Future of Design Education: Using the DESINNO Project as the Case Study

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Abstract. Challenges and opportunities facing designers have become increasingly more complex. Subsequently, traditional performance-based skills and knowledge were insufficient to tackle these issues. As design practices have evolved and expanded, it is important to train young designers with emerging knowledge and skills. To enlarge the breadth of the curriculums while maintaining the depth of performance-based skillsets of designers, the t-shape approach was recommended as a way forward. The horizontal part of the T signified the breadth of knowledge which expanded beyond traditional design skills, whilst the vertical part suggested that learners should develop the depth of knowledge and skills directly related to their disciplines. This paper focuses on how to add value to the horizontal part by the transfer of best practices. To demonstrated how this could be achieved, the Design and

Innovation Capacity Building in India project will be used as a case study, since it involved the transfer of best practices in terms of curriculum content from three HEIs based in Europe to three Indian HEIs. Hence, this paper will explain the process employed to transfer curriculum content, which includes: 1) background research to gain a better understanding of design in India and emerging design subjects in the global context; 2) course analyses to identify areas for improvement; 3) the benchmarking exercise to find out good practices from HEIs based in Europe; and 4) the proposed new/improved courses for Indian HEIs. The study revealed that collaborations and blended-learning experience are crucial to help designers develop emerging knowledge and skills.

Keywords: Design Education, Capacity Building, Design in India, Indian HEIs.

1 Introduction

Renowned experts in the design field had observed changes in design practices for more than a decade. For example, Sanders and Stappers [1] pointed out that an increase of human-centered design research led to a number of new design disciplines, e.g., service design and interaction design. They also noted that while tradition design disciplines tended to focus on the designing of *"products"* or tangible outputs of the design process (such as visual communication design, interior space design and product design), emerging design disciplines concentrated on designing for a *"purpose"* (e.g., design for emotion, design for interacting and design for sustainability). These emerging design disciplines led to changes in design education, e.g., new design degrees and education programs.

Design education was also affected by emerging challenges. For instance, the World Economic Forum [2] described the current technological developments as the Fourth Industrial Revolution, which was defined as: *"a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres"*. While these technological developments (e.g., artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3D printing, nanotechnology, etc.) disrupted nearly every industry in every country, they offered opportunities to address global issues, such as improving the quality of life for populations around the world (ibid). These challenges and opportunities created new requirements for the design process and design education. Meyer and Norman [3] grouped the challenges facing designers into four categories:

- The first category, ***Performance Challenges***, is directly related to what designers are expected to address, e.g., fulfilling human needs. These challenges can be addressed using traditional performance-based skillsets of designers, e.g., advanced knowledge in terms of materials and manufacturing and computer-based design tools.
- The second category, ***Systemic Challenges***, requires designers to look at the whole system (e.g., an entire manufacturing process), not just a single part. Hence, intangible outputs (e.g., a new system, process and/or service) are expected and some of which may have higher value than a phys-

ical product. In this case, system thinking as well as an ability to work effectively in a multidisciplinary team are required.

- The third category, ***Contextual Challenges***, deals with complex systems. While management and leadership skills are needed as same as the previous category, there is an emphasis on cultural and political acceptance. The co-design approach was recommended as a way to ensure in-depth understanding of the issues and multiple stakeholders' needs.
- The fourth category, ***Global Challenges***, is referred to complex socio-technical systems (see the United Nations' sustainable development goals for examples). Due to the complexity and the involvements of even larger number of stakeholders, the human-centered design approach was suggested as a means to bring all people to collaborate effectively.

In order to work with different stakeholders on complex challenges effectively, recent developments in terms of design approaches/practices tended to encourage open collaboration and conversations. For example, ***Speculative Design*** is one of emerging design practices that was developed based on critical thinking and dialogue. Designers are encouraged to speculate or use their imagination to come up possible future scenarios and alternative solutions [4]. Another example is ***Open Design*** which can be described as the *"internet-enabled collaborative creation of artefacts by a dispersed group of otherwise unrelated individuals."* This practice encourages sharing of knowledge between the professional and amateur designers [5]. The developments of new approaches/practices led to new subjects being added to design curriculums (e.g., ethics).

To enlarge the breadth of the curriculums while maintaining the depth of performance-based skillsets of designers (e.g., creativity), the t-shape approach was recommended as a way forward. The horizontal part of the T signified the breadth of knowledge which expanded beyond traditional design skills, whilst the vertical part suggested that learners should develop the depth of knowledge and skills directly related to their disciplines. According to Hansen and von Oetinge [6], the horizontal value could be created through the transfer of best practices. To demonstrated how this could be achieved, the Design and Innovation Capacity Building in India (DESINNO) project will be used as a case study, since it involved the transfer of best practices in terms of curriculum content from three higher education institutes (HEIs) based in Europe to three Indian HEIs.

2 The DESINNO Project

The DESINNO project was a collaborative project of three HEIs based in Europe (Brunel University London, University of the Aegean and Politecnico di Milano) and three HEIs based in India (World University of Design: WUD, Indraprastha Institute of Information Technology Delhi: IIIT-D, and Regional Institute of Management and Technology University: RIMT). It also involved an industrial partner, crethidev, that provided support in terms of quality assurance. The project aimed at establishing innovation capacities in India through improved design edu-

cation [7]. It intended to enhance quality of educational services and future human resources through the transfer of design curriculum content and good practices from EU countries as well as capability building activities, which included the establishment of three Design & Innovation Centers in universities of India [8]. These centers were expected to lay a common ground for:

- The development of innovative and permanent methods for research and design approaches
- The establishment of cross-sectoral projects for collaboration and co-learning
- The establishment of inter-industry projects to facilitate the inclusion of design thinking approaches
- The development of extreme affordability principles for the benefit of the developing nations while taking care of the accessibility and sustainability aspects of design
- The development of community-based programs enabling designers, craftsmen and artisans
- The modernization and internationalization of Indian HEIs by improving the university design courses that will encompass product and service design by following state of the art methodologies in design thinking, sustainability, design research, social innovation and ethical issues in design.

In this project, a course is defined as a unit of teaching that typically lasts one academic term, while a program is referred to a combination of courses or subjects delivered by HEIs to fulfill requirements for a predetermined qualification.

2.1 Background Research

It was crucial that the transfer of design curriculum content and good practices from EU countries matched the requirements of Indian HEIs. Hence, the project started by conducting a background research to develop a better understanding of design in India, especially contextual factors, such as government policies.

According to the investigation into the historical context of design in India, Indian government created the first policy on Industrial Design in 1957 and *"The India Report"* in 1958 [9]. This report helped set up design directions for India up until its first review in 1977. Following up on the review, the Ahmedabad Declaration was published. The National Design Policy was developed based on this declaration and approved in 2007 [10]. The key areas in the policy included:

- Preparation of a platform for creative design development, design promotion and partnerships across many sectors, states, and regions for integrating design with traditional and technological resources;
- Presentation of Indian designs and innovations on the international arena through strategic integration and cooperation with international design organizations;

- Global positioning and branding of Indian designs and making "Designed in India" a by-word for quality and utility in conjunction with "Made in India" and "Served from India";
- Promotion of Indian design through a well-defined and managed regulatory, promotional and institutional framework;
- Raising Indian design education to global standards of excellence;
- Creation of original Indian designs in products and services drawing upon India's rich craft traditions and cultural heritage;
- Making India a major hub for exports and outsourcing of designs;
- Creative process for achieving a design-enabled innovation economy;
- Enhancing the overall tangible and intangible quality parameters of products and services through design;
- Creation of awareness among manufacturers and service providers, particularly SMEs and cottage industries, about the competitive advantage of original designs;
- Attracting investments, including foreign direct investments, in design services and design related R & D; and
- Involving Industry and professional designers in the collaborative development of the design profession

As the policy clearly demonstrated a strong interest in enhancing quality of Indian design education to global standards of excellence, further research was carried out to identify emerging design subjects in the global context. **Emerging economy** (e.g., digital economy, sharing economy and service economy) was identified as an important issue that should be addressed in Indian design education. Thus, the study recommended that emerging design disciplines, such as **Service Design** and **Digital Design**, should be included in Indian design curriculums. Since the policy also aimed at promoting design at the global level, **Strategic Design** was identified as another subject that should be considered. It was observed that Service Design and Strategic Design were not included in the list of design programs published in the India Design Report [10]. It could be assumed that educational programs specialized in these disciplines were rather rare.

The investigation into the Indian economy showed that the current situation in India was not different from the rest of the world. According to the Confederation of Indian Industry [10], the number of HCI designers was equivalent to 29% of the whole Indian designers. Nevertheless, there were only five postgraduate programs and one undergraduate program that specialized in HCI design (ibid). This suggested that there was a need for more educational programs specialized in HCI design. Another crucial driving force was the rise of the sharing economy, which accelerated the shift from a *'goods-based'* economy towards a *'service-based'* economy [11]. This change was well aligned with sustainable practice, such as dematerialization that explored how material consumption could be reduced by replacing products with services or other forms of innovation (e.g., systems). It was clear that the Indian industries will require designers to be trained in the fields of Service Design as well. The research carried out by Bofylatos and Azariadis

[12] observed a substantial amount of investment in design by the Indian private sector. However, further support in terms of design might be needed in the fields of **social** and **grassroots innovation**.

The Confederation of Indian Industry [10] recommended that **Design Hubs** should be established across the country. The key role was to *"act as a facilitating center that connects, engages and involves people who provide design, people who commission design and people who use design. It will function as a network provider which links and brings together sets of people/agencies that can engage in dialogue and move further. It will engage the public through dissemination of information through exhibitions, talks and events and other suitable mediums."* There was a strong potential to utilize these hubs as a means to support social and grassroots innovation as well as small businesses. Indian HEIs were in a good position to set up these hubs (or, in the case of the DESINNO project, the Design and Innovation Centers), as they had already been offering making provision for their design students. By advancing their current making provision further, Indian HEIs could support grassroots innovators and help them scaling up their innovation to industrial products/services. The support provided by Indian HEIs could also be extended to traditional craft practices. For instances, these hubs could help traditional craft practitioners access to digital fabrication technology.

To sum up, principal recommendations from the background research were:

- Establishment of design hubs in HEIs around the country to bring together grassroots innovators and Industrial designers;
- Investing in the education in fields of digital design as the country becomes more connected;
- Incorporation of design thinking, strategic design and service design in the DNA of Indian companies;
- Integrating traditional craft practices in contemporary design practice;
- Fostering grassroots innovation and scaling up such innovation to industrial products

2.2 Frame of Reference

After key subjects (Service Design, Digital Design and Strategic Design) were identified, the review of current design curriculums offered by WUD, IIIT-D and RIMT was carried out to find out how these emerging subjects could be integrated into existing courses and/or programs. In this case, the UK Professional Standards Framework for Teaching and Supporting Learning in Higher Education 2011 developed by the Higher Education Academy or HEA [13] was used as a framework, since it was well recognized and provided clear guidance on how to support initial and continuing professional development of staff engaged in teaching and supporting learning in HEIs. It comprises three key dimensions as shown in Table 1.

Table 1. Dimensions of the Framework [13]

Areas of Activity (A)	Core Knowledge (K)	Professional Values (V)
A1 Design and plan learning activities and/or programs of study **A2** Teach and/or support learning **A3** Assess and give feedback to learners **A4** Develop effective learning environments and approaches to student support and guidance **A5** Engage in continuing professional development in subjects/disciplines and their pedagogy, incorporating research, scholarship and the evaluation of professional practices	**K1** The subject material **K2** Appropriate methods for teaching, learning and assessing in the subject area and at the level of the academic program **K3** How students learn, both generally and within their subject/ disciplinary area(s) **K4** The use and value of appropriate learning technologies **K5** Methods for evaluating the effectiveness of teaching **K6** The implications of quality assurance and quality enhancement for academic and professional practice with a particular focus on teaching	**V1** Respect individual learners and diverse learning communities **V2** Promote participation in higher education and equality of opportunity for learners **V3** Use evidence-informed approaches and the outcomes from research, scholarship and continuing professional development **V4** Acknowledge the wider context in which higher education operates recognising the implications for professional practice

Based on the background research, the key subjects that should be included in the core knowledge of new/improved courses were:

- **Service Design** including the Service Design process; relevant tools and techniques; related concepts (e.g., Product Service System: PSS)
- **Strategic Design** including Design Thinking; Design management; Design Leadership; related topics (e.g., branding, positioning, strategy, etc.)
- **Social Innovation** including community-led design, grassroots innovation and scaling up strategies, craft-base practices, human-centered design and other related concepts, e.g., extreme affordability principles
- **Emerging practices**, e.g., Human Computer Interaction (HCI), Digital Design, Interaction Design, User Interface Design (UI), User Experience Design (UX) and Behavioral Design
- **Emerging economy** such as service-based (or experience-based) economy, access-based consumption, sharing (or peer-to-peer) economy, and other related concepts, e.g., dematerialization and maker movement

Subsequently, recommended practice in regarding to teaching and learning activities, which were directly linked to professional values were proposed:

- **Problem-based and/or project-based learning (PBL)** was considered suitable for teaching cognitive knowledge, such as strategic design and

social innovation. Moreover, it promoted hands-on investigation of complex real-world problems. The PBL also addressed the majority of professional values. For instance, it respects different ways individuals approach the given problem (V1), encourages active participation (V2) and reinforces evidence-informed approach through research (V3).

- **Stakeholder engagement**: All subjects suggested above required a high level of engagement with various stakeholders (e.g., startups, design-led ventures, SMEs, craft-based businesses, grassroots innovators and communities). Traditional teaching methods (e.g., lectures) might not be as effective as collaborative approaches. More collaboration through industrial projects and/or co-creation activities should be considered. Stakeholders could be brought in to support all areas of teaching and learning activities, e.g., planning (A1), delivery (A2), assessment (A3), as well as support other dimensions (e.g., K2, K3, K6 and V1–V4).
- **Paradigm Shift**: As Sanders and Stappers [1] observed that design practice has moved towards designing for purposes. Subsequently, the way emerging design practice would be taught must reflect this change. The focus should be placed on human-centered design and strategic thinking.
- **Studio-based Learning**: While this practice was quite common among all partner institutes, the Design and Innovation Centers could enhance studio-based learning further. Generally, this practice enabled learners to learn through action and engagement with a community of practice. With new fabrication facilities, the types of action could be expanded further. Wider groups of users (such as startups, design-led ventures, SMEs, craft-based businesses, grassroots innovators and communities) could also help broaden the community of practice.

2.3 Course Analyses and Improvement Suggestions

In higher education a course is a unit of teaching that typically lasts one academic term Analysis of the design educational courses and programs offered at WUD, RIMT and IIIT-D suggested that many key subjects and recommended practices were already covered in their design curriculums (see Table 2 and 3).

Table 2. Mapping recommended subjects against WUD, RIMT and IIIT-D curriculums (1 = no explicit evidence; 2 = this subject was partially covered in existing courses; 3 = this subject was already covered in existing courses)

	WUD			RIMT			IIIT-D		
Key subjects	1	2	3	1	2	3	1	2	3
1. Service Design		✓			✓				✓
2. Strategic Design			✓	✓				✓	
3. Social Innovation		✓		✓			✓		
4. Emerging Practices		✓			✓				✓
5. Emerging Economy		✓		✓			✓		

Table 3. Mapping recommended practice against WUD, RIMT and IIIT-D curriculums (1 = no explicit evidence; 2 = this practice has already been applied in certain courses; 3 = this practice has already been applied in most design courses)

	WUD			RIMT			IIIT-D		
Key subjects	1	2	3	1	2	3	1	2	3
1. Problem-based Learning			✓			✓			✓
2. Stakeholder engagement		✓			✓			✓	
3. Designing for purposes		✓			✓			✓	
4. Studio-based Learning		✓			✓			✓	

Nevertheless, the delivery of these subjects and practices could be developed further. As a result, recommendations for each institute were proposed:

- **WUD:** There were opportunities to introduce emerging subjects (such as Service Design and Social Innovation) as a stand-alone course and/or integrate their principles into existing courses, especially project-based courses. While some subjects (e.g., Digital Design) could be introduced as an elective course in a short term, it might be more beneficial to create a distinctive pathway/program for this design discipline in a long term. In addition, existing project-based courses could be enhanced further by 1) taking a full advantage of the new Design and Innovation Center and 2) making a clearer link between design projects and related areas, e.g., Strategic Design. It would also be useful to explore how to engage with different stakeholders further and consider introducing 'entrepreneurship' in existing courses. At the end of the reviewing process, WUD expressed interest in developing a stand-alone **Service Design** course. The curriculum development process of this course will be explained in section 2.3.
- **RIMT:** There were many courses that include Service Design aspects. Since the topic was delivered in conjunction with other design subjects, there were concerns that students might not see a big picture of Service Design. Thus, it was recommended that the institute should ensure that a broader concept of Service Design was delivered to the students. Some elements of Strategic Design and other related topics (e.g., Social Innovation and Emerging Economy) were partially covered. However, they could be expanded further. For example, the institute may consider introducing Social Innovation as an elective course and/or integrate this subject into existing courses that covered contextual studies. Topics, such as Emerging Economy, would not be required to introduce as a course, but would be useful to be incorporated in design briefs. While Digital Design might not be directly applicable to the current degrees offered by RIMT, Interaction Design might be beneficial to students. There were opportunities to expand this type of knowledge further, as well as incorporate some useful tools and techniques in studio-based courses. Furthermore, the Studio-based courses could be enhanced further by engaging external stakeholders, and incorporating new knowledge, e.g., Strategic Design

and Systems Thinking. At the end of the reviewing process, RIMT expressed interest in integrating Strategic Design into their existing Product Design program. Thus, an **Integrated Product Design** course was developed – the process can be seen in section 2.3.

- **IIIT-D:** It was observed that there were many courses that include Service Design aspects. Since IIIT-D had strong Digital Design and Interaction Design expertise, it could consider develop a Digital Service Design course or pathway. This could help the institute leverage their unique knowledge and skills and differentiate themselves from other universities. Strategic Design, Social Innovation and Emerging Economy were partially covered. Thus, the institute could consider developing the knowledge and skills further through various teaching and learning activities, e.g., guest lectures and seminars. They could also be incorporated into many existing courses which cover contextual studies. As IIIT-D had expertise in Digital Design, UX, UI and Interaction Design. It could consider developing the Design and Innovation Center that specializes in this subject area. It could provide support to external organizations (e.g., grassroots innovators) on this type of design. By leveraging this expertise strategically, it could help IIT-D with wider engagement and more industrial collaborations. At the end of the reviewing process, IIIT-D expressed interest in enhancing their **HCI** course further. The development process can be seen in section 2.3.

The review suggested that all Indian HEIs in this project should take a full advantage of the new Design and Innovation Center. The centers should be seen as an integral part of their studio-based courses.

Firstly, the center could be used to support students' projects from the beginning to the end of the design process. They could use the Institute of Making established by University College London (UCL) as an example. The Institute of Making provided a workshop where staff and students from various disciplines (e.g., design, technology, history, art and engineering) can create artefacts using both advanced and traditional tools and materials. It also had the Materials Library, which enabled users to see, touch, research and have conversations about these materials. Access to materials and means of making is vital for the designing, prototyping and testing phases where design students experiment and refine their ideas. The workshop facilities could also support the final stage of the design process, which focuses on production and realization.

Secondly, these centers should play a key role in engaging with external stakeholders. This could be achieved through several ways, e.g., offering membership or issuing day passes to those wishing to use the resources. These external stakeholders could also be invited to attend a number of activities, such as workshop training and making classes. Using similar centers as examples, some of them offer advanced making courses, where professional designers/makers register to upskill their existing knowledge. Others provide training for high-school students who were interested in STEM subjects (see Fablab O, Tongji University, China

for an example). These engagement activities created opportunities for staff and students to network with businesses, entrepreneurs and the general public, which could lead to collaborative research projects for staff and industrial design projects for students. The centers could consider joining the international network(s) to enhance mobility of staff and students. In this way, they could exchange knowledge and ideas with external stakeholders from other countries. Enabling students to engage with external stakeholders through various activities could help them to build up useful contacts.

In addition, these centers should enable Indian HEIs to incorporate new knowledge by simulating real-life experience of professional design studios in university learning environments. This means providing business content (such as business strategy and design management), which could be done through collaborative projects with businesses. By asking students to go beyond designing a solution, but exploring how this proposed idea could fit in the business context of the company, students will be encouraged to engage with subjects, such as Strategic Design and System Design. The new content could be provided in a problem-based learning environment (e.g., getting the students to analyses a chosen brand) rather than a traditional lecture format. It was envisaged that the center could help simulate the real-life experience of professional design studios by bringing in clients as well as deliver new knowledge through a problem-based learning practice.

2.3 Transfer of Curriculum Content

In the next stage, the programs identified as representing best-practice in the fields of Integrated Product Design, Service Design, and Digital Design were analyzed to provide a benchmark for the new and/or improved courses at Indian HEIs.

The educational programs identified as representing good practice in the Service Design field were: MA Service Design, The Royal College of Art (RCA), MDes Design Innovation & Service Design, The Glasgow School of Art, and MA Service Design, University of the Arts London (UAL). Based on the analyses, all programs were strong in terms of **collaborations**. For example, the Service Design program at RCA is a collaboration between two HEIs and, hence, it combines the RCA's design practice with innovation in digital technologies from the Department of Computing at Imperial College and business management disciplines from the Business School at Imperial. In the case of Design Innovation & Service Design, the Glasgow School of Art provided an intensive workshop in collaboration with partner institutions, such as Audencia University and Koln International School of Design. The UAL also introduces students to multidisciplinary teams via larger system-level projects. All programs provide **blended-learning experience** through combinations of lectures, workshops, seminars, guest lectures, tutorials, master-classes and/or self-directed design projects. It was noted that taught subjects go beyond areas directly related to Service Design and cover **other relevant fields** (e.g., Entrepreneurship, Research Methods, Design Management and Social Innovation) – see Table 4 below. As a result, **various forms of assessments**

were carried out including group and individual projects, essays, research proposals, written reflections and portfolios. All programs also make good use of their **studio environments** and the universities' **technical resources** as well as other facilities.

The programs identified as representing good practice in the Product Design field were: BSc Product Design & Technology, Loughborough University, MEng Design Engineering, Imperial College, MA Collaborative and Industrial Design, Aalto University. The analyses yielded similar results as the previous one. Firstly, all programs were strong in terms of **collaborations**. For example, Loughborough University offers a wide range of companies for work placements as well as provides offers an opportunity to study abroad via the Erasmus+ Exchange Program. In the case of Imperial College, students can choose to take elective courses run by other Engineering programs at the College. Similarly, students at Aalto University were permitted to take minor studies or individual courses from other programs within the university, or from other Finnish institutions. In addition, some programs were also accredited by trade bodies, e.g., the Institute of Engineering Designers, the Institution of Engineering and Technology, and the Institution of Mechanical Engineers. Secondly, all programs provide **blended-learning experience** through combinations of lectures, workshops, seminars, guest lectures, tutorials, laboratory work, practical sessions and design projects. As same as the results of the previous analysis, taught subjects go beyond areas directly related to Product Design and cover **other relevant fields** (e.g., Entrepreneurship, Design Psychology and Engineering subjects) – see Table 4 below. Subsequently, **various forms of assessments** were carried out including group and individual projects, workshop/lab logbooks, sketchbooks, development portfolios, physical and digital prototypes, presentation boards and verbal presentations, research and design reports, and written exams. Their **studio environments** and **technical resources** were well utilized.

To enhance IIIT-D's HCI Design course further, the benchmark exercise tried to cover various educational programs relevant to HCI. The programs chosen for this analysis were: MSc Human Computer Interaction, University College London (UCL), MSc Human-Computer Interaction Design, City, University of London, BA User Experience Design, University of the Arts London (UAL). The analysis revealed that external **collaborations**, such as opportunities for internships/placements, and connections with industry were important components for all programs. As same as the previous ones, all programs provide **blended-learning experience** through combinations of lectures, supervised tutorials, interactive exercises, and design projects. Taught subjects go beyond areas directly related to HCI Design and cover **other relevant fields** (e.g., Inclusive Design, Assistive Technologies, and Game Design) – see Table 4 below. Some programs offer students the opportunity to explore emerging technologies, e.g., extended reality (XR), wearable technology, and AI within a design context. Thus, **various forms of assessments** were carried out including group and individual projects, digital

design portfolio, written reports and exhibitions. Their **studio environments** and **technical resources** were also well utilized.

Table 4. Blended Learning Strategies for all new/improved courses

Courses	Content	Taught subjects
Service Design	Key theories	Service design principles, service design methodologies, etc.
	Design research tools	Human-centered design tools
	Design tools	Service design tools, e.g., persona, scenario, user journey, etc.
	Prototyping & strategic planning tools	Service blueprint, roleplay, business model canvas, etc.
	Other relevant subjects	Social Innovation, design management, entrepreneurship
Integrated Product Design	Key theories	Design thinking, strategic design management, branding, etc.
	Design research tools	Established tools and emerging ones, e.g., Design Fiction
	Design tools	Ideation and visualizing tools
	Prototyping & strategic planning tools	Design for manufacture (DfM), brand positioning, etc.
	Other relevant subjects	Entrepreneurship, design engineering, design psychology
HCI Design	Key theories	UCD principles, user experience, design thinking, history of HCI
	Design research tools	HCI research tools, e.g., heuristic evaluation, PACT framework
	Design tools	Participatory design tools
	Prototyping & strategic planning tools	Storyboard, information architecture, wireframes, etc.
	Other relevant subjects	Social innovation, inclusive design, assistive technologies

While most programs chosen as good examples were based in the UK, the research team also took good practices from other countries into consideration, especially the programs provided by EU partners in the DESINNO project, e.g., Service Design courses and programs offered by Politecnico di Milano and HCI programs and courses provided by University of the Aegean. It can be seen that all programs share common features: having strong links with external parties, offering blended learning experience, going beyond key subject areas and covering other relevant topics, using various forms of assessments and making a good use of their studio environments, technical resources as well as other facilities. Employing various forms of assessments (e.g., written reports, verbal presentation

and portfolio) helped ensure inclusive learning. As individual students excel at different things, different forms of assessments enable all students to demonstrate their strengths.

2.4 Proposed New/Improved Courses

Despite aiming to develop different knowledge and skills, all new and improved courses share common features – as shown below.

- Focus on critical and advanced understanding
- Deliver a blended learning experience (see Table 5) with emphasis on studio-based practical activities, which is one of good practices identified through benchmarking exercise
- Encourage research-informed design practice with strong focus on human-centered design research to ensure the in-depth understanding of all key stakeholders;
- Embed strategic thinking and business management content into the course to ensure that the students appreciate strategic roles of service design in an organization (both for-profit and not-for-profit).

New and improved courses place an emphasis on studio-based practical activities and problem-based learning. Hence, all lectures will be followed by labs/workshops/tutorials. In this way, the students will have opportunities to practice what they have learned in classed while the knowledge is still fresh in their minds. Most courses run for 8 – 13 weeks. Lectures begin with the introduction of key theories, followed by the human-centered design research. Relevant tools and techniques will be introduced. All courses end with prototype and test in order to make a good use of the new Design and Innovation Centers. The business management topics, such as costing and business model development, were also included toward the end of the courses.

A range of assessment methods were suggested as follows:

- **Formative assessment** – During the lab sessions, students will be given a task that is related to the summative assessment. They will receive formative feedback on a weekly basis. They were expected to revise their work according to the feedback before handing in the final submission.
- **Summative assessment** – It is recommended that both group and individual assessments are included, as this will allow students to develop other important soft skills, e.g., teamworking and leadership.
- **Group Assignment** – Students could be put together in teams to work on a brief (which could be set by a course coordinator or an external partner from the industries). The students were expected to work collaboratively during the research stage, namely creating a research plan, designing research instruments, collecting data and analyzing data to extract key insights. The groups were expected to present their results (verbally or in a written report) as a team at the end of the research phase.

- **Individual Assignment** – Each student is expected to carry out their own design work individually based on the research results gathered by their team. Supervised tutorials and peer reviews will be organized on a weekly basis to support the design development.

Table 5. Blended Learning Strategies for all new/improved courses

		Teaching & Learning		Assessment	
Courses	Content	Lecture	Lab/Studio	Group	Individual
Service Design	Key theories	✓	✓		
	Design research	✓	✓	✓	
	Relevant design tools	✓	✓		✓
	Prototyping & strategic planning	✓	✓		✓
Integrated Product Design	Key theories	✓	✓		
	Design research	✓	✓	✓	
	Relevant design tools	✓	✓		✓
	Prototyping & strategic planning	✓	✓		✓
HCI Design	Key theories	✓	✓		
	Design research	✓	✓	✓	
	Relevant design tools	✓	✓		✓
	Prototyping & strategic planning	✓	✓		✓

A robust system of evaluation was put in place for these new/improved courses. After drawing up the initial course outlines, they were reviewed by corresponding staff at each Indian institute. After they approved the course outlines, the tutor guidance was developed accordingly. The course outlines and the tutor guidance were shared with all partners within the DESINNO project for further comments and suggestions. All proposed courses were peer-reviewed and successfully implemented at WUD, RIMT and IIIT-D. These courses are expected to be regularly reviewed and updated as part of the annual procedure of each Indian university.

3 Discussion & Conclusion

It can be seen that design education has to adapt to reflect emerging challenges and opportunities. The changes require HEIs to include new subject areas into their design curriculums. This paper explored one effective way of enhancing the breadth of curriculums by the transfer of best practices.

It is important to emphasize that the transfer could not be achieved without a good understanding of contextual factors. Hence, in the DESINNO project, a comprehensive investigation was carried out to develop an understanding of design in India and key requirements from the national and industrial perspectives.

Further research was also conducted to identify emerging design subjects in the global context. Prior to introducing any new content to the curriculums, existing programs and courses should be critically analyzed to find out their inherent strengths and areas for improvements. Rather than directly transferring the content, it is crucial to find key strengths of programs/courses identified as representing best-practice. According to the analyses, key factors included: strong external collaborations, blended learning experience, variety of assessment strategies, wide range of taught subjects, and effective utilization of studio environments and other facilities. In this way, the new/improved courses could maintain inherent strengths and incorporate good practices in the way that match their capabilities.

Despite taking existing course and program structures of Indian HEIs into consideration when developing these new and improved courses, there were still some challenges in implementing them. According to RIMT, it was not easy to embed improved contents with existing contents as well as align European credit systems with Indian credit systems while addressing Indian education policies/guidelines (e.g., New Education Policy: NEP 2020) given by regularity authorities, such as Ministry of Education: MoE, University Grants Commission, and All India Council for Technical Education: AICTE). Moreover, matching new contents with the curriculum of the competitive examinations in India (e.g., Graduate Aptitude Test in Engineering: GATE) was also considered challenging. This issue was mitigated through integration of new contents with Minor and Major Project based courses. In addition, it was difficult to train lecturers on skills and expertise related to design and innovation education through a multidisciplinary approach based on the Capacity Building Sessions delivered by the DESINNO project (e.g., blended learning, flipped classroom, project-based and problem-based learning, team-based learning, and experiential learning) since some of which were delivered with support of emerging technologies (e.g., Learning Activity Management System: LAMS). Challenges also arisen from an increase of industry interactions, which was arranged to enhance students' knowledge and understanding about different stakeholders, which is essential to the design and innovation process.

Since the institute already has expertise in HCI, IIIT-D did not have major challenges in implementing the improved course. WUD also did not experience major challenges. As the new course aimed to provide a blended-learning experience through combinations of lectures, workshops, seminars, guest lectures, tutorials, master-classes and/or self-directed design projects, as well as cover other relevant fields (such as Entrepreneurship, Research Methods, Design Management and Social Innovation), the challenge was to secure required resources to cover all aspects of teaching and learning in a short period of time. This challenge was addressed by pooling resources within the university (e.g., from School of Business).

As design education continues to evolve to address national and global needs as well as utilize emerging developments (e.g., Artificial Intelligence: AI and digital fabrication), an approach introduced in this paper could be adapted to support ongoing curriculum review and continuing professional development for staff engaged in teaching and supporting learning in HEIs. Firstly, it could be used to

identify new/emerging areas that should be incorporated in core knowledge and explore how they could be integrated into existing curriculums, courses and/or programs. Secondly, it could be applied to help HEIs stay at the forefront of professional practices in terms of teaching and learning strategies. In addition, it could be employed to help HEIs learn from each other in a collaborative manner. The main limitation of this study was that the analyses were conducted based on the review of course outlines and program specifications. Practical elements (e.g., teaching styles and learning environments) were not included in this exercise. In the future research, it would be useful to explore all aspects in greater detail.

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