

EXPLORATORY WORKING METHOD WITH REUSE PRODUCTS AND VALUING DIVERSITY

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ABSTRACT

This paper focuses on design processes with the reuse of products and valuing diversity, based on a case study in product design conducted by primary school teaching students at Oslo Metropolitan University. The research question is how exploratory working and inquiry-based teaching (IBT) methods are suitable for teaching themes related to different perspectives on reuse, diversity, and sustainable development. Describing a sustainable field where there are many sources of knowledge to critically assess the task, assess new ways of joining parts, evaluate new looks, and take into consideration the different types of information that arise in the process. How to set up exploratory teaching will be related to what the teacher wants the students to learn during the programme. In terms of methodology, the examination builds on research-by-design and IBT, where the practical aesthetic work with the materials is the deciding factor. This study illustrates the profound, though often hidden, consequences that design decisions and processes have on the total human experience. It also describes an example of teaching students to engage with the material world we live in.

Keywords: Valuing diversity, exploratory working method, inquiry-based teaching, re-design process

1 INTRODUCTION: EXPLORATORY TEACHING IN DESIGN EDUCATION

The design processes involving the reuse of products and valuing diversity, and the case exemplifies how design teaching can be executed in the education of primary school teachers with sustainability and inquiry-based teaching (IBT) [1] [2]. The background literature and research is based on the exploratory working method or IBT, 5-E model that originated in the Biological Sciences Curriculum Study (BSCS) [2]. IBT in this learning case is driven by a redesign process owned by the student. The content of the education at Oslo Metropolitan University (OsloMet) for design, arts, and crafts is based on what graduate teachers are going to teach in primary school. The teaching students were selected as participants because they should carry out a work requirement and the design project would help their practice as a as a graduate teacher. Following the 5-E structural framework for discussing how exploratory working and inquiry-based teaching (IBT) methods are suitable for teaching themes related to different perspectives on reuse, diversity, and sustainable development. This paper describes a specific design task, including redesign and dynamic repair, performed in 2018 by teacher students. They were asked to design a lamp made of wood and recycled material. With the guidance of a subject teacher educator, teacher students identified their own issues and questions. They then examined the resources they needed to research the topic, thereby acquiring the requisite knowledge. Dynamic repair shows how material consciousness defines the design process from a sustainable perspective. The subject Art and Crafts is an optional course in the Norwegian primary school teachers' education.

2 METHOD

The methods used in this study to address the research question were collecting data from a practical implementation of a reuse design process with written reflections, in Art and Crafts for teacher students at the Faculty of Education and International Studies, at OsloMet. The method also includes observation of the practical work. Students achieve a basic education that will equip them to teach design process in primary and lower secondary schools. Examines examples from a qualitative approach—research-by-design. Sevaldson presents a definition of *experimental practice*: ‘The practice is experimentally changed and modified to explore and evolve concrete enquiries, research questions or effects’ [3:28]. In this context, its research through the ethnological research method of participant

observation [4:248-261], [5]. Research-by-design is used as exploration through practical creative work with materials in the design process, where one's own observations in an educational setting and the experiences of the students in the process also work as part of this exploration. Research-by-design is then implied in aesthetic terms [3]. The method is used to explore the students' engagement in material consciousness and their experiences with the exploratory working method in the redesign process. In this context, it is interesting to note that Bresler emphasises that empathy, execution, and sensibility are qualities that are directly relevant to the research [6] [7]. According to Schön, reflection is silent and unconscious; therefore, it is difficult for the outside world to see when reflection is present [8]. This reflection involves a dialogue between the hand, the head, and experience through the sensory apparatus. The design project is based on Richard Sennett's [9:120] use of the term 'engaged material consciousness', which is material consciousness that initiates a conscious, craft-based effort to achieve good quality work. This work is dependent on a curiosity about the materials at hand. Research shows that how we learn about global challenges also affects the competencies we develop [10:16]. Amongst their many other responsibilities, primary school teachers are also obliged to lay the foundation of knowledge for future engineers and product designers as well as for those who collaborate with them or who will utilise what they design.

3 DESCRIPTION OF THE STUDENT PROJECT

Based on a review of 34 log documentation items related to student design processes and the systematisation of process reflections through the application of the 5E model, it has been possible to document some recurring findings. The 5E model stands for 'engage', 'explore', 'explain', 'elaborate' and 'evaluate' [10] [2]. Assessment is an integral part of all phases of the teaching. At the heart of the 5E model, teaching is intended to activate students-in-practice and theory so that they develop knowledge, skills, and attitudes that are central to understanding and acting to achieve knowledge of sustainable development. Included in the redesign process of developing and creating, there were aesthetic occurrences, trust, freedom, surprises, and ups and downs. Knowledge so gained through redesign projects is more readily retained because it has been acquired by experience and in relation to a real problem. Redesign explores how design, whether of products or diversity, affects diverse members of the design class.

Product design illustrates the profound, though often hidden, consequences that design decisions and processes have on the total human experience. The research results describe how students use an exploratory working method and how it affects the way the students think in a redesign process. Students should develop skills that are central to learning a skill and living for a more sustainable world. The design task was performed in a primary school teaching course and had an environmentally conscious 'reuse' profile. Exploratory working methods change the relationship between students and teacher educator. Students work more independently while the teacher educator has a guiding role. Exploring working methods in reusable design processes can make learning more marvellous, challenging, pleasurable and exciting. There should be an interaction between the phases 'engage', 'explore', 'explain', 'elaborate' and 'evaluate' where the students create their own experiences and structured phases so that they are guided towards the goal. When the students work exploratively, they will also gain experience with the value of diversity, creativity, reflective and communicating aspects of research [7:76]. The example discusses points out essential details that have made themselves visible in the execution of the task: dynamic repair and engaged material consciousness for a sustainable future. The dynamic repair design task was to redesign a lamp with wood as the primary material. An old lamp was used as the jumping off point for designing a new one by using old wood scraps chosen from boxes of leftovers. What are presented here are materials that are a source of inspiration to develop students' critical and creative abilities. Exploratory working methods in encounters with the different materials. Show how a teacher educator can support students' learning through a balance of structure, playroom and how this promotes the students' learning process.

3.1 Reflection: Exploratory working method and inquiry-based teaching

IBT is a way of working that is based on questions and challenges that the students themselves are given as part of the task of exploring. Inquiry can be defined as 'the process of exploring a theme or issue. Within science, the exploratory process consists of asking questions and looking for answers, by doing practical investigations and obtaining data interpreted in theory' [2:32]. The goal is that the students will both gain greater knowledge about redesign and develop skills that are important for

acquiring theoretical and practical knowledge. Communicating with fellow students and teachers through data, discussing acquired experiences, arguing for interpretations, displaying the process and communicating results are important parts of exploring. My role as associate professor, researcher and teacher educator becomes another when the students ask their own questions and explore phenomena related to individual design processes. Researcher changed role during the survey, from being a theoretical wizard to a practical guide that, at the same time as a practical review, explains and reflects orally, for example, in connection with a joining technique, what is done and how it is done. When a researcher goes from being an observer to showing direct practical actions, being action-based, and being directly exploring in practical action to show procedures, techniques and opportunities. This knowledge, as both practically and theoretically guide the teachers' own reflection on their own practical work. The results can also be raised to higher quality. As a researcher one can once again observe how the students individual reflect, how the knowledge is acquired and expressed the exploratory working method in the log note. Important to be aware of how the teacher student's view on learning, design, arts, and crafts makes sense and is the driving force in exploratory ways of working. At the woodworking workshop, the tutoring teacher should use tools to assess how this can support and guide the students through exploratory work methods in the design process with recycled materials. Exploratory working methods open up different perspectives on a question, and they search through different sources to find answers.

4 ANALYSIS OF THE 5-E MODEL AND REUSE EXPERIENCES

Exploratory working methods are very suitable for teaching themes related to sustainable development [10]. Dynamic repair and redesign of a lamp is a sustainable field where there are many sources of knowledge to critically assess the task, assess new ways of joining parts, evaluate new looks, and take into consideration the different types of information that arise in the process. These processes may be more or less teacher-controlled. How to set up the exploratory teaching will be related to what the teacher wants the students to learn during the programme. According to Lenz Taguchi and Sjøbu, 'Physical objects and artefacts can be understood as part of a performative acting production of power and change which stands in active relation to other physical objects and people' [11:14]. Therefore, how these recycled materials feel and are experienced affects how the student works with the object and what choices he or she makes along the way; an interaction between the student and the material is created. Furthermore, one can say that all objects that surround people affect what is being learned. In the lamp project, the chosen objects are wooden materials from the leftover boxes and old lamps, which were combined to redesign a new lamp. Learning takes place amidst the interaction amongst the students, teacher, tools, techniques, and materials. Therefore, the teacher educator should, in design projects such as this, make use of the potentials that exist in spaces, objects, tools, reused materials, and other materials. The 5E model and the design process have many similarities. It is especially the 'engage' phase that has turned out to be important in terms of initiation and the students' understanding of the diversity and sustainability perspective throughout the design process. Exploratory working methods were linked to the researchers/teachers' implementation and introduction of learning materials and tools in teaching. Exploratory working methods exist at a cultural level through the scientific view and view on teaching, in addition to attitudes and values. The students were given a guided reflection related to personal experiences with individual processes, learning and science in order to become more aware of how this affects their teaching.

Engage: The very central element in the first phase is to engage the students and get them curious about the topic to be explored. It is extremely important that a teacher of design, arts and crafts makes students feel safe in the unknown design process they are entering into. Together with the student, the teacher educator/researcher will come up with reflection questions. Here, it is important to come up with a question that can be explored and a process that is possible to implement. Here are some student questions: 'How can I make a table lamp/reading lamp that is characterised by a Scandinavian style?' 'How can I make a minimalist lamp that gives a lot of light and has an open solution?' 'I want to make a rustic low steel lamp with a tap technique that fits into the living room.' 'A form of exploration of rhythm and repetition using different compositions of equal or three different parts.' 'How can I make a lamp by joining something new and something old?' 'How can I make a lamp by joining an old coat hanger, plank from a resting box and a new lampshade?' The teaching is based on the students' needs, so the teacher organises a teaching programme where the students' learning assumptions and level of commitment are attended to. Activities in this phase can include showing

examples of sustainable design projects, engaging the desire to achieve quality, and focussing on showing good design and craftsmanship. Here, it has also been found that enthusiasm, dedication, and dissemination of professional knowledge from the teacher greatly affect the students' motivation for initiating the process. Motivation and interest are important factors for learning outcomes, and the engagement phase is central to students' further learning and should always be the start of a topic. When a teacher has gained students' commitment, students will be wondering and motivated to complete the learning activity. In this context, learning activity refers to both physical activity and cognitive learning [12]. A student reflects on motivation in his log: 'High degree of freedom made me extra motivated. In addition to finding the approach to sustainability, repair and redesign, time-consuming and exciting, and as future teachers, we have a responsibility to focus on incorporating this perspective into teaching. Self-determination, including virtually all of my fellow students, was motivating in itself. This led to increased ownership of the substance to be taught, which may both be motivating and increase understanding.' There should be a goal of creating new and lasting products that the students can be proud of and that do not create new waste that is thrown away immediately once the teaching is done. The students work on making their own mind maps, materials collection, and stream of ideas in addition to asking questions, and they make pictures, sketches, drawings, and trials of three-dimensional cardboard models as well as work in the wood workshop at school or in learning demonstrations to learn how to use machines, tools, and techniques. They also encounter daily exhibitions, museum visits, visits from designers or executive re-designers, media reports, the internet, and businesses outside the university.

Explore: This phase gives students the opportunity to explore a problem through practical and theoretical work. The students themselves bring in data to elucidate the issue to be explored. Data can be collected from students' own explorations in the form of model testing so they can become familiar with materials, tools, and materials testing. Students must really explore the things they have gathered to see new opportunities with these. Student comment: I created mood boards and models to illuminate the issue to be explored. I experienced getting to know materials and tools by examining the wood parts and using the things I've collected to see new opportunities. Thus I gathered knowledge through practical testing'. Exploration brings together knowledge through practical testing. Alternatively, students can gather other sources, such as theories or online resources, that inspire the process and can be collected and displayed in, for example, a mood board.

Explain: In this phase, students will begin to process and build knowledge based on the information they have gathered about the topic.

Elaborate: In this phase, the goal is for the students to build on their knowledge and draw conclusions so that they can make the knowledge their own and, thus, use it in other contexts. Here, the students can present their findings to other students through presentations, exhibitions, etc. In this way, they can practice giving a reasoned answer to the question they initially asked.

4.1 Valuing diversity and dynamic repair—inner and outer conditions

Engage, exploring, explaining, and elaborating gave the students a variety of experiences. This paper deals with the exploring and explaining phases, dynamic repair and valuing diversity, because they have been proven through exploratory working method to have a major impact on students' understanding of the process with a redesign product.

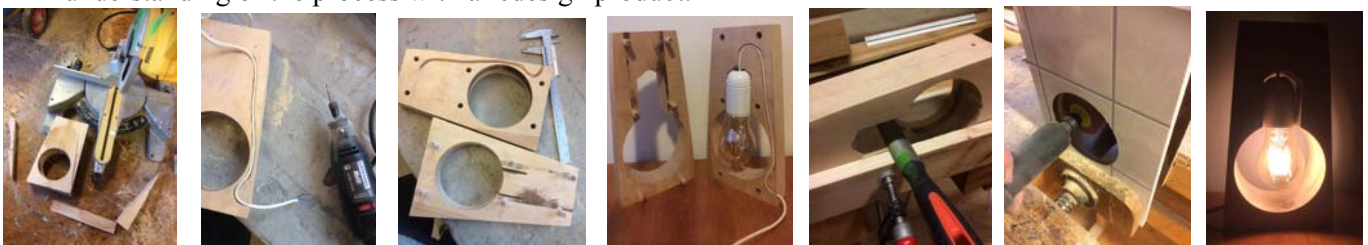


Figure 1. Some process pictures from a student log

Figure 1 shows pictures from a student log. There should be an interaction between open phases in the work where the students make their own experiences and structured phases where the students are guided towards the learning goals. Experiences with repairs became directly relevant to the students who took part in the project. As one student said, 'The plugs were refurbished to join the subjects with such sliding that it is also possible to interchange them again. I said the area to the shelf with a jigsaw

on the subject where the work drawing was signed. I felt a bit so that the edges became more correct, and then I wrote off the other topic and said it. I soaked the outside with a brushing machine. It took a lot of time to file the area where the shelf should enter. This is probably the hardest part on the lamp to get nice. I used two boards fastened with forces to not round the corners of the file. I used the same principle when I was going to brush in the hole for the light bulb. I drilled two equal holes in two plates that I attached to the force. The plates were harder than the oak, so I could not brush down the edges of the lamp. Then, I used a slab of sandpaper 60 to brush down the chips and notch inside the hole for the light bulb.’

Students find both inner and outer relationships in a practice of exploratory working methods. And it is difficult to change established practice based on an individual expectation of being told what to do. The students had different assumptions. Those with a lower degree of knowledge were most unsafe in dealing with tools and techniques, and those with good knowledge had the highest degree of reflection of diversity and possibilities with tools and techniques. In order to understand and act for more sustainable development, students need to experience the world in reality, not just through theory [10]. Several of the students made different attempts at joining the exploration phase. The students processed and built knowledge based on the information they had gathered on the topic, which was joining techniques. The students took pictures of their trials and showed cardboard models and craft material samples. Images were put into a digital labelling folder, and the photos were supported by design, art, and craft reflections in the explain phase. The explore and explain phases created opportunities for testing different possibilities for dynamic repair as well as explaining and showing what ensures quality in the final product. The students reflected on this as a useful experience that strengthens product life compared to, for example, parts that are simply glued together. According to Sennett, ‘The simplest way to make a repair is to take something apart, find and fix what’s wrong, then restore the object to its former state. This could be called a static repair ... A dynamic repair will change the object’s current form or function once it is reassembled ... the dynamic repair may invite new tools for working with objects’ [9:200]. The redesign of the lamp is an example of this kind of dynamic repair; one adjusts, changes, and renews the object’s original form. The redesign project challenged the students to reuse old wooden materials and lamps. Suitable tools, along with handling and touching the materials, became necessary to execute the dynamic repairs. A dialogue between the hand and the head [9], and a mutual acting production between things and people, was created [13]. To redesign a lamp and accomplish a dynamic repair required physical items, material objects, and tools. Several of the students acquired new material knowledge, and they expressed that it was inspiring to design their own lamp. This shows ‘life experienced’ and experiences through practical work.

The students themselves assessed what kind of potential they saw in the old lamps. To ensure high quality, the students were supposed to utilise one or several joining techniques, such as a mortise with wooden plugs, dowel joints, mortise and tendon, or finger joints. These joining techniques give strong and stable results and involve the necessity of being able to handle tools. Valuing diversity through work with materials became clear in the design process. The students experienced working their way into the materials in a more thorough way since they were relating to the properties of the wood, which leads to a greater material consciousness. One can see this material consciousness as a bodily experience—the act of sawing at a right angle, how one holds the plane, how hard one has to press the chisel against the wood to achieve exactly the track one would like, or feeling how a wooden plug has to be in order to fit precisely when one is joining two pieces of wood together. Here, one can see the body as Merleau-Ponty [13] does: as experiencing, sensing, and acting. Through the work of creating a lamp, one can say that the students’ craft-based efforts in the design process show an engaged material consciousness, but one can also say that it is a bodily manifestation of material experience. The practical work with the materials increases the students’ engagement, understanding and faced challenges, such as the following: ‘How do I clear the finish’ ‘It was also much harder to work with the hard oak than what I had seen for me, decay before I know what I know today.’ ‘I discovered many better solutions along the way, so I feel better equipped today to continue working with oak.’ ‘I think oak is a beautiful wood of high quality, but I recognise, both economically and for woodworking purposes, that it may not be the best wood for school use.’ This can be understood as a transformation between materials and material understanding; it is a metamorphosis in accordance with the clarification of terms given in the introduction [9]. The exploratory working method approach to recycled materials can give a lived experience, where the possibilities and limitations of wooden

materials are experienced and the students achieve new knowledge about suitable tools to connect something new with something old. Dynamic repair shows the students working their way into the materials as a bodily manifestation of material experience, but one can also say that the students acquired personal material experience with dynamic repair, where the activation of the sensory apparatus is central. The project was structured as a design process following the 5E model to make it exploratory and involve students throughout the process. The students worked at exploring through planning, implementing, and reflecting on the design process. Assessment took place throughout the process. Thus, the students gained a deeper understanding of how actions and the use of dynamic repair affect the process and outcome. Thus, students gained action competence in relation to sustainable development in a redesign process.

5 DISCUSSION AND CONCLUSION

The research question asked how exploratory working and IBT methods are suitable for teaching themes related to different perspectives on reuse, diversity, and sustainable development [1] [2]. The conclusion has resulted in learning outcomes for valuing diversity that can be used as a resource in reuse projects. Exploratory working methods release learning with diversity, quality, reflection, and communication. The learning is relevant to developing a good product and is also important for connecting knowledge from other subjects to the product's development. The students connected redesign to, for example, compositional principles in the development of form so that they achieved the expression they wanted in the lamp, and understand the design process better. They showed joy and motivation during the project, but also frustration. Through qualitative research [6] [7], the students find both inner and outer relationships in the practice of exploratory working methods. The new thing in this study is the connection between the design process, Inquiry-based learning and valuing diversity inspires students to learn for themselves, bringing a real research-orientated approach to the re-designing subject. When the students mastered the craft, they expressed joy at being able to produce a product they were pleased with. It is important throughout this entire process, supervision, time, and time management all played an important role.

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