in organizational behavior 10(1), 123–167.

Bozic, N. & Olsson, B. 2013. Culture for Radical Innovation: What can business learn from creative processes of contemporary dancers? Organizational Aesthetics 2(1), 59–83.

Deserti, A. & Rizzo, F. 2014. Design and the Cultures of Enterprises. Design Issues 30(1), 36–56.

Foray, D, Goddard, J., Goenaga Beldarrain, X., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C. & Ortega-Argilés, R. 2012. Guide on Research and Innovation Strategies for Smart Specialisation (RIS3 Guide). European Commission. Smart Specialisation Platform (europa.eu). Available at: https://s3platform.jrc.ec.europa.eu/en/w/guide-on-research-and-innovation-strategies-for-smart-specialisation-ris3-guide- [Accessed 07.10.2023]

Gardner, H. 1983. Frames of Mind: A Theory of Multiple Intelligences. New York: Basic Books.

Glen R., Suciu C. & Baughn C. 2014. The need for design thinking in business schools. Academy of management learning & education 13(4), 653–667.

Hakaniemi, K. 2023. ”Tuli vain sellainen fiilis” – Intuitiotutkija Asta Raami kertoo, miksi intuitiota kannattaa käyttää päättelyn apuna. Helsingin Uutiset. Available at: https://www.helsinginuutiset.fi/teemat/5796403 [Accessed 07.10.2023]

Introducing the (A) in STEM Processes. 2022. Webpage. Available at: https://steamprocess.xamk.fi/. [Accessed 07.10.2023]

Leifer, R. 2000. Radical Innovation: How Mature Companies Can Outsmart Upstarts. Harvard Business Press.

Magistretti, S., Ardito, L. & Messeni Petruzzelli, A. 2021. Framing the microfoundations of design thinking as a dynamic capability for innovation: Reconciling theory and practice. Journal of Product Innovation Management 38(6), 645–667.

Medlock, G. 2015. The San Miguel Artist Project: A Grounded Theory of The Emergence of Wonder". In: Forum Qualitative Sozialforschung/Forum: Qualitative Social Research.

Micheli P., Wilner S.J., Bhatti S.H. Mura, M. & Beverland, M.B. 2019. Doing design thinking: Conceptual review, synthesis, and research agenda. Journal of Product Innovation Management 36(2),124–148.

Qaiser, U., Khan, M. & Tariq, A. 2021. Design Thinking for Visually Impaired Individuals: A System Review of the Solutions and Future Directions. In: Proceedings of 1st International Conference on Business, Management & Social Sciences (ICBMASS), 2021.

Porvari, M., Suntola, S. & Suortti, H. 2022. Introducing the (A) in STEM Processes. Xamk Inspire 40. South-Eastern Finland University of Applied Sciences. PDF Document. Available at: https://urn.fi/URN:ISBN:978-952-344-432-4. [Accessed 07.10.2023]

Raami, A. 2015. Intuition unleashed: on the application and development of intuition in the creative process. Aalto University publication series Doctoral dissertations 29/2015. ISBN 978-952-60-6108-5 (electronic). Available at: https://aaltodoc.aalto.fi/handle/123456789/15347 [Accessed 07.10.2023]

Robbins, P. & Sandberg, B. 2023. Art thinking: amplifying the 'R'in R&D. Journal of Innovation Management 11(1), IX–XXI.

Schnugg, C. 2019. Creating ArtScience Collaboration: Bringing Value to Organizations. Springer.

Syed, F., Shah, S.H., Waseem, Z. & Tariq, A. 2021. Design thinking for social innovation: a systematic literature review & future research directions in Proceedings of 1st International Conference on Business, Management & Social Sciences (ICBMASS).

Tariq, A., Ehsan, S., Badir, Y.F., Memon, M,Al. & Sumbal, M, S, K. 2023. Does green process innovation affect a firm's financial risk? The moderating role of slack resources and competitive intensity. European Journal of Innovation Management 26(4), 1168–1185.