

FINDING BEST PRACTICES WITHIN EDUCATION THE STUDENT AND THE TEACHING AS THE STARTING POINT FOR NEW DIRECTIONS

Thomas Degn / Iris Ridder
Umeå Institute of Design, Umeå University / Dalarna University
thomas.degn@dh.umu.se / iri@du.se

1. INTRODUCTION

Vocation-focused design education should ideally aim at foreseeing the challenges and opportunities society and industry face, and act accordingly to these needs. Some of the obvious questions are: what should the next generation of designers be able to do, and how should they do it? Or to phrase it from an academic point of view what should they learn, and how should we teach it? In order to answer these questions, we first need to fully understand what makes present education and teaching successful and how it is structured and pedagogically organised, before a next step can be taken. This paper will show case studies from a small international masters education in industrial design that only enrol approximately 20 students annually. Despite its small size, it has ensured that the design institute it belongs to is presently positioned in the top of the ranking lists for the most awarded design schools in the world, from three different design competitions representing Europe, Asia, and North America.

2. STRUCTURE AND PROCESS-BASED DESIGN

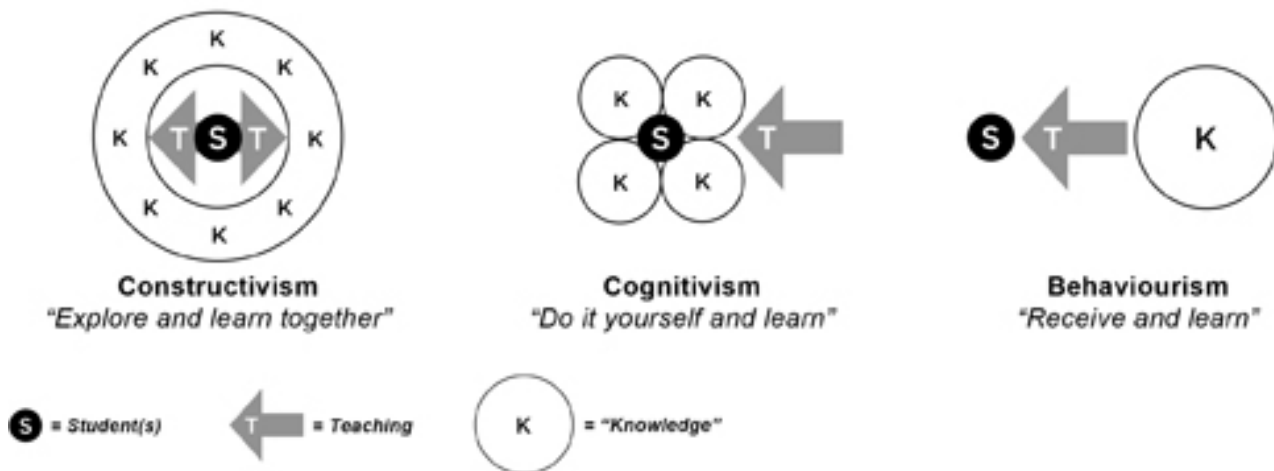
Most design schools provide education that combines teaching of various tools and methods and how to use these to achieve a specific goal. This paper builds upon the definition and division of “structure and process-based” teaching (Lundmark 1998, 39) and links structure to practical tools, and process to creative methods. Examples of structure-based studies within design education include tool-intensive teaching, like training in using machines in a wood or metal workshop, or software teaching in 2D and 3D software. Structure-based studies involve subjects where the students are taught specific rules and guidelines on how it *should* be done, either for safety reasons or limitations in the physical or digital tools capacity.

Process-based studies on the other hand relate more to the actual design process and the individual student’s planning and implementation of his or her design skills. Here there is also an emphasis on the student’s ability for making sound decisions in order to achieve the best possible result, often within a limited period of time. A typical example of this would be a shorter or longer creative design project, where the student is educated by a teacher in how it *could* be done, based on the individual student’s ambition, skill-set and mind-set. Building on Lundmark’s definitions, pairing up structure-based learning with teaching, and process-based learning with educating, compliments Keddie’s definition and separation of teacher and educator, and how the latter is defined as more professional and vocation-oriented, providing teaching that is distinguished by “a reflective and functional method for solving problems”, which ideally should be one of the main competences of an industrial designer (Colnerud, Granström 2007, 54-56).

3. INTERPRETATIONS OF CONSTRUCTIVISM, COGNITIVISM AND BEHAVIOURISM IN CONTEMPORARY DESIGN EDUCATION

By applying a pedagogical lens it is obvious that the three theoretical frameworks of constructivism, cognitivism and behaviourism are present, in smaller or larger scale, within contemporary design education. This is particularly the case for constructivism and cognitivism which both have strong ties to structure and process-based teaching.

Three deliberately simplified models of the theoretical frameworks have been visualised in this paper, and are shown together with summaries of their most common perceptions.



Figures 1. Simplified graphical visualizations of the three theoretical frameworks of constructivism, cognitivism and behaviourism.

1.1. CONSTRUCTIVISM - "EXPLORE AND LEARN TOGETHER"

Constructivism views learning as a process in which the learner constructs and builds his or her own knowledge through an interaction between old and new experiences and ideas. Constructivism promotes free exploration within a defined framework or structure where a teacher acts as a facilitator who encourages the students to discover principles for themselves and to experiment and build knowledge by working to solve realistic problems. Constructivism is clearly present in process-based studies.

1.2. COGNITIVISM - "DO IT YOURSELF AND LEARN"

Cognitivism considers how the memory works to promote and solidify learning. Learning activities are planned to support the learner's internal mental process and cognitive development. Compared to behaviourism, more control of the actual learning situation is given to the individual learner. Cognitivism can be present in both structure and process-based studies.

1.3. BEHAVIOURISM - "RECEIVE AND LEARN"

Behaviourism is, in a learning context, the acquisition of new knowledge through conditioning. This conditioning is made by a (dominant) teacher, who evaluates and clearly communicates what (he/she thinks) the student has done right or wrong in the specific context. Behaviourism should in its purest form only be present in structure-based studies.

4. CASE EXAMPLE ONE

The first case shows a clear example for how education can offer the students the opportunity to fully absorb and understand new information related to a complex situation and context. As the kick-off activity for a 10-week term project focusing on the rescue procedures and design challenges following a mass-casualty scenario like a train accident, a group of students attended a three-day course on the specific techniques and standard rescue procedures applied in case of such an accident. The course, normally taught to fire fighters and ambulance personnel, was facilitated by professional first responders and medical researchers within the field of catastrophic medicine. The course started with a theoretical classroom introduction focusing on the standard procedures first responders have to consider and go through when arriving at the site. The afternoon was spent outdoors where the students were introduced to basic first aid techniques and hands-on methods for securing victims for transport, and trying these out on each other. Emphasis and consideration were put on using the limited resources and equipment available in a situation with a high number of casualties in the best possible way (Figures 1-2).

The second day was used by trying out the different techniques, and the various obstacles that have to be taken into consideration and dealt with, when evaluating and moving injured victims from either a standing train carriage or a train carriage lying on its side.



Figures 1-2. Classroom introduction and exercises in securing victims for transport (the students were dressed in orange during the course).

A beneficial bonus (besides that the course was carried out during the winter) was that one of the teachers of the course was doing a PhD on hypothermia and ambulance transport. This gave the students additional realistic insight and information on the dangers of hypothermia, again, when linked to a mass-casualty scenario, the complexity multiplies with the number of casualties. The afternoon was spent indoors where the representatives from the R&D department of a company producing equipment for first responder units, showed and demonstrated samples from their product ranges. This gave the students the opportunity to examine these products and their features up close, and to try them out for themselves (Figures 3-4).



Figures 3-4. Trying out different evacuation techniques and expert introduction to first responder equipment.

The third day was dedicated to a number of brainstorming sessions where the students, based on their experiences from the first two days, generated ideas in smaller groups that also consisted of members of the first responders teaching team that had facilitated the course, and the company representatives. At the same time as questions were asked and issues discussed, concepts were ideated between the members in the small groups. As the last phase of the three-day course, the groups were asked to visualize their best ideas on large sized Post-Its and share and explain these to the rest of the participants (Figures 5-6).

4.1 CONSTRUCTIVISM IN CASE EXAMPLE ONE

A learning platform of constructivism can be implemented when the students are asked to define their own project focus within term projects or their thesis projects or other process-based learning situations. Thereby literally

asking the students to centre themselves within existing information and knowledge. From this point the students can then explore what T.A. Markus lists as the “(...) four basic sources of information available in a design decision-making situation: the designer’s own experience, other’s experience, existing research and new research” (Lawson 2005, 133). During the next steps, the students are offered guidance and feedback as they analyse and define their interpretations of the gathered information, and the insights they have gained, when they frame their own conclusions, and finally as they develop their newly generated knowledge through the gestalt of a conceptual design solution.



Figures 5-6. Brainstorm and ideation in smaller multi-disciplinary groups. For the last session the groups shared and explained the ideas they had selected from their brainstorm and visualized on large sized Post-Its.

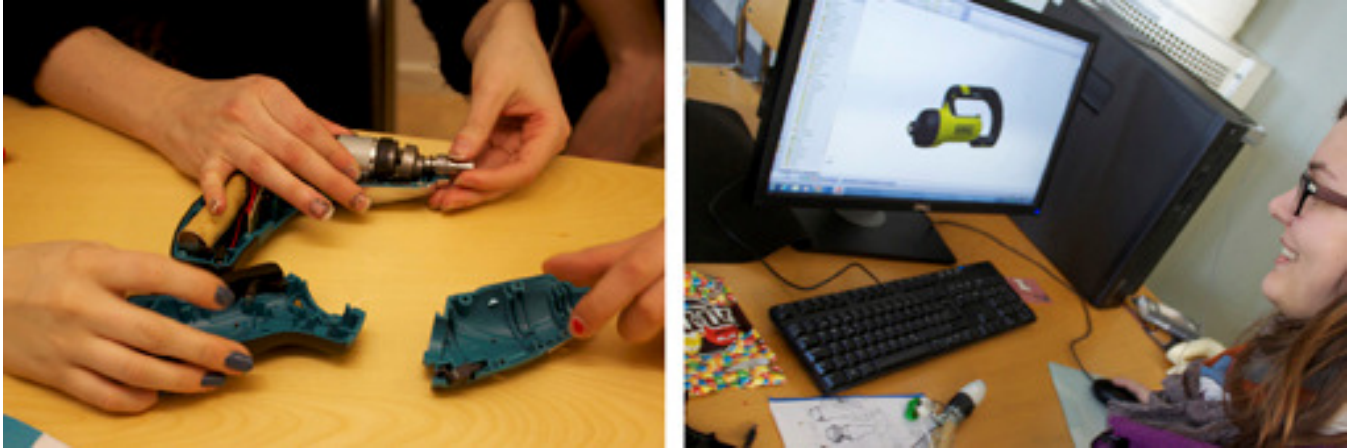
As shown in case example one, a platform of constructivism can be utilized to advantage even before the students have had the opportunity to define their project focus. As exemplified this can be done when the students and the teacher, as a collaborative group, explore new areas unknown to all involved, maybe even areas where it is required that more than just one individual takes part, to fully understand the implications and complexity of the situation and its context. This will, like the example with a train accident, accelerate the process of making the student “an active player in the pedagogical context” (Lundmark 1998, 47).

5. CASE EXAMPLE TWO

The second case is an example of a 5-week course where the main expected learning outcomes are that the students should learn how to use the 3D modelling software SolidWorks, and use this to model an object that should be rapid prototyped through 3D printing. The first day of the course starts with a group session where the students are each given an off-the-shelf product that they are asked to take apart and analyse. They are asked to examine its components and how it has been constructed and designed for production. In this particular case the product was a low-priced rechargeable screwdriver.

The next steps that week include a number of tutorials and exercises introducing them to the software. In parallel, they are given the creative assignment that they should individually create a new unique design for the product. In this case the students were expected to select an existing brand, and redesign the screwdriver based on this brand’s present design identity, using the original screwdriver’s components, and 3D model this in SolidWorks (Figures 7-8).

The steps that follow are the 3D printing of the modelled file and assembly of the printed parts with the internal components from the original screwdriver they were given the first day. At the end of the course each student will have their unique developed and modelled design in a 1:1 working prototype (Figures 9-10).



Figures 7-8. Dismantling the existing product and the 3D modelling of the student's new individual design.



Images 9-10. Assembling the original components and prototyped parts and photos of a working prototype.

5.1 COGNITIVISM IN CASE EXAMPLE TWO

Teaching that is built on structure-based learning, where the teacher gives clear directives on how a specific task should be solved by the learner, has strong ties to the theoretical framework of cognitivism. Within an industrial design education this may be best exemplified with the introduction and teaching of 3D modelling software. As shown in case two, the software teaching included two different steps both in regards to complexity and learning strategies. The first step included repetitive self-studies of defined standardized tutorials, introducing the software to the students, together with tutoring addressing the entire class of students. The completion of this step serves as an important and essential stage for the teacher to see that all the students have acquired and understood the basic knowledge of the workflow and modelling tools utilized in the particular software. When the students have completed this first step, the next step will be for the students to model the design they have created and developed themselves. This requires additional repetitive work, but it is now linked to the student's own defined project focus. The execution of this step requires independent and creative thinking, and if needed, individual support from the teacher, in order to 3D model their unique designs in the best possible way. One could therefore see the second learning step as a combination of both cognitivism and constructivism.

6. CASE EXAMPLE THREE

The last case example is taken from a presentation of the students' final results of a 10-week term project. In this particular project the students had, after a group activity similar to the one illustrated in case example one, identified design opportunities within the mining industry and designed conceptual solutions to address these. At the final presentation each student presented their project with digital and printed visual material, together with a physical presentation model of their specific design (Figure 11).



Figure 11. Feedback from external professional designers and mining experts representing different stakeholders.

Besides the teacher from the institute, there were several experts and professionals present on behalf of both a mining company operating on an international level, and an in-house design department from a global manufacturer of mining equipment. After the students had presented their projects, each student received specific feedback related to their project from the three different competences present; the mining company, who touched upon aspects from both a user and management perspective; the professional in-house designers, who provided feedback on both design and manufacturing issues; and the faculty teacher, who gave feedback on the student's work process linked to the expected learning outcomes of the course and the goals the student had defined for themselves and their individual projects.

6.1. BEHAVIOURISM IN CASE EXAMPLE THREE

By the definition established in the beginning of this paper, behaviourism primarily occurs when a teacher in structure-based teaching instructs or tells the students their interpretation of knowledge. But as case example three shows, behaviourism occurs even in process-based studies, but in this case more commonly at final critiques or examinations. Due to the artistic nature of industrial design, the knowledge given by the internal or external teachers to the students on how their designs are perceived by them can to a large extent be subjective. Any critique and exam should definitely encourage and allow students to respond, and can then result in a rewarding dialogue for both parties, but can at times stay within the theoretical framework of behaviourism, maybe due to the notion that there "has to be" a final conclusion of the design and the student's performance at the end. If behaviourists explained problem-solving, which is so crucial for industrial designers, as a result of learning obtained merely through trial and error, Max Wertheimer succeeded in developing a more appropriate definition when he defined "(...) problem-solving as grasping the structural relationships of a situation and reorganising them until a way to the solution is perceived" (Larson 2005, 132). A reflection of the feedback received in a learning situation dominated by behaviourism can, if the student so chooses, even be utilized and tested in a new study situation within a setting of constructivism.

7. CONCLUSIONS

As the authors have shown, a beneficial combination of both structure and process-based learning platforms together with a balanced mix of the theoretical frameworks of constructivism, cognitivism and to some extent maybe even behaviourism, should provide the basis from which future design knowledge could be taught. These platforms and frameworks should intertwine with each other multiple times during the education, "(..) no single teaching method (...) can be the method of choice for all occasions. An optimal programme will feature a mixture of instructional methods and learning activities" (Brophy 2015, 6). Intertwining pedagogical platforms and frameworks, can create a structure from which the students' skill-sets and mind-sets, and the application of these, can be constantly nourished and developed through creative study activities.

When asking the question: what should be taught, and subsequently how, it is paramount to fully know and understand how and why best practices have been developed within design education before the discipline can be developed further and apply qualitative teaching of the knowledge areas that the students are expected to explore and rely upon as professionals. No matter if future design education will educate the designer in mastering the process of mass-producing physical objects or intangible information-based services or experiences, something in between or something completely different, educators have to understand how to challenge and empower their students. Skill-sets will definitely change over time. Mind-sets, if taught correctly, might not have to.

REFERENCES

Brophy, J. *Teaching*, Educational Practices Series - 1, <http://www.ibe.unesco.org/publications/EducationalPracticesSeriesPdf/prac01e.pdf>, March 15th 2015.

Colnerud, Gunnel, Granström, Kjell, mentioning Keddie, N. *Respekt för läraryrket*, HLS Förlag (Högskoleförlaget vid Lärarhögskolan i Stockholm) 2007.

Lawson, Bryan, mentioning Max Wertheimer. *How Designers Think*, Routledge, 2005.

Lawson, Bryan, mentioning T. A. Markus. *How Designers Think*, Routledge, 2005.

Lundmark, A. *Utbildning i Arbetslivet*, Studentlitteratur, Lund 1998.