

CROSS-DISCIPLINARY TEACHING AND MENTAL SCALING IN COMPLEX DESIGN PROJECTS

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ABSTRACT

This paper investigates how cross-disciplinary teaching and the act of mental scaling may build valuable stimulus for creativity and influence students' learning outcome in an undergraduate design curriculum. With 'The Future of Well Being' as an overarching theme, each student in this case study was challenged to develop a future scenario as a holistic service design concept, while implementing brand strategy, corporate identity, interaction design, visual communication and product design as key design elements. While being both academics and practitioners from industry with very different background of experience, the educators had to collaborate in new ways, considering the diverse nature of these disciplines. This paper explores in particular how the act of mental scaling - or the active change of perspective - may support the students into an integrative thinking mode, in the span between overarching conceptual reflections and detailed design solutions. The students' ability to absorb divergent, theoretical input and tutoring from separate disciplines and to utilize this knowledge while building an integrative thinking mode, has clearly been challenged. The findings from observations, photo documentation and a written questionnaire suggest that active mental scaling may become catalyst for integrative thinking and productive creation of structure in complex design projects. While acknowledging cross-disciplinary design competence as important response to future corporate needs, it seems that this approach may be utilized by educators in order to facilitate increasingly relevant learning outcome during the design process.

Keywords: Cross-disciplinary teaching, mental scaling, learning outcome, complex design project, case study.

1 INTRODUCTION

While taking the rather traditional term industrial design as a starting point for this study, it was natural to ask what kind of competences that would be relevant for future designers. Donald Norman asks the same question: "Do we still need ID? No, not the old-fashioned kind of ID. The traditional industrial designer is too limited. What we really need is a new breed of designer, one who can work across disciplines, one who understands human beings, business, and technology..." [1]. This view supports our vision for a designer who is equipped and prepared for future user needs, new markets and adaptable to new corporate climates, and -not at least- trained to co-operate across disciplines and diversity of competencies. In current climate where industrial sectors must adhere to increasingly complex markets while solving changing and complex user needs, this diversity seems to reflect strong corporate demands for developing cross-disciplinary competences amongst designers in academia. As consequence of this, our institution aims at building a relevant design curriculum that reflects this demand for flexibility, and acknowledging multi-disciplinarity as an increasingly relevant and important ability is the reason for developing this service design course.

On that note, one might argue that service design is entangled in a 'wicked problem' [2], performing amidst complexity [3]. We acknowledge that service design is emerging as an increasingly important design discipline, reflecting human needs on a large scale in society. Service design is not only about building holistic understanding of users' mindset and investigating relevant user behaviour, but also to organize elements, such as people, material, infrastructure and communication to enable and stimulate the appropriate interaction between service provider and customer in order to create the best possible customer experiences. While contextualizing the assignment within this frame, this approach also

challenges our ability to provide cross-disciplinary tutoring during the project, and to maximize the students' abilities to work holistically and flexibly in the span between holistic and concrete mind-sets.

1.1 Cross-disciplinary teaching

When discussing the implications of cross-disciplinary teaching, it is important to distinguish between disciplinary and cross-disciplinary courses. While disciplinary courses usually focus on a specific field of knowledge through a certain 'micro-focus', cross-disciplinary courses are more general in character, by focusing on 'the big picture' through 'macro-focus', and the interrelations between different fields of knowledge [4]. Cross-disciplinary courses usually require teachers with a broad inter-disciplinary knowledge, which seems to be a rare competence in academia today. On that note, we also experience that cross-disciplinary theories are few and rarely well assimilated into the area of design teaching today, which might be the reason why cross-disciplinary courses seem so complicated to teach.

1.2 Mental Scaling

One way to understand the reason for decisions made by each individual student is to examine each student's personal characteristics - or the procedural capabilities - that each student holds. Student capability parameters [5] describe the ability to navigate on a mental navigation scale, or the personal inclination to perform on a mental scale between abstraction and concretization. This attitude can be described by two characteristics, 'A-navigator' and 'C-navigator'. The A-navigator tends to navigate within the abstract sphere of the mental scale, typically triggered by abstract, holistic or strategic thinking, while the C-navigator tends to navigate within the concrete sphere of the mental scale, typically triggered by concrete, fragmented thinking, often with strong attention to details in final solution. When facing intractable problems, De Bono argues that the theory of lateral thinking [6] may be constructive in order to explore a challenging task in different - and often - unorthodox ways. Being complementary to De Bono's theory, we acknowledge that mental scaling [7] - or mental elasticity - describes the ability to navigate elastically between divergent and convergent thinking, enabling mental fluctuation during the design process. This ability to fluctuate between abstraction through a holistic view and concretization through a fragmented view seems to be an essential capability for designers in order to attack a given problem from different angles, and even more essential during complex design assignments, which requires an implementation of all key design elements mentioned.

1.3 The Scope and Design Brief

As part of our undergraduate curriculum, a group of 23 students were challenged to develop a service design concept as part of a future scenario - The Future of Well Being - using elements from brand strategy, corporate identity, interaction design, visual communication and product design as 'building blocks'. The educator group of five educators consisted of both academics with rather extensive teaching experience, as well as practitioners from industry, having limited teaching experience. Two important issues were key: How to ensure that educators interact appropriately and efficiently with each other during teach modules, and -not at least- how should the educators teach the students, in order to facilitate the necessary cross-disciplinary mindset through holistic view. While focusing on pedagogical approaches, our research question was: How can mental scaling stimulate the students into an integrative thinking mode during a complex design project, taking in consideration that the project is cross-disciplinary?

1.4 Research Methodology

Our research methodology has mainly focused on teaching methods, project activities and student behaviour. Three different research tools were used in this study; observations of the tutoring sessions in the workshop and in the studio, photo documentation from the workshops and studio, and finally a written questionnaire handed out to the students after the course was finalized.

2 THE PROJECT

In addition to making preparations during initial meetings with all educators before course introduction, one educator was appointed as course coordinator in order to make sure that all the human resources in the educator's team were available at the right time and interacting as closely as possible with each other during the whole project period, while giving individual tutoring sessions.



Figure 1. Example of a student project describing a digital service for improving sleeping patterns

The 23 student projects displayed a thematic diversity, ranging from purely digital services using applications enabling interactive user experiences, to more tangible approaches where physical products solve specific problems. Figure 1 exemplifies the first case, consisting of a digital service where a service based on sleep monitoring provides feedback on the quality of the users sleep.

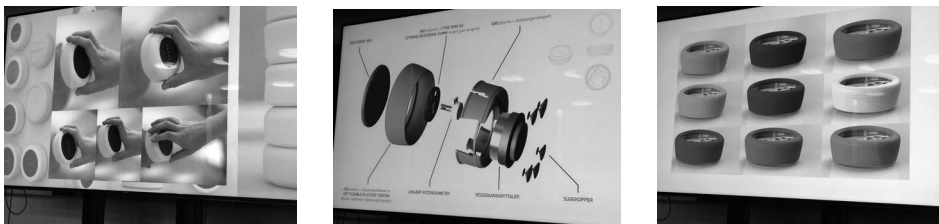


Figure 2. Example of a student project describing a tangible device for reducing unwanted noise

Representing the second case, figure 2 exemplifies the opposite approach, consisting of a physical solution where a tangible device is intended to reduce unwanted noise in domestic environments by setting window glass into vibration, in order to reduce noise from the environment outside residents.

2.1 Questionnaire

The written questionnaire was divided into three different focal areas; (1) Qualitative feedback on pedagogical aspects, (2) Mental Scaling and disciplinary distribution, and (3) Mental fluctuation within each discipline. The student’s feedback was organized and separated into the following tables:

Table 1. Questionnaire: Qualitative feedback on pedagogical aspects

1. "The flow of information from the teachers has worked well in the design project."	Do not agree	0																		
	Partly agree	2	■																	
	Quit agree	9	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Totally agree	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2. "I think the design project had too high level of complexity and it involved too many disciplines."	Do not agree	8	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Partly agree	9	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Quit agree	4	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Totally agree	2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3. "It would be an advantage with more milestones and part-presentations."	Do not agree	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Partly agree	11	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Quit agree	5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Totally agree	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
4. "It has been difficult to extract an overall essence of feedback from supervisors, since they come from different fields of competence and give guidance from their own field."	Do not agree	4	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Partly agree	5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Quit agree	14	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Totally agree	0																		
			0	5	10	15														

Table 1 indicates that a significant number of students found it difficult to extract an overall essence of feedback from the supervisors, caused by their different fields of competence – question 4.

Table 2. Questionnaire: mental scaling and disciplinary distribution

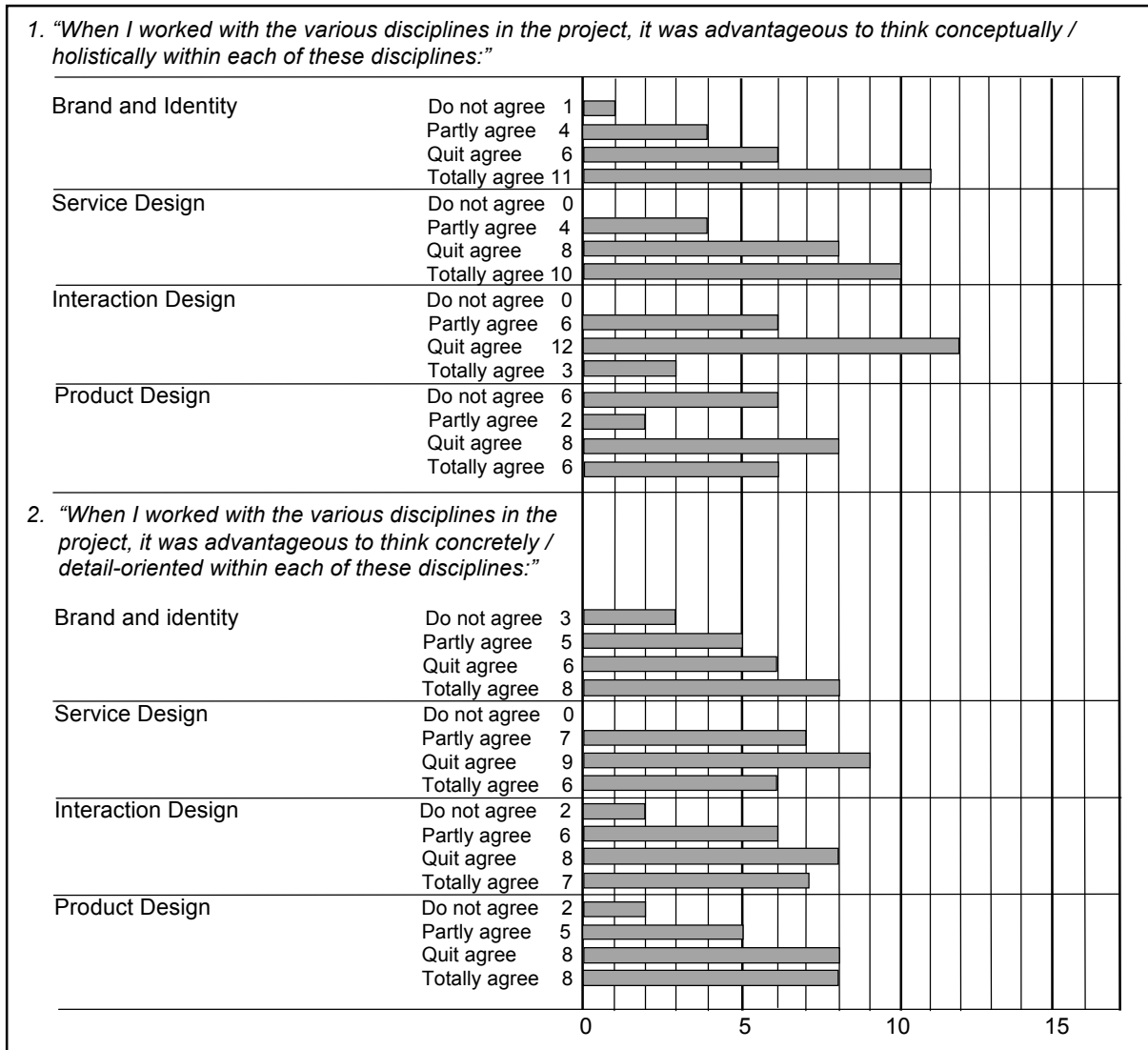
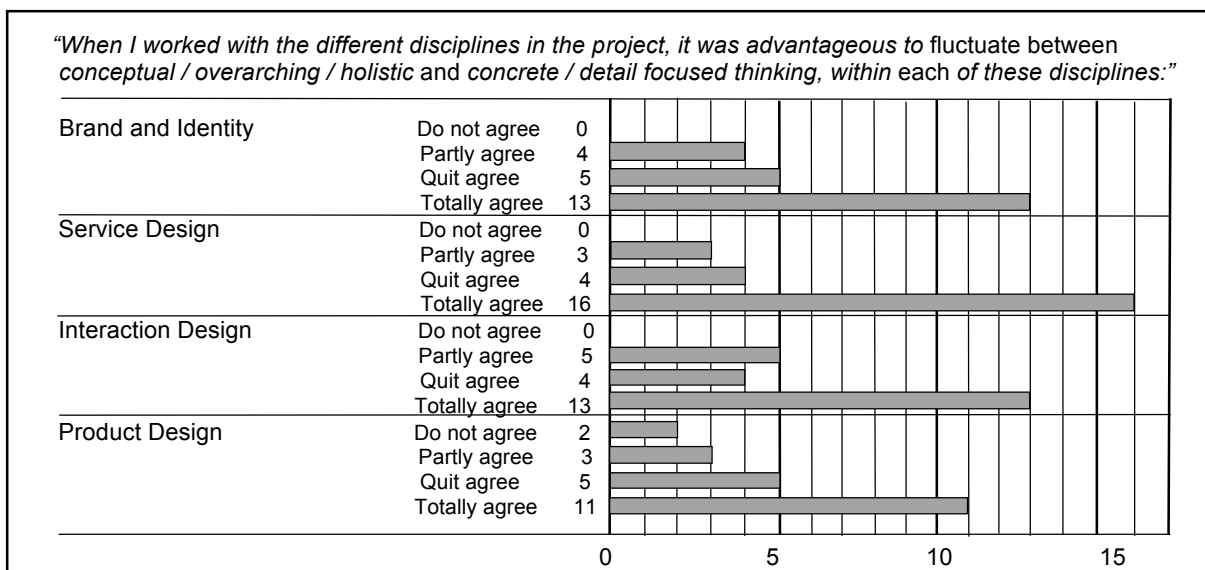


Table 2 indicates that a significant number of students found it advantageous to think conceptually / holistically during all the different disciplines, especially within brand identity and service design.

Table 3. Questionnaire: Mental fluctuation within each discipline



When assessing the effect and the experience from mental fluctuation within each discipline, table 3 indicates that a significant number of students felt that it had been advantageous to fluctuate mentally between conceptual / over-arching / holistic thinking, and concrete /detail focused thinking though the project. Particularly within the brand identity and service design disciplines, this pattern seems clear.

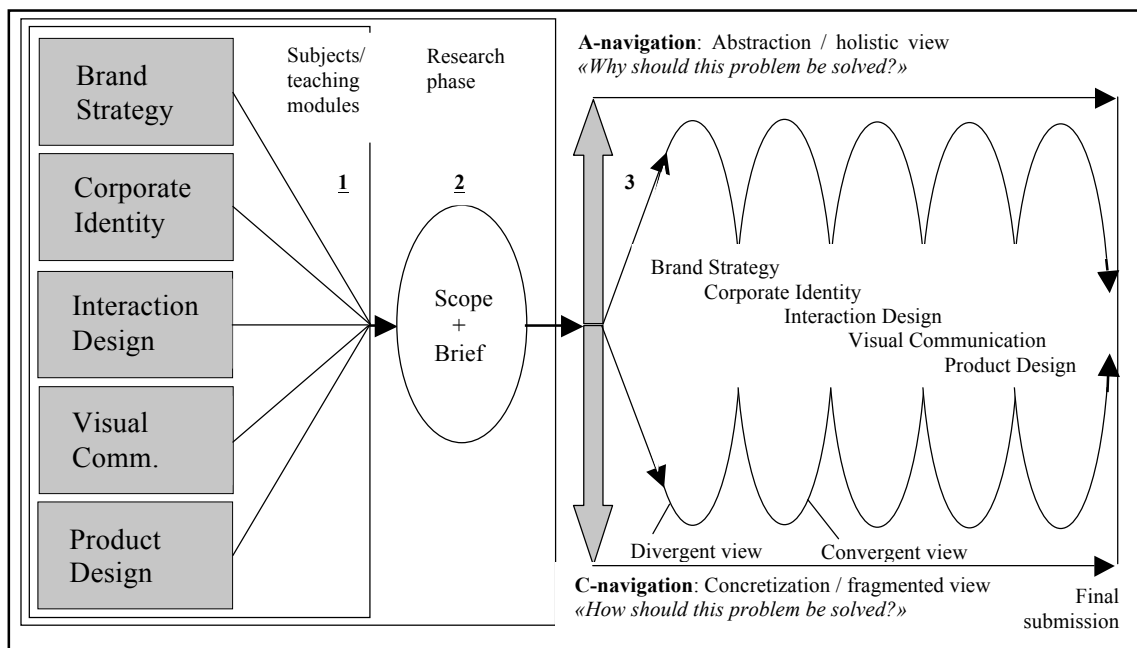


Figure 3. Teaching modules and mental scaling through integrative mode

2.2 Pedagogical structure

Figure 3 describes an overview of the operational structure of the course, where three important stages of the teaching procedure were executed. These stages are described as follows:

- Phase 1 constitutes the initial, plenary lessons aiming at holistic understanding of service design.
- Phase 2 constitutes the research phase, which includes framing the scope and creating design brief.
- Phase 3 constitutes the synthesis phase where each subject is tutored, based on individual needs.

2.3 Mental scaling as catalyst for integrative thinking

While stimulating the students to encounter each of the subject's focus areas through active fluctuation between abstraction and concretization, we encouraged the students to ask themselves: 'Why should this problem be solved?', and 'How should this problem be solved?' By answering the first question, each student was forced into A-navigation towards holistic reflection, or moral / ethical issues, through abstraction. By answering the second question, each student was forced into C-navigation towards concrete problem solving and attention to details through a more fragmented mind-set.

3 CONCLUSION AND REFLECTIONS

In retrospect, this case study has provided valuable insight into how pedagogical strategies of cross-disciplinary teaching has effected the learning outcome. Taking the multitude of diverse disciplinary topics and the inherent complexity of cross-disciplinary instruction as a starting point, this course has been more than average challenging, both for students and educators. In disciplinary courses, careful preparation of teaching and tutoring activities is fundamental key to success. In a cross-disciplinary course like this, the importance of thorough coordination through preparatory sessions seems even more crucial. This course has challenged our ability to establish a common conceptual understanding of the pedagogical aim for the course amongst the educators, as well as our ability to encourage the sufficient holistic and over-arching mind-set amongst the students, in order to grasp the magnitude of service design as professional discipline. One critical consideration has been to prevent disciplinary fragmentation during teaching. The lack of inter-disciplinary competence amongst the educators has influenced our pedagogical strategy, as each educator is trained through their individual professional

practice, making it demanding for each student to build a holistic and cross-disciplinary mind-set. Engaging a diverse group of educators from such a broad range of professional disciplines has established a resourceful learning environment for the students. However, this disciplinary diversity challenges our ability to obtain a coherent flow of information during both teaching and tutoring, since each of the educators seems to hold their own pre-conceptions of what to teach and how to teach their own subject, and aspects of each subject may overlap each other. By appointing an internal teaching coordinator for the educator team in this course, we managed to reduce this dissonance likely to appear from diverging personal expectations. However, as table 1 indicates, a significant number of students found it difficult to extract an overall essence of feedback from the supervisors, caused by their individual fields of competence.

An important challenge has been to enable each student to synthesis individual perspectives from each educator and to merge these across disciplinary conceptions through an integrative mode into a new, constructive whole. While challenging students' willingness and ability to actively commute between 'macro' and 'micro' mindsets, an important task during tutoring sessions was to encourage the students to genuinely involve in the repertoire of relevant service design issues spanning from overarching conceptual considerations to fragmented and detailed problem-solving issues when going through the user journey.

According to Cross, the oscillating process between analysis and synthesis, or divergence and convergence, must converge in the end to produce a concrete solution [8]. In a cross-disciplinary project like this one, this picture seems not so clear, since each subject is partly entangled into the next one, as they often represent overlapping focus areas. However, the concrete deliverables given to the students made structural guidelines for filtering and selecting solutions towards the final submission.

The findings from observations, photo documentation and the written questionnaire, suggest that we succeeded in stimulating the students into a flexible mind-set necessary for synthesizing information through A- and C-navigation, and finally framing possible solutions through careful, convergent selection. The introduction of mental scaling by consistently asking 'why' and 'how', has produced an increased awareness amongst the students of the impact of active fluctuation between holistic, overarching mindset through a holistic view, and concretization through a fragmented view – as this seems to enable the students to handle complex problem issues in a controlled manner. On that note, we acknowledge that the act of mental scaling -given the appropriate pedagogical frame and conscious individual tutoring- seems to be an efficient method in a cross-disciplinary student project where service design constitutes an over-arching focus area.

Practicing mental scaling has made the students aware of the broad specter of ethical issues and moral dilemmas that easily emerge in the holistic, conceptual end of the mental scale, when attempting to contextualize service design concepts. Finally, we acknowledge the need to continually develop cross-disciplinary courses that empower students with the ability to handle transboundary project issues in a cross-disciplinary manner, in order to prepare them for future demands from industry.

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