

SELFCONFIDENCE & SELFEXPRESSION THROUGH SKETCHING - THE SIGNIFICANCE OF DRAWING IN 'PRIMARY EDUCATION' & THE NEXT GENERATION OF ENGINEERING

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ABSTRACT

The value of cultural practice in design engineering education begins at the age of kindergarten – a playful cultural education. Sketching means self-expression and self-consciousness, in regards of significance of real experiences on hands on design in the earliest stage. In times of crisis, insecurity mirrors from the individuum and the society, and during the twin transition, in case of digitalizing the (design engineering) learning landscapes, the old capacity of sketching by hand seems to be forgotten. This research paper is showing that hands on experiences and constructive skills for the work in Augmented Reality (AR) is depending on sketching and reflecting the 3D-world. This research showcases a revalue of cultural practice for a design didactic approach with regard to cultural education, for design engineering skills within the post digital era. Sketching the world for sustainable designed solutions contributes by design methods in drawing by pencil, by digital tools and by different tangible materials – e.g., textiles. The design didactic approach is triggered by traditional cultural didactic methods, that supports the value of humans made design. If different stakeholder are part of the process, the entrepreneurial engagement in education are shaping beneficial self-confidence of our next design engineers' experts – beginning at pre-school education.

Keywords: Self-confidence by sketching, Sketching at primary education and in the Augmented Reality (AR), 'materialising immateriality', entrepreneurial engagement in 'DEEducation'. (*DEE=Design Engineering Education)*

1 INTRODUCTION

If we look at the first drawings, at real sketching experiences of children in drawing in the sand, we have to consider: from the neurological point of view, these connecting areas in early primary basic education set the ability to interpret in complex patterns and give the ability of abstract thinking as an adult. This research paper is showing that hands on experiences and constructive skills for the work in Augmented Reality (AR) is depending on sketching and reflecting the 3D-world. This research showcases a revalue of cultural practice for a design didactic approach with regard to cultural education and that the entrepreneurial engagement in pre-school education are shaping beneficial self-confidence of our next design engineers' experts. The comparable studies of case studies and expert literature, in addition to workshop experiences in mixed study groups in Germany and Great Britain, lead to educational evaluation and new European interlinked learning structures, that are necessary for didactical approach in cultural education.

2 SKETCHING BY HAND AND BY DIGITAL TOOLS

The phenomena of 'thinking through drawing'[1] becomes more meaningful again today. From the beginning of primitive wall painting during the Stone age, via sketching with hand and instruments during the renaissance time, (constructing the world of objects (machines) like Leonardo da Vinci), to computer added design and virtual sketching [2], we see the necessity to act during the covid-19 pandemic, we have seen a rising of digitalization, that needs a different understanding of the system [3]. Constructing by designing means self-expressing in being conscious about real world objects. This begins by postforming form, surface, outline, proportion, and leads to reproduction and visualization of world in generating and ideating.

The entrepreneur of industry 4.0, the institutions like schools and universities and the society, would be best prepared for finding sustainable answers for the future, if they would invest, in this form of cultural education in earlier phases, than we see at the moment: We have to recover sketching and drawing by hand for getting the advanced designing skill for the digital (virtual) world.

During the “primary education” - at Kindergarten and the first school experiences - we have to look at the cognition-based understanding of world [4]: it is the real three-dimensional experience by hand and mouth (tongue), by tools like pencils and branches drawing in the sand, reproducing, reflecting and rethinking objects and signs. That gives us the ability and adaptability to draw (generate) new cultural significant objects and concepts in augmented reality later as student, adult and design engineering expert.

3 DESIGN ENGINEERING EDUCATION STRATEGIES

3.1 Education strategies in industrial design engineering – case studies in sports design

To underline the thesis above, the next comparison of the industrial design process and fashion/textile design shows different strategies, and each student’s pathway to preparing for and finding the right university, which depends on their pre-design educational experience.

One German case study at the Hochschule Niederrhein is promoting an educational system in ‘design engineering textile’ [5], which is in line with industrial design engineering: They begin by analysing the process and textiles that revolve around material performance. This is achieved, for example, by using body mapping and textile layering, with the help of a warp knitting process for sports-tech trousers or running shoes. Other European study programs are taking a more physics-based approach by looking at the process and developing other solutions with alternative design methods – e. g., the Technical University in Dresden and Strathclyde University in Glasgow. Some European textile engineering programs are using more artistic approaches, according to the university’s profile as a university of fine arts. Fine arts had their primary focus on artistic-based education for design objects, from the 1960s until 1980s. [6]

Nowadays, the changing habits in the way products – objects – are designed, are serving as catalysts for applying a more holistic approach to theoretical methods. This begins with sports engineering courses at the higher educational level (master and PhD design students) and is supported by systems-oriented design methods and theory-based design thinking.

Generally speaking, the ‘playgrounds’ founded more on biology, physics and natural sciences, are used for master programmes in sports engineering (see Strathclyde University and Dresden University). These implement a classical and conventional design process: a process, which is based more on material analysis and can be directly measured in economic profits.

Although, different educational approaches related to industry and consumer habits have been demonstrated in Europe, imagine if the user, the designer or the entrepreneur, whoever is using the product, had a greater insight into the design system at an earlier point, rather than having to wait until university – as early as pre-school, for example. Several renowned architects claim that playing with wooden cubes in pre-school during their childhood, paved the way for their future careers. He or she could be viewed as expert from those very first hours onwards, in a (design engineering) playground. Experiencing such simple processes, optimised by the support of a didactic environment, builds a foundation for future learning and exploration. We can see this being embraced in the UK, where teenage pupils can join design engineering courses at school, allowing them to participate in the courses, practice the methods and learn expert terminology in a more playful manner and an earlier age. Can this indicate ‘design’ with greater acceptance within the curriculum and with higher didactical worth?

This vision is considering cause and effect for the overall future of our educational systems in Europe: We need earlier design education (strategies) at primary schools, which may coincide with a change in the terms ‘design’ and ‘industry’.

This shows us that, although design engineering solutions often set out with the same goal, the pathway towards innovative designs and concepts varies across Europe. We can benefit greatly from comparing, discussing and reflecting together: diversity is the key to our success.

3.2 Education parameters and models – the value of artistic competences in engineering design

3.2.1 Sketching with material

'In the last two years it was shown, the demand for high value designed products created across the future European landscape require new educational talents working seamlessly across integrated analogue and digital platforms while responding to evolving cultural needs emerging through new behaviours [...] connected European learning landscape to increase creative diversity.' [7]

On the one side, higher scholarly educational systems tend towards being design-theory based: that means that PhD programs place a higher value on 'thinking design' (Rittel) concepts, used to design solutions for highly relevant societal problems today. Complex problem solving is trained by means of concept-based design theory work. On the other side, this concept has to be mediated and the lack of *visualising* immateriality – caused by theoretical design methods – needs to be addressed. The following figure shows the profitable result of a 'Fashioning Furniture Future' workshop and demonstrates that the 'materialisation' of design concepts in 'design doing': using material rather than being virtual-based, is very helpful within an artistic or practice-based playground. A tangible user interfaced is long time discussed [8]. Here, ideas are transferring into material visualized methods. The aim is to express, mediate, communicate, and visualize, as well as get people involved in discussions, while being able to evaluate your thoughts by using three-dimensional, material-based sketching. The following figure shows a case study in which the PhD student is working on visualising and mediating the ongoing process of the illness, dementia. This is expressed through textile and form, as well as colour and surfaces, and represents the method of 'materialising immateriality' [9] (see figure 1 at workshop at RCA, London) with different qualities. This design method involves different senses, the tangible, tactile one is very beneficial.

The process is demonstrating the synesthetic approach by sketching with pencil and by textiles.



Figure 1. PhD Student B's case study in visualisation the development of the illness dementia, during the workshop, the exercise called for 'materialising immateriality'. Royal College of Art, London, 2019

3.2.2 Estimating the Value of artistic intelligence alongside Artificial Intelligence

The process of 'Artistic Engineering Design' explores a concept that gives us the opportunity to reflect on the needs of tomorrow's creative processes: It takes the perspective of art, design, engineering and humanities into consideration, while simultaneously providing a framework for evaluating each one of these disciplines. In addition, the societal value of a holistic and humanity-centred education in design engineering, which benefits from fine art's freedom, integrates people around the globe and is helpful for solving problems that emerge, as a result of the global connections between human beings.

Needless to say, holistic and humanity-centred education begins early on. The playgrounds in pre-schools are spaces for exploration and creative expression – a concept that needs to be valued and mediated through all phases of education: "because everything is language"[10], everything is design! To read, to understand and to solve the complex design problems of the post-digital era, we need this kind of valuable design engineering education system, to make the universities attractive as learning landscapes for everyone and create educational landscapes for every age – lifelong learning landscapes. The aim is to fill in the gap between theory and practice – between thinking and acting – and to create the habitus which society needs to form through its anthropological view.

By thinking and acting together, in design engineering education and expert playgrounds (see workshop case study) possibilities emerge that also illustrate how this style of interlinked designing and learning could be implemented through future platforms of educational playgrounds. These playgrounds will be characterised by philosophical experiences that augment more ‘corporeality and impulsiveness’ for a holistic approach. The goal is to transfer knowledge as early as possible, in a playful and valuable way – thereby acknowledging the value of time. For a change to happen, the valuable visions in design engineering and the ideas behind them need to be applied to a system.

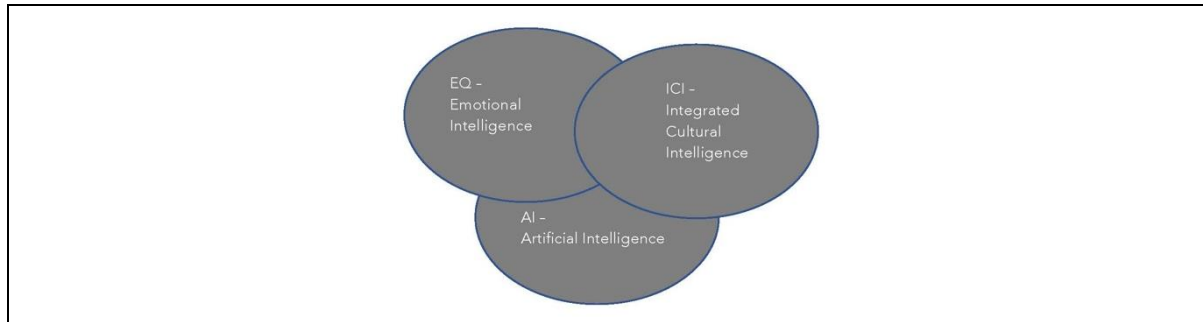


Figure 2. Trigger points of advanced management of knowledge: artificial – emotional – integrated cultural intelligence in design, 2020

Alongside Artificial Intelligence (AI), there is an emerging need for artistic and emotional intelligence forces that reflect the cultural behaviour within a complex design process and in complex interlinked design education landscapes [11]. As we move forward, the behaviourism related to sustainable materials and sustainable design education systems – which is formed before university – will require the basic skills provided by artistic education. These skills will be needed, in order to be able to correctly estimate the ethical values of advanced societies in the future. In addition, they will be essential for managing complex design issues in the post-digital era.

4 BALANCING FINE ARTS + STEM COURSES TO AN HOLISTIC DESIGN-EDUCATION: REVALUE DRAWING COMPETENCES AT PRE SCHOOL TIMES

Optimized design conditions, in design engineering creative fields today at Europe by virtual interlinked designing landscapes, this represents aspects of the benefits of resilience. In addition, the research revealed two essential parameters for creating landscape models:

Firstly, there is an ongoing trend towards theory-based design and design thinking, based on practiced models. This brings with it the risk of losing important handcraft skills and knowledge rooted in various places throughout Europe, which drive creative design and the creative industries. Yet, due to the digitalization, emotional and manufacturing intelligence are more important now than ever before, in every aspect of business as well as the increasing need for competence in using artificial intelligence.

Secondly, the results each team – in design engineering studios in practice and education - produces directly, correlates to the individuals’ prior education level, particularly in design or design engineering. All prior knowledge that can be conveyed at schools within the next few years will determine the design engineering competence and success (in this holistic perspective) of any nation or culture on this continent – or perhaps even the planet. If we are interested in empowering Europe’s design engineering communities to reach a strong capacity and efficiency, we have to invest in the cultural education at school – in preschool we have to invest in forming and revalue cultural competences: Balancing fine arts + STEM courses forward to a holistic DEEducation Strategies (DEES) means entrepreneurial invest by brands, by universities, by pre-schools.

Aside from the ‘designers paradise’, with optimised collaboration conditions as described above, a return to the cultural heritage of design education is required. We also have to focus on the prosperity of the futuristic Ps – people, planet, profession, positioning – and define this prosperity’s sources:

I. Design education as a role model versus its ongoing relation to society

When art and technology joined forces 100 years ago at the Bauhaus, it was based on technical generated design products for everybody to use, but with a focus on economic benefits. This is changing now, and design education should serve as the foundation – during the digitalization of the present times, that correlates to a different ‘design behaviour’ to the ‘design shift’ [12].

II. Preschool playgrounds as a cradle for design engineer skills'

Combing back to human's roots and honouring the potential of 'fine arts', in combining new didactical formats of 'manmade' courses, gives space to shape and to manage future tangible interconnecting design areas – a wish full thinking?

III. Design schools are a source of entrepreneurial spirit and influencers

The influence of an individual who represents a role model – as a designer or a design engineer and design 'educator' – who also proclaims new parameters is highly relevant.

A 'person of the hour' can be very convincing and influential with regard to the education and design system. In addition, they can facilitate exchanges with other relevant communities in European countries. With this in mind, moving forward will entail the entrepreneurial power of design schools and designers: around the globe, across Europe, of all genders. After all, they have already demonstrated an enormous cooperative power to optimize models as drivers of design engineering. This is reflected upon and discussed, which highlights the female designers who operated 'under the public radar' [13] during the Bauhaus era, for example. The best design engineering models for European's future are giving new value to art and design and its influence on children's skills, and also providing new models for mentoring programs in design. These are elements of social entrepreneurship and entrepreneurial universities [14], that are essential for sketching a resilient future in design and educational programs.

Felicidad Romero-Tejedor refers to acting as 'thinking designer' and being something between a scientist and an artist. By this she means to design with an emotion-based, more 'intuitive and synesthetic style of thinking' [15]. So, a designer is someone who creates through thinking and the creative act – in design doing. Within the culture of sciences in the 21st century, designers are able to deal with unknown and undefined things, and they are able to step into new foreign fields while working in interlinked, non-linear thinking processes. According to Romero-Tejedor, the designer possesses interlinked, non-linear thinking, that is necessary for creating accommodative systems. [16]

As such, by interacting with and integrating systems into the design engineering future, it is paving the way for meeting new needs in various industries and in engineering – needs related to the fourth industrial and social revolution, **and** thus also education. Developing concepts for innovative interlinked design theory within complex non-linear economic and common social systems requires design thinking. Digitally based tools are used in analogue linked systems and are influenced by emotionally triggered human behaviour. At the time, this creative (ideating) system is in the process of evaluating and revaluing the sketch as a tool for representing and visualising ideas by materialising concepts.

As illustrated – see figure 1 / workshop – according to the method of material-based design thinking, the sketch (also in architecture) could be considered an epistemic-based scientific object used as an interlinked, collaborative creative tool for visualising ideas [17]. The use and value of sketching and drawing, as a unique and original tool in design, is currently being re-assessed. In addition, the design code, or product language, in design is being transferred and communicated via media. This always relates back to the cultural imprint and sociological determination, on the one hand, and the anthropological significance of the culture of remembrance (Erinnerungskultur), on the other. 'Materials, which determine the terms relating to design objects, also supplement the materiality of culture. [...] This specific material code is always a part of social behaviourism and can thus be decoded within that cultural context.' [18]

Hence, taking socially and politically relevant action in design, combined with the rethinking of technology and of cultural practice, include a revalue of sketching by hand. Needless to say, that self-expressing, and self-confidence is supported by sketching with your own thoughts and 'ductus' and are essential elements for the future quality of creating: sketching by hand, with pencil or textiles or other materials and tools: the sketch is basic for discussing, reflecting, communicating and generating your ideas and design engineering solutions. Sketching competences for the next design engineer experts begins at pre-school and kindergarten.

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FIGURES

- [1] PhD Student B's case study in visualisation the development of the illness dementia, during the workshop, the exercise called for 'materialising immateriality'. Royal College of Art, London, pic.: Wachs M.-E. 2019.
- [2] Trigger points of advanced management of knowledge: artificial – emotional – integrated cultural intelligence in design, graphic: Wachs M.-E. 2020.