

DESIGN AS A CATALYST: A PEDAGOGICAL FRAMEWORK

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ABSTRACT

There is an increasing interest in the design and creative thinking process in the Sciences, Technology, Engineering and Mathematics (STEM) and health education disciplines. Many new degree programmes are integrating design thinking into their syllabi. The idea was to bring creative problem-solving culture in these disciplines. The exposure these students get is minimal, and it does not provide enough foundation for them to use the knowledge in a real-life situation. There is an increased awareness for the importance of design thinking in the innovative process and more and more STEM, business and health establishments are embedding trained designers into their research teams. Yet many designers are not equipped to work in interdisciplinary teams. Design students tend to approach problems in a more intuitive and opportunistic manner whereas STEM and health disciplines approaches are often more algorithmic and systematic. In interdisciplinary teams, this often creates tension. In this paper, we share the outcome of a phenomenological study on a high functioning interdisciplinary team working on a health innovation project focused on aging with a disability. The project is used as a case study to illustrate the skill set needed for a designer to make a significant contribution to its overall outcome. Utilising the Belbin team role, we identified key attributes that are essential for a designer to become an effective member in interdisciplinary teams. Based on this study, we propose changes to current design pedagogy framework to better equip design students to work in interdisciplinary teams.

Keywords: Interdisciplinary, team, design thinking, design education, design research

1 INTRODUCTION

There is an increasing awareness that design thinking skills play a catalytic role in innovation outside the design domain. This realisation has resulted in an explosion of educational programmes that integrated design thinking skill in their respective disciplines. This trend is especially evident in the Sciences, Technology, Engineering, and Mathematics (STEM) and health education disciplines [1]. Over the past decade, there has been increasing acknowledgement of encouraging a wider awareness of knowledge while concurrently developing a deeper level of expertise in an area. What is often referred to as a T-Shaped educational model, expertise in one profession and awareness of related professions [2]. This educational model facilitates the incorporation of design and creative thinking skills as part of breadth knowledge and more holistic thinkers. These efforts have resulted in an appreciation of design skills and designers in STEM and health disciplines. However, the attitude and behaviour involved in a problem-solving activity is quite different in both these disciplines. This often results in ineffective and unproductive teams. There is also an awareness that the inclusion of design thinkers in interdisciplinary teams produces much more effective outcomes. In this study this phenomenon is explored using high functioning interdisciplinary team working on a health innovation project focused on aging with a disability, to illustrate the skill set needed for a designer to make a significant contribution in an interdisciplinary team.

1.1 Effective team

This Interdisciplinary Design team originated at the University of Illinois Urbana-Champaign in Champaign, Illinois, to collectively design solutions based on the everyday challenges that older adults with a mobility disability face. To understand these challenges, an archival study was completed which derived from the Aging Concerns and Challenges and Everyday Solution Strategies (ACCESS) study. The ACCESS study is a large-scale interview study that aims to understand what challenges older adults

living with long-term mobility, vision, or hearing disability have and what their specific solutions are for those challenges.

The Design team members in this study came from a mix of Interaction Design, Empathic Design, Human Factors, and Community Health. Research shows that a successful team is often a diverse mix of behaviours. Belbin Team Roles stated that there are two parts to any team: first is the functional role, which is the skill-set a person brings to the team. Second is the team role, which is the behaviour of a team member in terms of contribution to its effectiveness [3]. There are nine roles that can be roughly grouped under three categories: (1) thinking-oriented (Plant, Monitor, Evaluator, and Specialist); (2) action-oriented (Shaper, Implementer, Completer Finishers); and (3) people-oriented (Coordinator, Team worker and Resource Investigator). Each of these roles plays a critical part during a project life cycle [4]. The following is the involvement of team roles at different stages of a project.

Ideation – Plant and Resource Investigator

Evaluation – Monitor Evaluator

Implementation – Implementer

Completion and deployment - Completer Finisher

Designers often play the role of a Plant in interdisciplinary teams. Plants can tackle complex problems innovatively through their creative thinking skills. However, they also tend to get distracted or may pursue an impractical idea. To make the most out of a Plant you need a Co-ordinator who can channel their talents and help keep their ideas aligned with the team’s needs. Plants can take leadership role when supported by a Monitor Evaluator and or an Implementer. Both help keep the Plant rooted. In any team there should not be too many co-ordinators or plants, and they should be involved at the right time of a project life cycle [5].

In the Design team, we have a well-defined co-ordinator, focused monitor, and a Plant. The team is effective because there is minimal overlap in roles, and they are involved only at the right time of the project life cycle. Most importantly, all the members have experience in working in interdisciplinary teams.

2 WHAT IS MISSING IN THE DESIGN EDUCATION?

Design is the driving force of the new economy illustrated in Table 1, which was adapted from ‘*Designing a Future Economy: Developing design skills for productivity and innovation*’ by Design Council (2018). It is well documented that design skills make a significant contribution to innovation in discipline outside of itself. This also implies that designers are working in organizations that are not their traditional destination [6]. What used to be an exception is becoming a norm in the current economy. The changing requirements of the new economy will be expecting different set of skills from future designers, skills that are not part of their current training. This presents some serious challenges to design education to bridge the skill gaps sooner than later.

Table 1. Future demand for design skills [6]

Skill	Importance to Design Economy occupations (Importance Premium)	Predicted future demand
Operations analysis	23%	22
Fine arts	15%	51
Programming	22%	58
Computers and electronics	5%	60
Geography	4%	61
Visualisation	3%	64
Design	40%	68
Engineering and technology	18%	76
Building and construction	9%	82

Traditionally the following characteristics highlight the skills often associated with good designers [7]. These skills are in addition to discipline-specific skills and knowledge, designers are expected to possess the ability to:

- Tolerate ambiguity associated with the interactive process of divergent-convergent thinking.

- Think holistically by switching between micro and macro level thinking.
- Make decisions in uncertain conditions.
- Think as part of a team
- Communicate using the appropriate language of design.

What is missing from this list is the skills and knowledge required to work in fields outside of traditional establishments. This gap is being addressed to an extent by introducing arts and design into technical education programmes. Especially programmes at the high school level where there is a significant amount of work underway [8].

3 STEM TO STEAM

STEM fields are adopting arts and design pedagogy to enhance creative thinking skills in technological disciplines [9]. With the addition of arts and design to the technological disciplines, capital A was introduced into STE'A'M. STEAM curriculum adoption in high schools is increasing drastically, and it is already producing some positive results. One of the most visible outcomes is that there is an increase in awareness of design and importance of it in the technology development process. This trend is resulting in an increasing presence of designers in traditional STEM establishments. Whereas the new breed of the STEAM cohort is adapted to working in interdisciplinary teams, sadly, designers in this cohort are still not adequately equipped to work in these environments.

Designers often in a Plant role with 'work alone' attitude find it hard to get accepted into teams that are not aware of their behaviour or value [5]. Similarly, 'work alone' Plants find it hard to cope with a structured way of doing things. Both are issues that can be resolved through proper training and experience. However, most design curricula are situated in an intensive creative environment that encourages students to adopt individualism and gut-feelings towards problem-solving. Thus, Plants that are emerging from these environments are often not good at communication. This approach, at times (and to non-designers), may appear unrealistic and irrational as we move towards more interdisciplinary solutions. There is already a realisation of these limitations and there are numerous examples of integrated programmes where design and technology students work together [10]. Often the integrated learning environment is still very design specific where technology students get immersion in design programme rather than other way round.

The current culture in industry expects that working in interdisciplinary teams is a given and our students are prepared for the challenges this form of collaborative working expects. Therefore, design curriculum must align with the changing nature of the workforce. In this regard recent experiments on integrated bachelor's degrees are in the right direction but much more needs to be done. Most of these programmes have addressed limitations in cross-disciplinary knowledge (functional role). However, the problem has another facet – attitude (team role). Attitude and resulting behaviour are deciding factors of a person's role in a team.

3.1 Interdisciplinary education

Although we are seeing progressively more awareness in multiple disciplines about design, design education is yet to catch up with preparing their students in return. Figure 1 illustrates the gradual overlap of disciplines that we are seeing in practice. This pattern is not yet reflected in preparing future workforce.

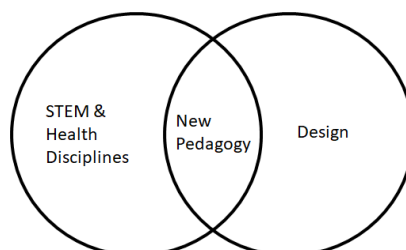


Figure 1. The intersectionality of STEM, health disciplines, and design to create a new interdisciplinary design pedagogy framework for design students

A current challenge in interdisciplinarity in design education is that it is restricted to individual courses and their instructors. Its benefits are largely dependent on students' openness to the idea, their profile, and aptitude to make sense at a macro level [11]. It is imperative that the new curriculum should address this at systemic level to change the complete outlook of the programme. In Figure 2 'T' is traditional

programme path where a student will start at introductory level and with increasing knowledge, skills, and proficiency of problem solving they develop the required attitude for professional success. The ‘B’ in Figure 2 illustrates most current integrated courses which are more concentrated in providing breadth in terms of skills rather than thinking/attitudinal skills. Ideally, ‘I’ in Figure 2, one should have in-depth knowledge of their core area and gain enough thinking/attitudinal skills in breath major.

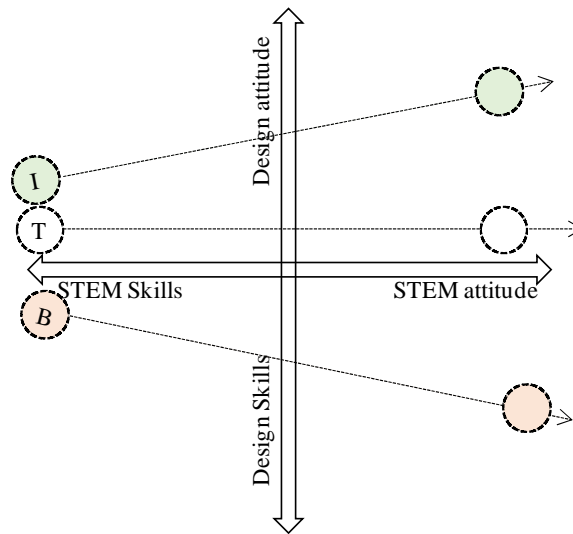


Figure 2. Integrated course structure

3.2 Design pedagogy framework

For a designer, ‘design attitude’ is a defining factor that cannot be negotiated. Design attitude encourages working towards solutions that are "assertion-based rather than evidence-based". Emphasis is more on proposing novel solutions that challenges the status quo [12]. For a researcher, ‘scientific attitude’ on the other hand is more evidence based, objective observation and not concluding anything that is not based on or supported by facts [13]. To work on an interdisciplinary team, students need to be prepared and equipped to switch their thinking approaches based on their team role [14]. The skills required to be flexible in thinking approaches is missing from the current design curriculum. To help acquire these skills, the proposed design pedagogy framework will extend cliched T-skill model by inclusion of development of attitudinal skills as part of their breadth knowledge.

Taking from Edward De Bono’s six thinking hats [14] which encourages to not only think outside the comfort zone but also gain an empathetic point of view. The proposed pedagogical framework encourages students to take courses in-breath discipline in a much more structured fashion, from introductory courses to a level that allowed them to gain an adequate skills and knowledge. Finally leading to capstone projects where they are encouraged to adapt attitudinal thinking expected from breath discipline. Meaning, if a design student is taking a collaborative programming class, they will play the role of a programmer in collaborative project. Similarly, a programming student in a design course will take on the role of a designer.

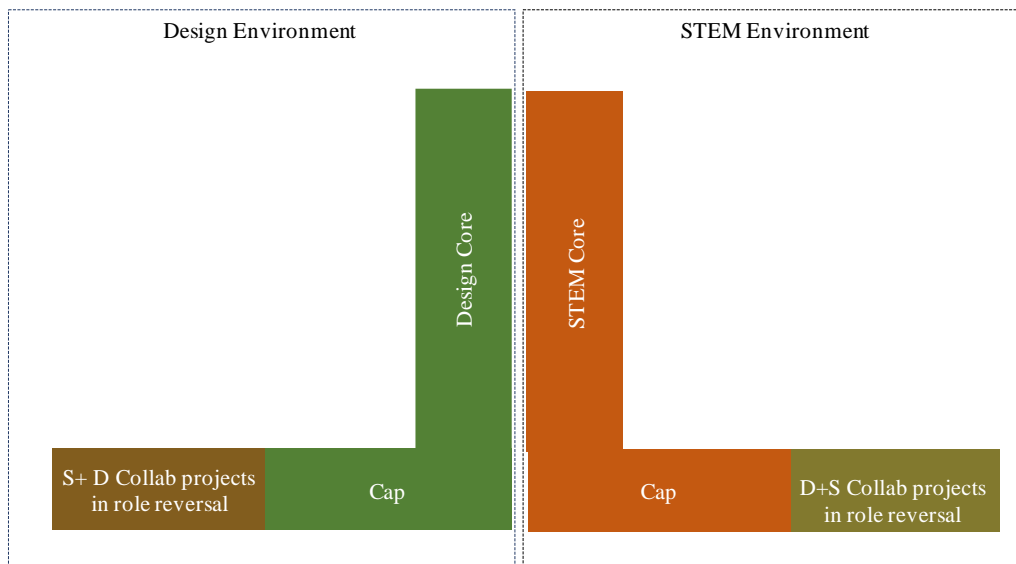


Figure 3. Possible plan for integrated courses

As shown in Fig 3, the overall journey will go through the following milestones:

1. Learning discipline specific skills, approaches and attitude
2. Learning breadth discipline specific skills and problems solving approach
3. Getting core discipline specific skills, knowledge, problem solving approaches and attitude.
4. Learning how to use breadth skills by using breadth specific problem-solving approach and attitude.
5. Collaborative mixed projects to capstone project (cap).

4 DISCUSSION AND CONCLUSION

Acknowledging that interdisciplinary teamwork is becoming the standard in industry as the STEM fields increasingly integrating the designers, this moment becomes a challenge for design education and an opportunity for the design community. It is no longer enough to gain knowledge the traditional way without the ability to be a highly functioning team member.

Designers are often the most equipped to humanise technology by integrating the supra-functional needs that complement the functional needs that scientists, technologists and engineers are trained to focus upon. However, function in interdisciplinary environment with conflicting approaches to problems solving could be challenging. As we have observed during our study the conflicts often are a result of working styles and behaviours. In this regard, Belbin team performance model provided us an insight into how a successful team is built on a balance of team and function roles. Team role is based on human aspects such as attitude and behaviour and functional role is skills that are necessary to fulfil a profession-based task. Most importantly, it showed how these variations can be used constructively in an interdisciplinary team.

Traditional design curriculum is very effective in providing function skills and many recent integrated courses included to breadth subjects to help with functioning in interdisciplinary teams. However, not much focus was given to 'team roles, which are essential to be an effective team member. In this paper we shared a new pedagogical framework to address this aspect.

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