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PEDAGOGICAL IMPLICATIONS OF SERVICE DESIGN FOR INDUSTRIAL DESIGN EDUCATION: CURRENT CLAIMS AND FUTURE DIRECTIONS

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ABSTRACT
With the service sector's dominance in the world economy, we have witnessed the development of service design as an emerging field. Not only do design programmes offer courses on service design, but there are universities offering undergraduate and graduate programmes specific to this field. However, the professional development of service design and its alignment with other design disciplines is still in progress. With this perspective, we aim to take a snapshot of current service design offerings at the university level to discuss their impact on the future of industrial design education. We systematically analysed the courses and programmes of the first 50 design universities with design schools listed on QS World University Rankings by Subject 2022: Art & Design. There are 19 universities offering a total of 82 courses and 12 programmes related to service design. Service design courses and programmes are more common at the graduate level. The analysis of service design course descriptions shows that the skillset and knowledgebase identified by these programmes are not highly unique. Their pedagogical goals are aligned with delivering human-centred design, design research, design thinking, and design strategy content central to industrial design education. Further integration of service design in industrial design programmes might mean a decrease in the high-fidelity model-making capabilities of industrial design graduates and an increase in visualisation skills for the communication of systems. Every industrial design programme must assess and align service design based on existing course offerings with averting redundancies in a competitive resource environment.

Keywords: Service design, industrial design, design pedagogy, curriculum

1 INTRODUCTION
Today's economy has been increasingly defined by services rather than the other two economic sectors, industry and agriculture. In 2021, the service sector contributed 76.74% to the US's gross domestic product (GDP) and 65% to the EU's [9]. While the service sector is not new, its expansion to e-services increased its significance compared to other sectors in the digital era. This reality and the competition around better service offerings have impacted organisations' service approaches. For-profit and non-profit enterprises have been investing in the design of services to better serve the user/customer, business, and society [2]. This sectoral need led to the development of service design as a field and increased the number of jobs requiring service design expertise [8]. These positions are filled by designers from diverse backgrounds, including industrial designers [2].
The increasing service design job market for industrial designers has also initiated a transformation in industrial design education. Some design schools have restructured existing design programmes to offer service design courses, while others have launched programmes specific to service design. The professional development of service design and its educational alignment with other design disciplines have been discussed for some time. Sleeswijk Visser and Stappers [5] discussed how the similarities between the "mindset, methods, and tools" of industrial design and service design helped the Delft University of Technology to incorporate service design courses into the industrial design engineering curriculum rather than offering service design as a separate area of study. On the contrary, two universities, one in Europe (Laurea University of Applied Sciences) and one in the US (Savannah College of Art and Design), started master's programmes in service design as early in 2009 [2] as an expression of the unique expertise requirements for service designers.

Regardless of being integrated into existing design programmes or being offered as stand-alone programmes, the pedagogical developments in service design can be interpreted as the need to deliver a unique knowledgebase and skillset for service design to prepare graduates for sectoral needs better. In the service-dominant logic, services are co-produced between users (customers) and service providers [7]. Designers need to consider how an experience around a service evolves over time and space to fully capture the interactions around multiple stakeholders and various digital and physical touchpoints [3]. At the same time, they need to consider the societal and environmental impact of their service design decisions for the global wellbeing [1,4]. Such plurality and complexity warrant a system-level approach. This brings the efficient and effective communication of systems, especially in cross-disciplinary teams, as a major concern in service design. In contemporary service design practice, communication tools such as visualisation techniques and prototyping are central to the service design process [6].
The systems mindset, methods, and tools in service design practice are familiar to the ones applied in the industrial design discipline [5]. This brings a question about integrating service design content into the industrial design curriculum. For service design to flourish sustainably within the higher education ecosystem, it is essential to understand the current state of the pedagogical offerings. Our paper provides an important first step to filling this knowledge gap by providing a snapshot of the service design offerings in higher education.

2 METHOD

To sketch the current state of service design education, we systematically analysed existing courses and programmes specific to service design offered by design schools worldwide. To do so, we consulted QS World University Rankings [10], a highly reliable international university ranking. We explored the service design courses and programmes offered by the first 50 universities' design programmes listed on QS World University Rankings by "Subject 2022: Art & Design."
We followed two strategies to extract the service design courses and programmes. First, we conducted a keyword search with the term *service design* (without quotation marks) on the official website of each university. We searched for information on courses or programmes in the results. We also explored the websites specific to each university's design schools and analysed the curriculums of the programmes offered in these schools to define courses. Second, we conducted keyword searches on google with the university name in quotation marks followed by *service + design* as well as the university name in quotation marks followed by the following terms: modules, curriculum, schedule, "course catalogue," "courses offered," "course offerings," "course list," "classes offered," and "class offerings." This second search strategy allowed us to access course catalogues for the universities that share them publicly. In these course catalogues, we searched for the courses with the term *service* in the course title. We specifically did not search with "service design" as our initial trials showed that there are service design courses that do not use this term in their title but use service alone.
We limited our search to schools of design and undergraduate and graduate programmes, but not masterclasses, online short courses, MOOC courses, or certificates. We only searched for the most current course catalogues available; we did not do a retrospective search (which was also not a feasible approach). We did not include the courses and programmes from other schools, such as business (e.g., Aalto University Master of Business Administration in Service Design) and architecture (e.g., Building Services course offered by Pratt Institute), as our primary focus is the implications of service design on industrial design curriculum. On the other hand, we included all courses in design schools where industrial design programmes are a part, as industrial design students have a higher chance of taking these courses as electives.
We collected data on the university name, school/college, department/programme, course name, instruction level (undergraduate, graduate), course description, and country information for the courses along with data on the university name, school/college, programme name, overview/description, programme type (undergraduate, graduate), degree granted, total credits, and country information for the programmes. Course descriptions and programme overviews/descriptions were analysed using the R statistical computing language. We implemented topic models using LDA (Latent Dirichlet Allocation) algorithm to cluster the courses according to topics and cosine similarity measures to examine the extent of similarity between course descriptions. We only report quantitative results for course descriptions because of space limitations, noting that programme descriptions show a similar trend.

We do not claim that our dataset is comprehensive enough to depict the whole reality around service design education. For example, we are aware of other programmes (e.g., the Service Design Strategies and Innovations (SDSI) programme that is a joint effort of the University of Lapland, Art Academy of Latvia, and Estonian Academy of Arts) that did not make it into our dataset because of the universities not being in the first 50 of QS ranking. We limited our analysis to the first 50 universities on QS ranking as we aimed to get a snapshot of the phenomenon to have an informed discussion on the impact of service design on industrial design education.

3 FINDINGS

Out of 50 universities, 28 were not offering any courses or programmes specific to service design during our study. We also had three other universities (Central Academy of Fine Arts (CAFA), Universidad Nacional Autónoma de México (UNAM), and Tongji University) for which either the official website was not working, or there was no English course and programme descriptions available.

3.1 Dataset overview

In our dataset, there are 19 universities offering a total of 82 courses and 12 programmes related to service design. Savannah College of Art and Design is the university with the highest number of courses (N=18) related to service design. This can be expected as it is also the university with the highest number of programmes in service design (one undergraduate and two graduate programmes).

There are seven universities offering programmes in service design. Service design programmes are more common at the graduate level (Table 1) than undergraduate level, and the UK is the country with the most service design graduate programmes in our dataset.

Table 1. Distribution of programmes across education levels and countries

Level	Country	# of Programmes	Total
Undergraduate	Hong Kong	1	3
	UK	1	
	USA	1	
Graduate	Hong Kong	1	9
	Italy	1	
	UK	5	
	USA	2	

On course level (Table 2), 52 courses are graduate courses, whereas there are 20 undergraduate courses. Ten courses are listed both at the undergraduate and graduate levels. The USA has the largest representation in the dataset, as 34 courses are from this country.

Table 2. Distribution of courses across education levels and countries

Level	Country	# of Courses	Total
Undergraduate	Australia	1	20
	Finland	4	
	Hong Kong	1	
	Netherlands	2	
	Switzerland	1	
	UK	1	
	USA	10	
Undergraduate and Graduate	USA	10	10
Graduate	Australia	9	52
	Finland	4	
	Hong Kong	6	
	Italy	6	
	Japan	2	
	Netherlands	2	
	Sweden	1	
	UK	8	
	USA	14	

Within our dataset, while 34 of the courses are offered by programmes specific to service design, 49 are offered by existing programmes (e.g., industrial design, interaction design, design strategy) at schools of design. This indicates the trend towards integrating service design into existing design curriculums.

3.2 Analysis of course descriptions

Of 82 courses in our dataset, 12 did not have course descriptions. For the remaining 70 course descriptions, Table 3 shows the frequency of tokenized words (features) used 15 times or more.

Table 3. Frequency of words that appear 15 times or more in course descriptions

Word	N	Word	N	Word	N
method	36	social	26	explore	20
develop	34	understand	26	context	19
system	33	research	25	complex	18
product	33	concept	24	solutions	17
experience	32	model	24	use	17
process	32	people	24	value	17
interaction	32	innovation	23	designers	17
tools	30	approach	23	innovative	16
business	29	sustainable	23	create	16
practice	28	user	21	technology	15

In course descriptions, the communication and analysis of services as "systems" and the complexity of the systems thinking approach are highlighted more frequently than other aspects of service design. This systems approach comes from the "sense making of complexity and organisational and networked relationships" (Aalto University, Designing for Services course). The emphasis on the systems is also followed by a reference to "interaction" to indicate a difference between service and system. Services are theorised as systems that involve user interaction. Therefore, it is not surprising to see a focus on human-centeredness in service design course descriptions with references to "experience," "user," and "people." However, the service design course descriptions also emphasise how they differ from any other design field, for which human-centeredness is paramount, by combining human-centeredness with other aspects, most importantly, with "business" and "social." The significance of "social" in service design is also represented by the words "public" (N=13) and "society" (N=8) in course descriptions.

The analysis of word frequencies also conveys the attention given to service design practice by the introduction of "methods" and "tools" in courses. Another important aspect to highlight is that the course descriptions do not only name specific methods (e.g., visualisation, co-creation) and tools (e.g., blueprint) to utilise in the process, but some also describe "design," "design thinking," and "design process" as tools to handle the complexity of services. The programme description of the Glasgow School of Art's Design Innovation and Service Design is an example of this: "At The Innovation School, Service Design is taught as a means of applying design processes to complex problems, combining artifacts and interactions to produce services that exist, unfold and evolve in both space and time."

The qualitative analysis of course descriptions also indicates that the courses aim to differentiate between being digital or physical oriented. Some courses try to combine both. These differences are partly because of the programmes that are offering the courses. While courses in communication design address the significance of digital interactions for services as touchpoints, course descriptions from industrial design programmes also add products as the main point of interaction.

One last point to highlight is the focus on the collaborative nature of service design. Course descriptions specifically address two types of collaborations. One is the value of cross-disciplinary collaboration and teamwork. The other is the utilisation of co-creation and co-design with service providers and users in the service design process.

The topic models in Table 4 show the patterns and relationships in course descriptions. Topic 1 is about the value of service design and what it brings to the table by emphasising how it differentiates from business-oriented service development. Topic 2 illustrates the content of the courses and what they deliver. Topic 3 is mostly about what is designed, especially with a human-centred approach to services. Lastly, topic 4 exemplifies the focus of service design and how this focus is different from other design practices.

Table 4. LDA topic models of course descriptions

Topic 1	Topic 2	Topic 3	Topic 4
people	methods	interaction	business
system	develop	product	model
opportunities	experience	user	sustainable
practice	process	different	system
use	social	technology	product
create	research	making	value
communicate	concept	creation	explore
explore	tools	people	challenges
interaction	understand	digital	stakeholders
ideas	innovation	first	strategic

As a last step, we also analysed how the courses are clustered. Figure 1 shows that the courses are grouped into four based on their descriptions. Two course descriptions from Chiba University (only the same, one sentence in both courses), one from the University of Technology Sydney, one from the University of the Arts London and one from Loughborough University were outliers and were taken out. The course descriptions with pink mainly address the relationships (e.g., among people, things) and inclusiveness (e.g., all stakeholders) that must be considered in service design. In this sense, these courses emphasise how the designers' focus should shift from singular (e.g., product, end-user) to plural (e.g., interactions, systems) during design. The common aspects of the course descriptions in orange have the objective of communicating and teaching human-centred methods and tools that are important for service design practice. The courses in purple highlight the service design process and communication with visualisation and storytelling. The last cluster in blue groups courses that describe services' complexity and system attributes. They bring the business and management aspects; assess and measure future service solutions. It is also important to note that the courses on product-service systems do not cluster in a different group. This might be interpreted as an overlap between service design and product-service systems course contents.

Figure 1. Course clusters based on their descriptions

4 IMPLICATIONS OF SERVICE DESIGN FOR INDUSTRIAL DESIGN EDUCATION

Given the significance of the service sector in today's economy, we expected to see a more comprehensive implementation of service design in higher education. Out of 50 universities, there were only 19 universities offering service design courses and/or programmes. This can be interpreted as a lack of understanding of the importance of service design in many universities and design programmes. Design schools are slow in addressing sectoral needs.

Service design courses and programmes are more common at the graduate than undergraduate level. However, more undergraduates have also been hired as service designers [2]. This can also be interpreted as a need to further implement service design competencies and skillsets at the undergraduate level.

The analysis of service design course descriptions demonstrates two main issues. First, some core offerings highlighted in service design course descriptions, such as human-centeredness, co-creation, and systems thinking, are not new to industrial design. These core offerings mostly overlap with the pedagogical goals of delivering human-centred design, design research, design thinking, and design strategy content in industrial design education. On the other hand, courses on service design also indicate a transformation in design education in general and industrial design education in specific. The sheer number of service design courses offered by existing design programmes is a good proxy for the integration of service design. At the same time, we do not observe a change in total course numbers or

credits of industrial design programmes. This can be interpreted as the changing nature of industrial design education.

Based on our data, one of the core changes is the increasing importance given to system visualisation. However, the same cannot be said for the making aspect of design. While service prototyping is introduced as a tool in courses, this differs from the high-fidelity model-making common in industrial design education. Thus, further integration of service design in industrial design programmes might mean a decrease in the high-fidelity model-making capabilities of industrial design graduates.

In addition to a pronounced emphasis on business and user needs, one of the core aspects of service design is its focus on society and the public good. This focus expands the practice of industrial design beyond the commercial sector. This might be interpreted as a need to further include theoretical courses on social issues. There has always been an interest in social issues in industrial design. While this might be true, there has never been a coherent framework to address these problems.

Integrating service design into industrial design education further highlights design as a medium for multiple stakeholders to communicate and interact. Some service design course descriptions exemplify how visualisation techniques can become tools for co-creation. Hence, it is important to define and effectively communicate the designer's role in the ever-changing design landscapes to students through clear learning objectives.

Our study communicates the significance of service design in the industrial design curriculum. Our findings also illustrate possible redundancies in industrial design curriculum (especially on design research, human-centred design process, and design thinking) if the service design is hastily integrated into industrial design education without in-depth analysis. Every industrial design programme must assess and align service design based on existing course offerings with averting redundancies in a competitive resource environment. It is also important to reflect on students' experiences regarding service design course offerings, which our study comes short of addressing given our data.

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