Moving Education: a design led exploration of the impact of movement in the learning environment

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Abstract: This paper seeks to describe the methodological approach, initial outputs and future plans of the Task Furniture in Education (TFE) project, a group of interdisciplinary researchers made up of academic and industry partners situated in Germany, Ireland, Portugal and the USA who are using a design led approach to explore the theme of 'Moving Education'. The project is the recipient of a 1.3 million euro Marie Curie FP7 IAPP research grant. Lack of movement during daily activities has been linked to increased risk of obesity, diabetes and heart disease. Movement has been shown to have a positive impact on cognitive performance. Globally, there are many experts in the fields of science, pedagogy and technology researching the topic of movement and education in relation to physical and mental well-being and academic performance. Practicing educators are also implementing innovative approaches to movement in their learning environments. This has not been reflected in the range of task furniture available on the market today. The ultimate goal of the Moving Education project is to join the dots between these groups to provide educators, students and relevant stakeholders with a resource that will raise awareness of the impact of movement in the learning environment.

Key words: Human Factors, Design Education, Design for Subjective Wellbeing

1. Introduction

The overarching aim of the TFE project is to create and explore opportunities for knowledge transfer and collaboration in order to inform guidelines for new product development within a consortium of complementary researchers working in the fields of design, task furniture manufacture, physiotherapy, architecture and ergonomics. 'Task Furniture' includes seating, work surfaces, storage, display, lighting and acoustic solutions and here refers to furniture, fixtures and equipment that support the task of learning.

The project is composed of two phases. The 'Learn' phase of the project began in November 2010, and to date the TFE research team has been working closely with experts, educators and students, employing a range of qualitative and quantitative design and science based methods in order to collect and curate a knowledge bank on the topic of movement and education. The next phase of the project, 'Moving Education', which commenced in October 2012, involves the use of design methodology to build on the initial research, adopting the lens of movement and education to translate the research gathered to date into tangible solutions and critical provocations. These outputs will aim to bridge the gap between academia and industry, research and practice and designers and stakeholders.

2. Background

Research and design in the area of task furniture which supports movement in the learning environment is in its infancy when compared with the extensive body of research, government legislation, and design solutions addressing movement and adult users in the workplace. The majority of studies conducted to date have investigated the working postures of learners in a lecture-based classroom setting [1] and focus on the forward and reclined postures associated with reading, writing and listening activities. These studies do not reflect the changes that are happening in education today and the reality of a learning environment in the 21st century where there is a shift from teacher-centred practices of delivery of knowledge to student-centred acquisition of skills [2]. Studies such as these, along with anthropometric data handbooks [3] have formed the basis for the design of task furniture in education. Guidelines for posture in the learning environment are based on the right-angled posture currently found in these publications, a posture which has evolved rather than being scientifically proven to be beneficial. "Safe Seats of Learning", published in the UK in 2008 by the Furniture Industry Regulation Authority (FIRA) has called for a "transformation" in the way school furniture is designed [4]. However, often designers, architects and those procuring task furniture also do not fully understand learning, the learner and the learning environment.

Existing ergonomic research indicates serious long-term health problems being inflicted on children in our schools. There is an increased awareness of the damaging effect of prolonged sitting which cannot be offset by sporadic exercise, and it's effect on childhood obesity and health problems such as back pain - European studies have found that 60% of school pupils experience back problems by the age of 16 [5]. Several studies have been carried out in "active permissive" or "movement ergonomic" learning environments [6]. In these studies a range of postures have been made accessible to the learners – standing, lying and active-dynamic sitting. The teaching methods have also been modified to provide more movement and activity opportunities for the learners. This is in accordance with WHO guidelines on physical activity, which recommend that children aged 5 –17, should engage in at least 1 hour of intense physical activity daily. [7] This evidence only serves to highlight the corresponding deficit in design research that would examine creatively the potential for user-oriented, innovative, tested and proven furniture. Studies have emerged which investigate the impact of physical activity on learning [8] and certain actions on activities such as problem-solving [9]. Within TFE and the 'Moving Education' project we intend to explore the relationship between self-regulated movement throughout the school day, physical and mental well-being and cognitive performance and determine how the task furniture can support and enable this type of learning experience.

3. Methodology & Process

Underpinning all research activities in the project is a user-first and inclusive design methodology, designing 'with' rather than 'for' users. While the team has extensive experience, and is drawn from range of disciplines, cultures and ages, they are obviously not representative users and have sought to involve an appropriate mix of people to input into all steps of the design research process. In order to help structure our research we have tried to gain useful feedback from a diverse range of representative users to reduce biases in the sample user's and stakeholder's responses and observations.

Within the scope of this project it was important for the team to be aware that children and young adults are distinct user groups with a variety of physiological, psychological and sensory needs - they are not miniature versions of adults. It was also important to be aware of the other stakeholders in the educational sphere, for example, educators, policy makers and parents. Although the project would take inspiration from alternative educational models it would focus on public formalised education systems within primary and secondary education, which conform to a set curriculum, examinations and assessment procedures. With this in mind the team decided to adopt the following research and design approach for the duration of the project:

- Start with understanding the learning
- Design should be user first
- Design should consider external factors
- The design process should be participatory
- Employ a research focused and experimental design process
- Change for now.

The project is made up of a multidisciplinary team, with experience in both qualitative and quantitative research methodologies, employing a mixed methods approach. During the 'Learn' phase there was a clear division between the design and science strands of the project, with both strands pursuing separate, but complementary research activities and pilot studies under the broad theme of Task Furniture in Education. These activities were also driven by the work packages outlined in the project proposal. This mode of collaboration could be classified a "1) Distributed: Characterized by informality and centred on exchange of ideas and information and 2) Complementary: Each individual contributes according to his/her own field of expertise." [10, p7]. During the second phase of the project the team will work more closely together, addressing the research question posed by 'Moving Education' from a variety of angles and combination of methods and approaches during the research and analysis stages. The pattern of collaboration will be integrative, along the lines of John-Steiner's categorisation of inter-disciplinary work "Collective undertake in which the roles are set by research questions and people's experience rather than disciplinary identities." [10, p7].

4. 'Learn' Phase

4.1 Research Activities

The overall aim of the Learn phase was to use primary and secondary qualitative and quantitative research methods to immerse, understand, see, interact, analyse, broadly explore and understand the current landscape of design for learning. Within this the researchers would review, test and observe current and new task furniture solutions, ergonomic testing methods and traditional and progressive pedagogies. The Learn phase ran for the first 18 months of the project and was divided into three stages: Groundwork, Fieldwork and Analysis.

The aim of the Groundwork stage was to familiarise the researchers with the subject area through a range of bottom-up and top-down research approaches by conducting a literature review, expert interviews and initial field visits. During the Fieldwork stage further observations and research activities were carried out by the design and science strands of the project. These include ethnographic and ergonomic observation techniques in the field, in-context interviews, observation of the introduction of an alternative task furniture solution, lab testing of selected task furniture solutions, creation of mini-documentaries by students, distribution of remote research activity packs

(similar to cultural probes). This stage produced a large bank of raw data from the field for analysis. This included photographs, videos, student's drawings, interview transcripts and the researcher's own field notes. Following these initial activities the team moved beyond asking 'what is' to 'what could be' and begun to engage at a deeper level with stakeholders. Activities included participatory workshops in primary schools, secondary schools and third level institutions.

Figure. 1 Participatory workshop with secondary school students, 2011, NCAD, Dublin

4.2 Key Findings

Following analysis the Groundwork stage produced a range of themes, user focused, product focused and mindset focused. User focused themes were: Design for the learning experience, Support variety, activity and movement, Knowledge and needs of learners and educators are key, Consider and be inspired by extreme users. Product focused themes included: Technology integration, Storage requirements and School, nature & the community. Mindset focused themes showed the need for a Mindset shift regarding task furniture and the learning environment and the lack of awareness of the effect of space, well-being, learning and technology on the learning environment in the worlds of design and education.

Following the completion of the Fieldwork stage the research activities described provided a clear set of results and guidelines for the project, which were documented in a milestone document, containing implications for design and directives for subsequent research and development within the TFE project. The key insights were that the chair and desk should no longer be at the core of design for learning, there is no such thing as one ideal posture, TFE should aim to challenge the traditional "sit up straight and pay attention" mindset and that movement and activity should not be an "add-on" but integrated seamlessly throughout the school day. A common finding from both the design and science strands of the project, was the impact of the attitude and knowledge of the educator and the type of pedagogy employed on the dynamics of the learning environment.

5. 'Moving Education' Phase

5.1 Introduction

In October 2012 the main hub of the project shifted from Dublin to Cologne as planned to enable the team to be based within a key industry partner, VS. Following reflection on the 'Learn' phase findings, re-examination of the strengths and knowledge areas of the project partners and analysis of the current landscape of research into and about education, 'movement' emerged as an area of opportunity which had been examined from a wide variety of perspectives and yet lacked sufficient cross disciplinary exploration. There was also evidence that the research work which had been carried out on the topic of movement from scientific, ergonomic and pedagogical standpoints had not been translated into tangible outputs, which could truly support and enable movement in the learning environment.

The 'Moving Education' platform is an interactive network of teachers, learners and other stakeholders working in education exploring the value of movement in the learning environment. Underpinning 'Moving Education' is a creative, exploratory and iterative mindset. Initially the aim of the TFE project was to produce a single piece or system of task furniture for education. Inspired by projects such as MoMA Workspheres [11], which produced a series of speculative scenarios and prototypes based on the office environment, the team decided that greater impact could be achieved by the creation of design briefs which would be answered not solely by the team themselves, but through working with a variety of stakeholders including other designers, educators, students and parents, through a variety of 'expert' creation and 'co-creation' methods. Ultimately 'Moving Education' aims to change the way designers, educators, students and scientists think about task furniture by engaging with these groups and eliciting responses from the stakeholders we want to effect, through the lens of 'Moving Education'.

Researchers will examine the theme through the lenses of physical well-being, mental well-being and academic performance. Four drivers will be considered when exploring the theme: Societal Context | Pedagogy | Media | Learning Environment.
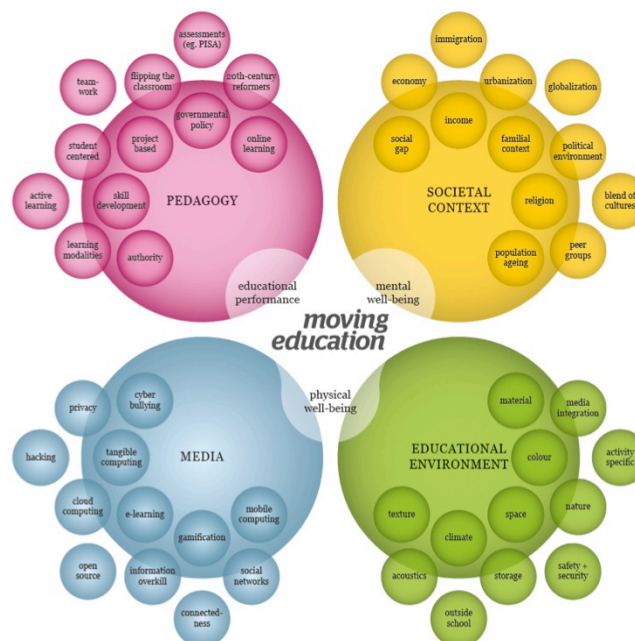

Figure. 2 Moving Education Drivers

The 'Moving Education' phase of TFE is made up of 4 stages:

Collect: Undertaking a comprehensive literature and design review.

Curate: Critiquing the field and selecting exemplars of best practice.

Create: Producing participatory methods, design guidelines, tangible solutions and speculative prototypes.

Communicate: Disseminating the findings through publications, exhibitions and a website.

5.2 'Collect': Literature and Design Review

The overall aim of this stage is to build on the broad content gathered in the 'Learn' phase with a focus on 'Moving Education'. The Collect stage is divided into three distinct strands, which will be explored by multidisciplinary sub-teams during the time period January – June 2013. Although each strand has it's own particular focus cross-pollination and sharing of resources will occur.

Strand 1 is 'Movement and the user: body & mind' and will involve a physiological review of the issues surrounding movement, ergonomics, concentration, self-regulation and academic performance through case studies, identification of best practice and expert interviews. Strand 2 is 'Movement through artifact and environment' which will comprise of a design review, exploring task furniture archetypes and materials using design critique, product autopsy, case studies, expert interviews and identification of best practice. Strand 3, 'Movement in educational practice', will explore formal and informal pedagogies in relation to 'Moving Education', investigating educator instigated movement, self-regulation and barriers and enablers to physical activity in the learning environment. The methods used here will include case studies, identification of best practice, expert interviews, stakeholder interviews and cultural probes. The team have also been engaging with users through a preliminary user interaction activity at an educational fair and by the creation of an online platform for the project.

5.2.1 Preliminary user interaction

An initial information gathering event and launch of the 'Moving Education' theme was held in February 2013 at Didacta, Germany's largest educational trade fair in Cologne. The researchers occupied a space on the stand of manufacturing partner VS and posed an open-ended question to educational stakeholders at the fair: what is your experience of movement in the learning environment?

Figures. 3 & 4 'Moving Education' space and participants recording responses, Didacta 2013, Cologne

The participants recorded their responses and experiences of the theme, which will be analysed using a Grounded Theory method to extract themes and insights, which will also inform the methods and approaches employed in each strand.

5.2.2 User engagement tool – 'Moving Education' website

Didacta also provided an opportunity for the team to launch the 'Moving Education' website and extend an invitation to stakeholders to contribute. In it's initial state the website will function as a platform where stakeholders can submit their experiences and stories for publication on the blog. In the future, it is hoped that this tool may function as a crowdsourcing resource [12] posing challenges to an online community, gathering research and translating this material into tangible solutions, which address the challenges surrounding 'Moving Education'.
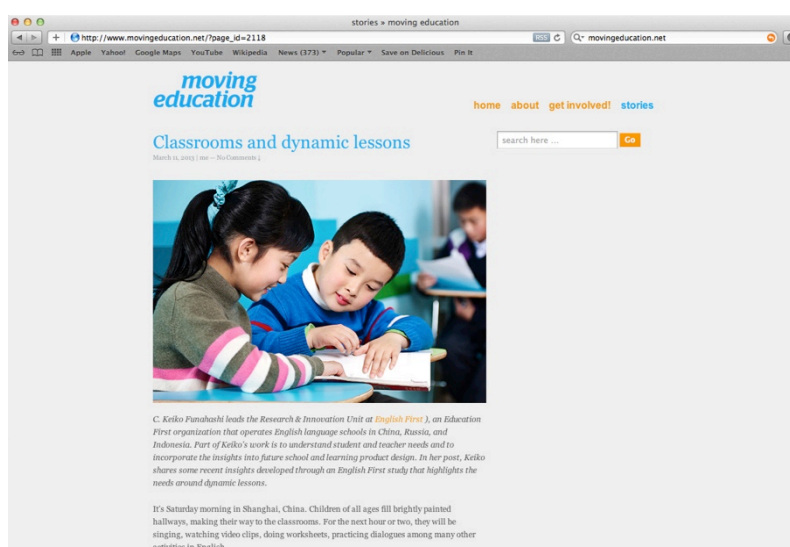

Figure. 5 Moving Education – Guest Blog Post

5.3 'Curate': Design Brief(s) and 'Perceptual Map of Landscape'

During July – September 2013 the team will reflect on, analyse and synthesise the material collated in the 'Collect' stage. The outputs of this stage will translate the raw data gathered into digestible design briefs and a perceptual map of the 'Moving Education' landscape. Again researchers will work together in multidisciplinary teams within the 3 research strands, employing the deductive, inductive and abductive reasoning strategies [13] within the team to arrive at these outputs.

Methods for Strands 1 & 2 will include lab and real world testing and analysis of task furniture archetypes and prototyping rough and ready solutions to explore challenges which have emerged during the 'Collect' stage. Strand 3 will focus on critiquing and curating the material collected during the 'Collect' stage using participatory methods and stakeholder workshops. The outcomes of these activities will be combined to populate a 'Perceptual Map of the 'Moving Education' Landscape', the dimensions of this map will emerge through the synthesis activities and the team will work together to identify these parameters. This map will uncover opportunities and gaps in the field of 'Moving Education' which will inform the creation of several design briefs addressing selected audiences. These briefs will be generated by the team through a series of remote and co-located co-creation activities.

5.4 'Create': Creation of Prototypes and Guidelines

This stage of the project will commence in October 2013 and will continue until the end of March 2014. Using prototyping, testing and iterative design cycles the team will test and hack current task furniture archetypes and develop and test new concepts through co-creation methods and by working with expert stakeholders. The team will be generating concepts along with additional activities such as prototyping, ergonomic testing and developing creative methods for task furniture in education.

Outputs will include the creation of a number of concepts ranging from physical to digital which will explore and highlight the responses to 'Moving Education'. While some of the concepts being developed will seek to engage with commercial realities and act as prototypes for new mass-produced products, the TFE team will also produce speculative concepts that aim to critique the research and field as a whole. Critical design, as defined by Anthony Dunne and Fiona Raby is an alternative approach to established product design practice that challenges and reveals the current situation by producing artefacts that embody alternative values and ideologies [14]. One of the key aims of critical design is to provoke reflection on cultural values that might involve the process of design, the actual object produced, and the reception by an audience of such an object. Critical design products are not intended for mass-market; critical designers are free to pursue their individual goals and not those of a client. The use of a range of concepts is intended to enable the TFE team to present the work through a series of different lenses, addressing the theme of Mindset Shift that emerged during the Groundwork stage.

Designer and stakeholder guidelines will also be produced. These will target the 2 main groups involved in the task furniture landscape – the task furniture industry (including designers and manufacturers and governing bodies) and the educational community (students, parents, educators and governmental bodies). The guidelines will aim to build on documents such as 'Safe Seats of Learning' [4], with a focus on the core principles of 'Moving Education', to equip designers, the task furniture industry and educators with an awareness of current ergonomic research, user experiences and needs, and methods, tools and strategies for the effective design and procurement of task furniture in education.

5.5 'Communicate': Dissemination Activities

Communicating effectively with clients, collaborators, manufacturers and end-users is a vital element of the FP7 funded projects remit. As such the TFE team has adopted tried and tested methods to communicate our ideas and thoughts to our industry partners, stakeholders and the general public, while also seeking to develop novel approaches to public engagement and participatory design practices. Design research cannot reside in an academic ivory tower or insular design studio, and we have sought to engage the public wherever possible in our research activities, and ensure we have a robust plan to share the eventual benefits with the public.

Engagement is by definition a two-way process, involving dialogue and interaction with stakeholders, with the goal of generating mutually beneficial outcomes. Public engagement can dramatically improve the quality and relevance of ones research, helping one to refine ideas and develop presentation and communication skills. Those audiences and stakeholders who engage with design research can play an invaluable role in contributing to design research, while stimulating their curiosity for ones work. Not only do the public raise relevant questions but projects that have been defined and researched in partnership with the public also often result in greater disciplinary and commercial impact and relevance. TFE public engagement has covered a range of different activities, from traditional one-way forms of engagement such as public lectures and talks, to more interactive

forms of engagement such as participatory design. As a design researcher it is all too easy to lose perspective on why your research matters, especially when addressing longer-term speculative research that may only be commercialised in years to come. The TFE team has through a series of activities worked with stakeholders to help question our assumptions, introduce fresh perspectives to improve our thinking, and provide an opportunity to reflect on our design practice and research.

The TFE research team has considered four key aspects when determining how to present our research and engage with the public: Purpose, Audience, Activity and Assessment.

Purpose

The purpose of engaging the public with our research is to create awareness of our area of exploration, disseminate our findings and encourage members of the public to respond to the outcomes of our research project. Often the situation occurs where research is conducted by industry and academia and results are accessible only to those in the field or close to the research partners. Education is a topic that impacts on almost everyone and the team feel that the public should be enabled to access and respond to our findings and outputs.

Audience

As this is an FP7 project our immediate audience is the EU commission and we must fulfill the criteria specified in the proposal as creatively as possible. The team feels however that our primary audiences are the educational community, the task furniture design industry. In order to reach these audiences TFE have taken a top-down and bottom-up approach, forming close relationships with governing bodies, change agents and leaders within these fields in our partner countries and globally. Their input has been sought throughout the process and will be instrumental in the dissemination of our outputs to our selected audiences. By utilising social media tools and internet based platforms we hope to engage others with an interest in this area.

Activity

The team will build on previous experience to continue engaging with the public through a variety of forms from social media sites and the 'Moving Education' blog to international conferences, coverage in the press and events in the partner countries. The team will continue to embrace opportunities to participate in activities alongside their partners in the fields of education, design and science in order to learn from the expertise of others, gain feedback and reach a diverse audience.

Assessment

As part of the Midterm review the team were assessed by the EU project coordinators in October 2012, this was a helpful milestone which enabled the team to reflect on the first 2 years of research and formulate the 'Moving Education' approach. The team will continue to liaise with EU representatives in order to assess the effectiveness of the project. Regular formal Partner meetings and frequent informal meetings have been held since the project kick-off, this practice will continue until the project ends. These have informed the project strategies methods and enabled the modification of the team's approach. The Project Outcome report, which will be presented in October 2014, will assess the success of TFE and 'Moving Education' in meetings our aims, evaluate the outcomes and overall benefits of the activities and document the overall impact of the project. Engagement with the public and our stakeholders formed a significant part of our Mid-Term review and will continue to be important as we approach the end of the project.

Throughout the 'Learn' phase of the project, and now during the 'Moving Education' phase the team have sought to be sensitive to tailoring our approach to a variety of audiences, whether students themselves, educators

of legislators, crafting presentations and material which is visual and lacking in 'jargon' when appropriate. They have actively and consistently sought feedback from their stakeholders and have carefully considered their opinions and experiences. The team are aware that many of our stakeholders have significant day-to-day experience and knowledge of the research area and that the project has benefited greatly from the partnerships have formed since the project began.

The team has adopted a continuous process of documentation through the online blog and website, academic conference presentations and events. The project will culminate in the production of the following dissemination outputs:

Publication

The research will be captured and communicated to a wider audience through a publication developed in conjunction with our Industry Partners [15], designed by Bruce Mau and developed in partnership with VS provides a benchmark, and the book is intended to act as a companion publication while exploring a non-linear format to enable readers to navigate a personal path through the research.

Guidelines

The TFE team will produce a suite of guidelines for designers, educators and procurement officers that will seek to assist in the creation, specification, deployment, purchasing and evaluation of task furniture for education.

Exhibition

Exhibiting design products and process has proved to be challenge for researchers and practitioners alike. Art galleries have traditionally adopted a questionable approach to displaying design, focusing on pure aesthetics and exclusively crafted historic products, while promoting leading designers as individual artists, divorced from the realities of the design manufacturing and development process. Indeed, one could argue that the only difference between an institution such as the Terence Conran endorsed Design Museum in London, and his Conran Shop design emporium, is that the designer chairs and knick-knacks you can buy in the shop are placed on pedestals or within glass vitrines in the gallery.

The TFE team intend to produce an exhibition that complements the existing VS educational design museum [16] a permanent exhibit within VS which chronicles the development of school furniture during the 20th century to the present day. Production models, prototypes, marketing and research material and examples of innovative school buildings have been curated to document the effect of the learning environment on the wellbeing of the learner. Comprising of artefacts and research data and findings, the planned TFE exhibition will seek to enable audiences to investigate Task Furniture for Education and access an accompanying website and central research resource.

6. Conclusions

Biologist E. O. Wilson defined consilience as "Literally a 'jumping together' of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation." [17, p7]. By bringing together educators who are implementing innovative approaches to movement in their learning environments and practitioners in the fields of sports science, endocrinology, pedagogy, ergonomics, physiotherapy and technology, the TFE and 'Moving Education' team hope to create an accessible and relevant

series of outputs which brings focus on the area of movement and education in relation to physical and mental well-being and academic performance.

The 'Moving Education' outputs will fulfill the aspirations of the initial FP7 project proposal by utilising a multidisciplinary approach throughout the process, reviewing the most current theories and practices on this topic, researching and analysing activities in the field and translating this research into tangible outputs which will ultimately have a lasting impact on the task furniture industry and improve the long-term health and learning experiences for students and educators.

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