Perspectives on Multi-Material Craft in Basic Education

Sinikka Hannele Pöllänen

Abstract

In Finland, the National Core Curriculum for basic education from 2014 discusses holistic and multi-material craft, which includes technical work and textile work aiming to break down the gender-based tradition in craft education. However, teachers have been confused about the concept of multi-materiality; it has raised tension between textile work and technical work, and teachers have not found practical pedagogical solutions for teaching these subjects. In this systematic literature review, the main aim is to open the concept of multi-materiality and give examples to implement multi-materiality in craft during basic education. Twenty articles dealing with craft, multi-materiality, material or materialisation formed the basis of the analysis. According to the results, the concept of multi-materiality is open, it does not define the means by which the design and making process is supposed to be implemented or who is the actor. However, the clear impetus is non-gender-based and material-free knowledge-building and learning activities in craft education. The pedagogical examples presented in this article indicate that multi-materiality is not an end itself. In advancing creativity, critical thinking, discovering and understanding of the technological and cultural world through multi-materiality, student learning can have different starting points and can be implemented in diverse ways.

Keywords

basic education, common craft, craft, craft education, holistic craft, multi-materiality

Introduction

Unlike many other countries, Finland has integrated craft into general education as a school subject in its own right – separate, for example, from art and home economics (Reincke 1995) and technology education (Autio & Soobik 2013). Today, craft is a distinct school subject with its own objectives, which are supposed to be implemented through open themes, a holistic interdisciplinary approach and environment-based learning tasks. From 2014, the most recent National Core

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Curriculum (Fnbe 2014) discusses holistic and multi-material craft, which includes technical work and textile work. The curriculum identifies technical and textile work as a subject matter rather than as separate school subjects but provides no instructions in relation to pedagogical models, prepared handicrafts or materials and techniques to be used. Instead, the curriculum focuses on students' interests, co-creation and collaboration and participatory learning in projects supporting experiential and multisensory design and analysis of artefacts, surroundings and nature (Fnbe 2014). Craft is oriented toward integrating design and skilled creative work and new technology. In this regard, computational thinking, programming and ICT have also been incorporated into craft education to equip students with the extensive skillset needed to live in a rapidly changing society (see Webb *et al.* 2017). First and foremost, craft is supposed to be explanatory and experimental, involving a range of visual, material and technical methods and manufacturing solutions (Fnbe 2014).

According to the gender-segregated tradition of craft education, male teachers have taught technical work and female teachers textile work. Thereby, craft teachers have largely been specialised in either textile or technical work, typically working in separate classrooms with separate equipment and devices. After the new National Core Curriculum (Fnbe 2014), teachers have been confused about the concept of multi-materiality (Vuolas 2017); they have not found practical solutions for common crafts thought to break the gender dichotomy in craft education (Kokko 2007). Also, tensions between design and technology education have arisen after textile work and technical work were joined (Marjanen & Metsärinne 2019). Therefore, to reframe craft education, the main aim of this literature review is to provide answers to the following research questions:

1. What does the concept of multi-materiality mean in common craft and holistic craft in basic education?
2. What examples can be presented to implement multi-materiality in craft during basic education?

To begin, the article describes the way to common craft that preceded multi-material craft and reviews the holistic craft process concept: one of the main curriculum concepts. Then, the research results open the concept of multi-materiality and introduce illustrative examples of multi-materiality-based craft in basic education.

Literature

Towards common multi-material craft education

When the Finnish school system was founded in 1866, crafts included all the traditional craft techniques and materials of that period. In those days, craft education was clearly gender-segregated – textile-based women's handicrafts for girls and men's woodworking for boys. Teaching focused on practical skills educating children for familial and societal roles (Reincke 1995). Following industrialisation, the educational model series delivered to schools presented exercises and tools to be taught (Marjanen 2012). For a long time thereafter, girls were taught traditional women's crafts and clothing care, and boys learned woodworking, metalworking and electrical skills, as well as electrical and mechanical engineering

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(Marjanen 2012). After the Second World War, the content of school craft was practical and highlighted technical skills and maintenance work needed at home (e.g. patching, darning, repairing) and in the new labour market (Marjanen & Metsärinne 2019).

In 1970, the idea of equal educational opportunity became a key concept (Ahonen 2003) and students were expected to choose either technical or textile work as independent subjects with no gender-based division (Marjanen & Metsärinne 2019). The main idea was to develop students' personal approach, individual product design and manufacturing skills (Pops 1970a). After all, hierarchically presented goals for all subjects were introduced to the curriculum: techniques, materials and objectives for students' products were listed for each grade (Pops 1970b). In practice, for more technical reasons, craft was organised on the basis of gender (Kokko 2007).

To promote gender equality, the National Core Curriculum (Pops 1985) introduced new objectives in 1985 to provide the same opportunities for boys and girls in all school subjects. However, craft education was still divided into technical and textile work, and the curriculum loosely discussed common and separate implemented crafts. This meant that part of the syllabus for grades 4 to 6 was the same for all, but some remained separate according to the student's own choice. In these circumstances, the reorganisation of teaching technical and textile work was left to the municipal authorities, in terms of both the number of hours and content emphasis (Marjanen 2012). In upper secondary education, this usually meant a short exchange period of a few hours for learning the other craft subject. This was one attempt to break down the gender gap and was later seen to pave the way for gender-independent career choice, although but students' choices remained largely gender-based (Kokko 2007).

In 1994, a more individualised curriculum with less state control was introduced (Ahonen 2003). As the National Curriculum (Pops 1994) emphasised the spirit and aims of common craft, the objectives of craft education were described jointly for technical and textile work. The national goals for crafts also introduced the idea of design and evaluation, which envisaged that students would design the materials, techniques and tools to be used in the manufacturing of their crafted products. Because these goals were broadly defined, with no clear instructions about content or number of lessons, implementation differed from one school to another (Marjanen 2012).

Following a major change in craft education in 2004, craft has become a combined, single compulsory subject for all students. The National Core Curriculum (Fnbe 2004) combined the separate subjects of technical and textile work into one common subject named craft, based on the concepts of holistic craft process and common craft, which include both technical and textile content. According to the most recent National Core Curriculum (Fnbe 2014), craft is a compulsory subject, taken by all students from first to seventh grade (ages 7–13) for two hours per week. After that, craft is optional, along with other arts and skills-based subjects (ages 14–16). As a common school subject, then, craft has two material areas: so-called 'soft' materials from textile work and 'hard' materials from technical work. Craft has its own objectives, to be implemented through open themes, a holistic interdisciplinary approach and environment-based learning tasks. These aims are grounded in multi-materiality and a holistic craft process that emphasizes creativity, critical thinking, problem-solving,

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discovery as self-expression and understanding of the technological and cultural world (Fnbe 2014).

Holistic craft process

Craft has been characterised as a holistic and intention-based activity (Ihatsu 2002). These characteristics can be observed in two processes: the inherent aim of the craft process and the craft maker's sense of inner self. As a brain-activating activity, craft entails intuitive learning, which in the craft process involves solving problems, selecting alternatives and reflecting while creating a material-based solution (Lahti 2008; Veeber & Syrjäläinen 2015). Accordingly, a vision of doing by hand constitutes a special way of knowing about oneself and about the world, shaped by the mental and concrete products of doing from any kind of material (Kojonkoski-Rännäli 1998).

To describe the holistic nature of the design and manufacturing of handicrafts and the role of the maker, Kojonkoski-Rännäli (1998) introduced the concept of the holistic craft process, in which all phases are conducted by the same person. The maker individually or as an active member of a group is in charge of the ideation, designing, making and assessment of both the artefact and the process (Pöllänen 2009). In a group creative design process, collaboration and sharing all the steps in a holistic craft process, including digital activities, may support participation and include computational thinking as participating (Kafai 2016).

In holistic craft, embodied knowledge informs thinking, reflecting, designing and problem-solving during all phases of the process (see Figure 1). The holistic craft process begins with ideation, which may have its source in daily life and cultural forms and may be linked to regional, local issues or global challenges (Pöllänen & Urdziņa-Deruma 2017). The design stage concretises inner ideas to form an operational image, with visible design plans and planned action, including information retrieval, conducting experiments, solving problems and evaluating solutions and possible outcomes. All of these activities reflect personal and

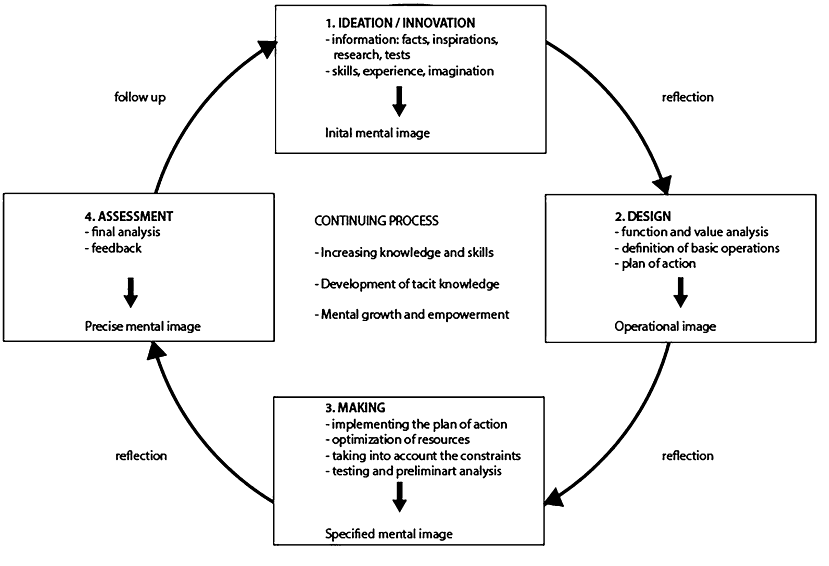

Figure 1
The holistic craft process

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group-working processes and balance outcomes against constraints (e.g. user, purpose, available resources) and resources (e.g. time, materials, machinery, equipment, tools, skills, costs). According to Nimkulrat (2010), the core of any creative process is grounded in materials; the dialogue with materials and thinking about techniques, functions, forms and concepts comes later. For that reason, students' feel for the material assists design (Väänänen *et al.* 2018) through the acquisition of applicable skills, definition of basic operations, technical experiments, prototyping or model-making and communication with others. Collective meaning-making and learning can be supported by drawing (Darling-McQuistan 2017).

Making an artefact is about materialising the design and implementing the plan of action. In practice, students have to reflect on their designs, accounting for constraints and optimising resources. To achieve a specified mental image, students must revise previous knowledge and skills so that new things learned during the process are assimilated to the existing body of knowledge. As a result of searching and testing, the design of the artefact can change during the making process (Pöllänen & Urdziņa-Deruma 2017). As the requirement is to become intimate with the design process in preparing a new product, the student's creative process may lead to innovation (Lepistö & Lindfors 2015). The final stage of the holistic craft process is assessment. Final analysis involves assessing the artefact and especially the making process, reflecting and getting feedback to construct a precise mental image of the process. It is important to return to the previous phases of the process to deepen understanding.

Methods

The methodological option in this qualitative study was developed based on pragmatism (Gutek 2014) and a systematic literature review (Miles *et al.* 2013). After defining the research question, the steps of the systematic literature review process were followed with relevant literature to be able to report the results (Durach *et al.* 2017).

The systematic review started by searching the papers that focused on multi-materiality in craft. For the first research question concerning the concept of multi-materiality, the National Core Curriculum from 2014 was chosen as background literature. Thereafter, publications discussing or describing multi-materiality in craft were screened through the Finnish National Library Service (FINNA) that contains a wide range of databases managed by Finnish universities where the search for international scientific reviewed articles could be carried out. Unfortunately, the results contained only three hits. Therefore, more open screening in Google Scholar was done through pairing the concepts – multi-materiality and craft – which resulted in 123 hits. For this study, 20 research papers, book chapters and conference papers were chosen as the final data for both research questions. The data was based on the following inclusion criteria:

1. The paper focused on craft and the Google Scholar results contained also the words 'material', 'materialization' 'multi-material' or 'multi-materiality' in the title, abstract or introduction; and
2. The study was written in English and published after 2014.

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To avoid bias, all of the relevant papers were captured to get a representative literature base for this study (see McGowan & Sampson 2005). To avoid selection bias (Felson 1992), the inclusion criteria were carefully considered from the perspective of holistic craft that was one of the key concepts in the National Core Curriculum 2014.

After data collection, the full texts were read by assessing their content in terms of the inclusion criteria to verify selection. To answer to the first research question, the references to the concept of materiality were selected and combined to define the concept of multi-materiality in the context of common and holistic craft. Thereafter, to find examples of how multi-materiality can be implemented in craft, the full texts were read itemising the widest variety of opportunities combining textiles and technical work as a common craft. The examples, as perspectives to multi-materiality, were produced through abductive reasoning. Adopting the pragmatist perspective in this qualitative research, the situating abduction got support from inductively sourced literature-based evidence. According to Awuzie & McDermott (2017) extant well-known historical starting points and theories can be used as a basis for the development of propositions for describing the phenomena qualitatively. Thereby, an incomplete set of observations proceeds to the most likely description for the set.

Research results

The concept of multi-materiality

The Core Curriculum (Fnbe 2014) identifies technical work and textile work as subject matter by discussing multi-materiality. This refers to common craft for both girls and boys, and instead of focusing attention on gender issues it stresses materialisation. It does not reveal by what means the design and making process is supposed to be implemented or who is the active maker – in other words, it does not describe any divisions, for example, based on gender or the number of actors. All the materials – soft materials in textile work and hard materials in technical work – as well as related techniques and technology are included in the concept. Although materials are an indispensable condition for making, the literature shows that multi-materiality refers more to the concept of the holistic craft process and knowledge-creating by highlighting the intentional design and making process and problem-solving during the craft process. The tools, machines, equipment, devices and craft techniques that constitute the technology of craft are no more than instruments. In the experiential and explorative acquisition of information in a multi-material 'hands-on' making process (Lepistö & Lindfors 2015) and learning-in-doing (Pöllänen & Urdziņa-Deruma 2017), the individual gains a concrete understanding of the material world (Groth & Mäkelä 2016; Väänänen *et al.* 2018) and abilities to relate to the world in a new, more sustainability and well-being enhancing way (Pöllänen 2015; Veber & Syrjäläinen 2015; Väänänen *et al.* 2018). This kind of embodied knowledge requires designing, thinking, reflecting, exploring and problem-solving during all phases of the craft process (Kangas 2014).

The results show that holistic craft-based learning tasks should be constructed on the principle of user-centred design and selecting appropriate materials and techniques to create a workable and sustainable solution to carry out the project. In a multi-material learning environment, students can design and produce solutions to design challenges and reflect on the holistic craft-based process and

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solutions (Jaatinen *et al.* 2017). As Lepistö & Lindfors (2015) noted, students need not, however, engage with all of the available materials and techniques but should be aware of a range of material and technological means to be used. Härkki *et al.* (2016) found that if the materials are known in advance of the design process, the materials may guide the solutions or students will not know what to do with the new materials. Thus, materials must be introduced as potentials for the multi-material creative design and making process. Lepistö & Lindfors (2015) also argued that if students must think and act traditionally on such gender-based choices as feminine textile work and masculine-based technical work, they are not encouraged to experiment and to innovate using a variety of materials.

The findings show that contemporary multi-material and design-based holistic craft may also encompass different forms of technology and may help students learn computational thinking by starting with design and practical problems and proceeding to technology-mediated programming skills as one way to materialisation (Pöllänen & Pöllänen 2019). Riikonen *et al.* (2018) found that most students succeeded in co-design and co-invention processes that involved using traditional and digital fabrication technologies for inventing, designing and making complex multi-material artefacts. Respectively, the literature emphasises the idea that knowledge of different materials, techniques and technology, and a process acquired through authentic experience create a sense of commitment and responsibility and stimulates learners' own cognitive, sensorimotor, emotional and social resources (Rönkkö & Aerila 2015; Härkki *et al.* 2016) as immaterial craft (Väänänen *et al.* 2018). Multi-materiality therefore implies being bodily, emotionally and cognitively active in developing the requisite skills in craft (Hilmola & Lindfors 2017; Groth & Mäkelä 2016).

Examples for multi-materiality

Multi-materiality with versatile techniques in 'one material world'

When the craft process is based on the student's choices rather than on predetermined materials (Lepistö & Lindfors 2015), the student's own design for a specific product may still be based on either different kinds of soft or hard materials, using more versatile techniques and extending basic craft-related tactile skills – learning to be a skilful handcrafter (Groth & Mäkelä 2016). In these cases, students may acquire skills and knowledge about techniques and tools in 'one material world' from either soft or hard materials as material knowledge (Härkki *et al.* 2016). This kind of learning task is particularly suitable for self-expressive and design-related purposes (Pöllänen 2009).

In building skills and knowledge, the student encounters different material- and technique-related problems and ideas that enhance product design and refinement (Kangas 2014). An example of this kind of multi-materiality is tuning or DIY (do-it-yourself), which can simultaneously mean reusing and expressing a personal style or impression (see Figure 2). In practice, this means that learning tasks should begin with joint planning and end-reflection sessions, from which students transition to working in the relevant multi-material learning environment and return to joint assessment to share their learning experiences (Jaatinen *et al.* 2017). Success in this requires teachers' interactive and responsible planning, implementation and reflection targeting students' holistic craft process and co-teaching.

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Figure 2
Chairs in new clothes. Left: Influences from Latvian and Finnish traditional skirts and signs (knitting, felting, double running stich). Artefact: Daina Kalnina. Right: Influences from Lapland's traditional costume colours, Latvia's traditional costume patterns, ancient Latvian and Finnish tablet woven belts and traditional Russian footwear (valenki) (knitting, crios, tablet weave, wet felting, needle felting, flat stich). Artefact: Ilze Gailane.

Multi-materiality beyond material-based borders

Open learning tasks and co-teaching are required to overcome specialisation in technical or textile work – learning to be a designer. The learning environment can be constructed as an authentic experience, in which the main objective is to design a solution to a multidisciplinary complex real-world problem and to prepare an artefact in a user-centred way, using appropriate soft and hard materials and techniques (Pöllänen & Urdziņa-Deruma 2017). While the open design problem must be relevant to a personal frame of reference and to the student's own life (see Figure 3), it must also include design constraints (Kangas 2014), such as technique, purpose or user, to frame the ideas and direct attention to relevant considerations – in other words, to reduce the difficulty of getting started while also expanding students' world of thought. Learning tasks may also involve a wider project (Pöllänen & Urdziņa-Deruma 2017), in which the student manufactures an entity like a stool (with a top) or a traditional sheath knife or an artefact that may include electronics or computing. Equipping student to design and program artistic creations may expand the role of technology in future-based educational settings, as for instance in robotics projects that combine art and technology in artistic works involving motion, light, sound and music (Pöllänen & Pöllänen 2019).

To address the design challenge, the student develops visual and technical designs and tests and obtains information and other resources to justify and refine their designs. When the design problem has been articulated, the student begins to define the type of knowledge, techniques and materials the solution requires, as well as learning about failure (Kangas 2014). Through this iterative process, students investigate, redesign, test, analyse and articulate their ideas and designs before finally making the product, using appropriate materials and techniques (Pöllänen & Urdziņa-Deruma 2017).

Teachers have to divide students into groups according to process, combining their strengths and competences to implement multi-materiality. They must cooperate to plan, implement and evaluate teaching and learning in a comprehensive way

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(Jaatinen *et al.* 2017). In an ideal interconnected learning environment, all craft technologies can be taught appropriately, within scope for joint design, working with and testing different kinds of materials and techniques, both hard and soft. Based on the available advice, equipment and materials, students gain a broad understanding of the holistic craft process and develop their understanding of a multi-material world (see Figure 4). The design problem may involve preparing a new product or innovation (Lepistö & Lindfors 2015), of which the student has no previous experience; the intention is to motivate inquiry in a wider context, beyond knowledge of materials, methods and tools (Härkki *et al.* 2016).

Multi-materiality through crafting of the tool

One way of implementing multi-materiality in craft education is to manufacture a tool needed for a particular technique such as tablet weaving, making strings, looped needle knitting or crocheting. The simplest tools can be manufactured using traditional wood working methods (see Figure 5). To produce more demanding tools, three-dimensional printing (3D) and subtractive techniques such as laser cutting can be used for virtual model productisation and manufacturing of a physical object (Pöllänen & Pöllänen 2019).

Figure 3
A pocket for weaving supplies. Soft and hard materials involving several techniques (e.g. screen and block printing, sewing, painted plywood with holes and painting). Artefact: Maija Pulli.

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Figure 4
Lamp with several materials and techniques (e.g. laser cutting, electronics, macramé). Artefact: Diana Lucane.

Figure 5
An example of combining hard and soft materials in lower classes in primary school.

Software and devices such as 3D printing can support creating a hand-made artefact; the objective is to exploit embedded systems or programming in designing and manufacturing products. This means different ways of editing, combining and dealing with materials (Kangas 2014), with bold and creative use of a range of traditional and new materials, technologies and manufacturing techniques (Riikonen *et al*. 2018). This kind of multi-materiality can readily be implemented with the youngest pupils and in cases where textile and technical work classrooms are located in different buildings. However, to be a pedagogical continuum for technology education as well as for both technical and textile content, this requires intensive planning and team-working among teachers.

Multi-materiality in team projects

The central learning objective in team projects would be to solve a problem or produce an innovation. This may involve addressing a real-world design

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challenge, such as recycling (see Figure 6) or pedestrian roadside safety using technology and new structural, material, functional and design elements. Equally, the design task might involve designing a table game (Pöllänen & Urdziņa-Deruma 2017). The design process starts with a joint theme, but the learning challenge can lead teams to different multi-material-based solutions (Kangas 2014).

Projective work involves several iterative processes, in which students investigate, search for information, redesign, and test and analyse their ideas from theoretical and practical perspectives before making the product and testing it in a real-world situation. During the process, team members must negotiate; in familiarising themselves with the technologies and multi-material preconditions for the solution, they work in collaboration with others to boost authentic assessment and

Figure 6
A recycling sack: a sustainable solution to recycle students' needless goods. Artefact: Linnea Breiling, Aino Ilva, Liisa Parhiala

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reflection. The solution may be a common jointly manufactured artefact or a prototype (Kangas 2014), or the group members may manufacture their own artefacts according to the joint design and tested version.

Working in teams, students recognise their strengths and learn from each other. The students move between learning multi-material environments and make use of the hard and soft materials and techniques needed for their problem-solving process (Jaatinen *et al*. 2017). During this process, students articulate their understanding of concepts – first, in terms of multi-materiality and the concrete artefact they are manufacturing in their own project, which is then transferred to similar artefacts or situations and finally to abstract principles of the material world by presenting their projects inside the team and finally to the whole class (Riikonen *et al*. 2018). Projects may extend beyond a particular school subject or content, encouraging students to adopt diverse roles, learn process-based working in teams (Pöllänen & Urdziņa-Deruma 2017) and to think in interdisciplinary terms promoting science learning as well (Kangas 2014). The idea is to discover that the same starting point can lead to alternative correct solutions.

Multi-materiality in collaborative design

Multi-material craft solutions can also be achieved through open, complex real-life design challenges, in which all students from an entire class are helped to connect diverse tools, materials, artefacts and people around a shared concrete object of activity. The starting point might be students' everyday practices or a local or global phenomenon understanding the surrounding world more holistically – reflecting on the material culture (Väänänen *et al*. 2018). Importantly, the learning target should be connected to authentic educational opportunities beyond the school that reinforce a communal, research-based learning-in-doing culture (Pöllänen & Urdziņa-Deruma 2017). The solution requires joint analysis of the design context and design task; above all, knowledge, skills, creativity, experience and applications during the making process are employed in collaboration (Riikonen *et al*. 2018). The idea is to acquire information and apply new skills to understand and improve the ideas in question and to express them verbally and visually in material form – for example, by sketching, exploring and testing (Kangas 2014; Härkki *et al*. 2016). Learning in heterogeneous groups and from/with teachers and external domain experts fosters extended thinking in the early phases of the design process as equal partners in knowledge creation (Kangas 2014) in interdisciplinary and environment-based learning tasks. The tools and information networks provided by new technologies enable students to immediately share ideas, designs, knowledge and comments to facilitate the individual and collective goals of the whole group (Pöllänen & Pöllänen 2019).

This approach moves students toward a more participatory culture based on offering support and sharing outcomes – being a genuine learning community. The jointly designed solution may take the form of sketches or models but they may also be a prototype, as for example in a design challenge to innovate inspirational outdoor equipment for physical exercise based on well-being and ecological solutions. Equally, students might learn computing and circuitry basics while designing a programmable smart product or a smart garment (Riikonen *et al*. 2018; Pöllänen & Pöllänen 2019), for example, creating a prototype for shoes that measure steps and calorific consumption based on power output while playing football. Above all, as Kangas (2014) noted while creating a learning community, the descriptive and

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working knowledge of the whole class should be deliberately drawn together to collectively learn how to generate the new knowledge and skills required by design challenge solutions.

Conclusion

Materialisation is the guiding phenomenon in craft education to exceed the genre-based traditions in educational practices in the Finnish National Core Curriculum (Fnbe 2014). The results show that the concept of multi-materiality refers more to the concept of the holistic craft process and knowledge-creating by highlighting the intentional design, making and problem-solving processes while creating a craft. The concept is open; it does not define by what means the design and making process is supposed to be implemented or who is the actor. However, clearly the impetus is on non-gender-based and material-free knowledge-building and learning activities in craft education. All the materials and techniques are included in the concept. By that means, craft can also be oriented to integrate design and skilled creative work with computational thinking and participation (Kafai 2016). With multi-materiality the intention may guide craft education to be explanatory and experimental acquisition of information with different visual, material, technology and technical methods and manufacturing solutions (Fnbe 2014). As a result, we can conclude that multi-materiality in craft refers to the possibility of using different kinds of materials, technology and techniques as resources in holistic craft-based activities that construct an intentional three-dimensional communication for learning-in-doing between the maker(s), activity and material. More importantly, this knowledge of the material world is grounded in the understanding of sustainable lifestyle and development.

The pedagogical examples indicate that multi-materiality is not an end itself. In advancing creativity, critical thinking, discovering and understanding of the technological and cultural world through multi-materiality, student learning can have different starting points, implemented in different ways. The aim is to guide them to be bodily, emotionally and cognitively active while creating high-quality products and developing solutions to their learning challenges (Groth & Mäkelä 2016; Hilmola & Lindfors 2017; Pöllänen & Urdziņa-Deruma 2017). During the holistic and multi-material craft process, students learn to apply materials, techniques and technology concretely which allows the students to make choices and take actions that support creativity and diversity in craft. Participatory learning culture with shared multi-material practices and authentic learning in collaboration with others (Haupt 2015; Darling-McQuistan 2017) may enhance students' understanding of the surrounding world and help them to acquire the requisite skills to reflect also on the material world. However, as Riikonen *et al*. (2018) reminded, teacher expertise regarding design and fabrication methods, materials, as well as pedagogical solutions, appears to be crucial when conducting knowledge-creating projects.

The results of this study intend to reframe craft education and dispel uncertainty about the possibilities to implement multi-materiality in craft education. With this in mind, despite the case being based on the Finnish educational system, it is hoped that the findings will open perspectives on common multi-material and holistic craft education in other contexts where craft materials and processes form part of the general education programme.

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