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Human- and design-centric source: comparison using requirements checklist

Gouri Naik ✉ and V. Srinivasan

Indian Institute of Technology Delhi, India

✉ Gouri.Naik@design.iitd.ac.in

Abstract

The overall aim is to assess the superior of human- or design-centric source. This research compares the categories covered in a checklist by pain-points and needs identified individually using human- and design-centric sources. Data from 6 projects of a design course is used. It is found that there is no significant difference in the number of categories covered by pain-points and needs but the categories are not the same. This calls for integrating both sources in comparison to using only one source for designing which can potentially help to identify diverse and relevant outcomes.

Keywords: human-centred design, design process, design checklist, pain-points, needs

1. Introduction

The success of novel products hinges upon comprehensive understanding of various elements, including the needs and desires of the target audience, the competitive landscape, and the intricate dynamics of the market (Cooper, 2003). Brown and Katz (2011) emphasized the consideration of human desirability, technological feasibility, and market or business viability for human-centered design or design thinking. Human desirability is a design's capacity to meet the demands and desires of relevant stakeholders, including users and customers; technological feasibility is the ability of a design to be realized using existing tools and technologies; market or business viability is a design's potential to find acceptance in the market or gain market share to help earn profit. Designing is initiated by gathering pain- and pleasure-points from sources: stakeholders, existing designs, and markets. These sources are referred to as human-, design- and market-centric sources, respectively. The pain- and pleasure- points are the basis for eliciting needs and requirements for the ensuing designs to be developed. After the development of designs at various abstraction levels, they are evaluated to check conformity with the identified needs and requirements, before progressing to developing and testing of prototypes. Thus, the pain-points, pleasure-points, needs, requirements, and designs at various levels of abstraction are contingent on the human-centric, design-centric, and market-centric sources. The human-centric source holds significance in understanding the tasks, behaviours, preferences, likes, and dislikes of stakeholders. This understanding is achieved through empathetic approaches such as interviews, surveys, focus group discussions, observations, shadowing, field visits, etc. On the other hand, the design-centric source informs the capabilities and limitations of existing designs to a given design problem, and thereby, contributes to assessing the competitive advantages of the intended designs and facilitating development of innovative solutions. Kjeldskov and Howard (2004) highlighted the benefits of integrating both human- and design-centric sources for a more comprehensive and effective design process. Notwithstanding the individual benefits, no researcher has compared these sources to ascertain which is more important. Therefore, the overall goal of this study is to compare the outcomes developed through human-centric and design-centric sources in different stages of designing.

2. Literature review and research objective

Incomplete or unclear information of needs and requirements can lead to unsatisfactory designs, resulting in project delays and increased redesign costs (Becattini and Cascini, 2014). To mitigate these challenges, a requirement checklist serves as a valuable tool for designers by offering a structured set of considerations (Altavilla et al., 2022) and setting clear expectations to ensure project teams possess the necessary information. The checklist has multiple benefits: allows completeness of design specifications; enables assessment and enhancement of design quality; ensures development of comprehensive and effective designs; enables consistency and standardization across teams and projects; etc. (Becattini et al., 2015). Some well-known checklists of requirements in designing were developed by Pahl and Beitz (1988), Roozenburg and Eekels (1995), Hales (1993), Pugh (1990), etc. The checklist of Pahl and Beitz (1988) is used for identifying and documenting design requirements and comprises the following categories: Geometry (G), Kinematics (K), Force (F), Energy (E), Material (M), Signal (Si), Safety (Sa), Ergonomics(Er), Production(P), Quality Control(QC), Assembly (A), Transport (T), Operation (O), Maintenance (Ma), Recycling (R), Cost (C), and Schedule (Sc). The checklist of Hales and Gooch (Hales, 1993) comprises the following categories: function, safety, quality, manufacturing, timing, economic, ergonomic, ecological, aesthetic, and life cycle. Pugh's checklist is more detailed and relies on questions to elicit requirements. Roozenburg and Eekels (1995) identified the following attributes for a design specification to be effective: validity, completeness, operationality, non-redundancy, conciseness, and practicability.

In the realm of human-centric sources, Okesola et al. (2019) conducted a qualitative study comparing requirements elicitation techniques to assess the importance of context in technique selection. They reported that techniques such as interviews, focus groups, and observation provide direct user feedback, and thus, offer real world insights of user behaviour. However, challenges, including potential bias and difficulties in interpreting qualitative data, underscore the complexity of relying solely on human-centric sources. Nebe et al. (2006) showcased the benefits of integrating user-centered design (UCD) with the product development lifecycle in improving product quality and user satisfaction. They pointed out that challenges such as resistance to change underscore the need for a balanced approach. Hyysalo (2004) introduced cultural historical activity theory to emphasize the complex relationships between users, communities, and technological environments. This challenges conventional understandings of user needs and emphasizes the importance of considering evolving, latent, and unexpected needs. Norman, (2005) argued for a holistic approach, cautioning against a narrow focus on users at the expense of broader considerations such as economic goals, societal needs and consideration of all stakeholders. Comparative studies by Nishikawa et al. (2013) and Dahiya and Kumar (2019) explored the influence of user-generated data on design outcomes, emphasizing the value of primary user research data in the design process. Poetz and Schreier (2012) compared the ideas generated by designers and users; they found that user-generated ideas had higher novelty and customer value than designer-generated ideas.

In the design-centric domain, Ambaram (2013) identified the product-centric organizations' internal goal which is to produce and sell superior goods. Cooper, (2003) highlighted the importance of providing user value for profitability, drawing attention to the significance of understanding and addressing customer needs. Kjeldskov and Howard (2004) pointed out the integration of human-centric and design-centric sources for innovative and human-centered designs.

In summary, both the human-centric and design-centric sources have their individual pros and cons. Consequently, researchers have advocated the need to use both these sources in designing. However, no researcher has compared the sources to estimate the better among the two. So, the overall goal of this research is to compare the human-centric and design-centric sources through various stages of designing by studying the influence of the sources on the various outcomes developed at different stages of designing. The use of checklist of design requirements has multiple benefits. The specific research objective of this study is to compare the coverage of the Pahl and Beitz's checklist by the pain-points and needs identified through the human-centric and design-centric sources. The assumption is that the width of coverage of the checklist by outcomes from a source is an indicator of the comprehensiveness of the source.

3. Research methodology

Design data from 6 design projects carried out as part of a course is used for this study. In these projects, the pain-points and needs identified individually using the human-centric and design-centric sources are categorized using the Pahl and Beitz's checklist. The coverage of the various categories of the checklist by the pain-points and needs identified through both these sources is compared.

3.1. Data collection

Design data for the comparative analysis is taken from 6 distinct course projects conducted within the Design and Innovation Methods course, which is a graduate-level course offered at the Department of Design in the Indian Institute of Technology Delhi. In this course, the students were taught various design methodologies and design methods. To test their learning from lectures, the students have to apply their learning in projects and assignments. These projects were carried out as a team of 5-6 students, where each team undertook a project of product or service design. Data for this study is taken from an assignment where the task was to identify stakeholders, employ human-centric and design-centric sources individually to identify pain points, needs, and requirements. The students employed human-centric methods such as interviews, observations, focus group discussions, and surveys with the stakeholders to identify pain-points. For the design-centric source, the students conducted a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of existing designs for the design problem to identify the pain-points. The sets of pain-points from the human-centric and design-centric sources were converted into needs using guidelines taught in the lectures. The students were instructed to clearly document the various methods used, pain-points discovered, and the needs identified in their submission. Table 1 provides an overview of the design projects.

Table 1. Details of design projects and data collection methods

S. No	Objective	Stakeholders	Team Size	Human-centric methods				Design-centric methods
				A	B	C	D	E
1	Improving the user experience of the course registration process in ERP portal	New students, Existing students, Faculty, Parents, School/coaching	5	20	12	0	32	3
2	Redesigning the Department of Design website for improved user experience	B.Des, M.Des, Ph.D. students, Aspirants	5	3	0	0	37	6
3	Improving the user experience of outdoor seating benches at the institute	Students, Professors, Staff, Security guards, Visitors	5	18	6	3	40	8
4	Tackling the shortage or inadequacy of storage and locker furniture	Students, Faculty members, Staff, Security guards	6	7	6	0	17	8
5	Redesigning the seating configuration in Lecture Hall Complex rooms for comfortable extended work periods.	Students	5	14	3	1	20	6
6	Enhancing the user-experience of furniture surrounding eateries and open spaces across institute campus.	Students, Admin staff, Faculty members, Visitors, Relatives	5	7	6	0	55	6

NOTE: A: No. of interviews conducted; B: No. of cases observed; C: No. of focus group discussions held; D: No. of responses to survey; E: No. of existing designs analysed

3.2. Requirement checklist utilization

The pain-points and needs identified using the human-centric and design-centric sources are categorised by the first author of this paper into one or more of the 17 categories from the Pahl and Beitz's requirements checklist. In addition to the 17 categories, another category "Other" is introduced in case the pain-points and needs cannot be classified with the existing 17 categories. Table 2 shows the categories, their definitions, and examples.

To assess the reliability of the categorization of the first author, an intercoder reliability test employing Cohen's Kappa is conducted. 2 design researchers with at least 2 years of design research experience individually undertake the categorization for 20% of the dataset. This subset of the dataset is chosen to cover all the categories of the requirement checklist. The researchers are provided the categories from the checklist, their definitions, and an example of an electric bicycle (see Table 2). Another example has been incorporated in Table 2 from the student work in the projects to provide a much better insight into study.

Table 2. Requirement checklist definition, acronyms, and examples

Category (Acronym)	Definition	Example
Geometry (G)	Refers to physical shape and dimensions of a design, including its size, shape, and orientation; e.g., size, height, breadth, length, diameter, space requirement, number, arrangement, connection, extension, etc.	The frame height needs to be suitable for different rider heights (pertains to the physical shape and dimensions of the design)
		The locker system must efficiently manage space to accommodate a diverse range of items, including those with non-standard shapes, in order to maximize storage options for students.
Kinematics (K)	Includes study of motion of a design and type of motion, including its speed, velocity, acceleration, and trajectory without considering external forces.	There needs to be a smooth transition between pedal-assist levels (focuses on the motion and type of motion in the design).
		The outdoor furniture design needs to be structurally stable.
Force (F)	Includes study of forces that act on a design, including the direction of force, the magnitude of force, frequency, weight, load, deformation, stiffness, elasticity, inertia forces, and resonance.	The frame should be designed to withstand static and dynamic loads (deals directly with the forces(loads) that act on the design).
		Outdoor seating benches at the institute needs to be lightweight.
Energy (E)	Refers to energy consumption and energy efficiency of a design, including its power consumption and energy output, efficiency, loss, friction, ventilation, state, pressure, temperature, heating, cooling, supply, storage, capacity, and conversion.	The battery needs to be efficient for long-range use.
		The locker furniture must include electric power outlets.
Material (M)	Includes study of materials used in a design, including physical and chemical properties, auxiliary materials, and prescribed materials along with flow and transport of materials.	The frame materials need to be lightweight and durable.
		The seating configuration in the lecture hall complex must feature surfaces that are not hard, ensuring comfort for students during extended periods of sitting.
Signals (Si)	Represent the physical form in which information is channeled; e.g., data stored on a hard drive (information) would be conveyed to the processor via an electrical signal, input & output signals, form, display, etc.	Audible beep for low battery warning.
		The locker system must maintain consistent connectivity to the server, even in adverse network conditions, to guarantee uninterrupted access for students to their lockers and personal belongings.
Safety (Sa)	Includes safety of a design, including its compliance with safety standards and regulations; e.g., direct safety systems, operational and environmental safety.	Speed limits for electric assistance to ensure rider control (talks about the safe speed limit of bicycles).
		Furniture must be designed without sharp edges to prioritize safety and prevent potential injuries to users.

Ergonomics (Er)	Concerned with designing systems, processes, and products that are comfortable, efficient, and safe for humans to use; e.g., man-machine relationship, type of operation, operating height, clarity of layout, sitting comfort, lighting, etc.	Adjustable saddle height for rider comfort (addresses the comfort of product for users).
		The chairs need to have back support for comfortable sitting.
Production (P)	Refers to manufacturing process of design, including the equipment, tools, and materials required; e.g., factory limitations, preferred production methods, means of production, achievable quality and tolerances, wastage, etc.	The weight of individual components shall be within the factory's lifting capacity to ensure safe handling during manufacturing and assembly (addresses the limitation of the factory's lifting capacity).
Quality Control (QC)	Process of ensuring that a design meets the desired level of quality by identifying defects and taking corrective actions to eliminate them; e.g., possibilities of testing and measuring, application of special regulations and standards.	Individual testing of motor, battery, and electronic components (emphasize the need for testing to meet quality standards).
		The Face ID functionality must consistently perform reliably, ensuring minimal occurrence of failure or inconsistency in its operation.
Assembly (A)	Refers to the arrangement and integration of components to create the final product, including considerations for ease of assembly, compatibility, and alignment; e.g., special regulations, installation, sitting, foundations.	The motor and battery assembly shall be designed for quick and easy removal (focus on facilitating quick and easy assembly and disassembly).
		The lockers need to be modular.
Transport (T)	Includes features and design considerations that facilitate the movement and transportation of a product, including the modes of transportation, logistics involved, means of transport (height and weight), conditions of dispatch, ease of transport and the logistics involved both in its pre-assembled state and during use.	Foldable pedals to reduce the bicycle's width during transport (focuses on product features that enhance the product transportability).
		Furniture must be designed for effortless relocation.
Operation (O)	Includes operation of design and operating environment, including its functionality, user interface, and performance; e.g., quietness, wear, special uses, marketing area, destination.	Smooth transition between manual and electric modes (highlights seamless change between different operation modes).
		The design must facilitate interaction among users from diverse backgrounds.
Maintenance (Ma)	Refers to maintenance (upkeep and repairs) of a design, including procedures and tools used to maintain the design; e.g., servicing intervals (if any), inspection, exchange and repair, painting, leaning.	Accessible battery compartment for easy replacement (emphasizes feature to simplify maintenance tasks).
		The seating arrangement should be resistant to water damage and be stable to avoid tipping over.
Recycling (R)	Includes study related to recyclability of a design, including the materials and processes used in recycling; e.g., reuse, reprocessing, waste disposal storage.	Use of recyclable materials in manufacturing (choice of recyclable material).
Cost (C)	Includes costs associated with a design, including the maximum permissible manufacturing costs, operating costs, maintenance costs, cost of tooling, investment, and depreciation.	Manufacturing costs ≤ Rs. 10000.00 (sets specific cost limit)
		The seating arrangement should be affordable and cost-effective.

Schedule (Sc)	Refers to timeline for development, production, and maintenance of a product or system, including the milestones and deadlines involved; e.g., end date of development, project planning, and control, delivery date.	Realistic development timeline that accounts for testing and iteration (focuses on developing timeline).
		The system should facilitate the creation of personalized semester work plans for students without difficulty.
Other (Ot)	Any other category not mentioned above.	The electric bicycle shall feature a dynamic and visually appealing aesthetic design to promote a modern and stylish image.
		Faculty information is not available in the ERP site.

3.3. Comparison of human- and design-centric sources

Each pain-point and need is categorized into one or more of the categories from the Pahl and Beitz's requirement checklist. The number of categories covered by the pain-points and needs from the two sources across all projects is compared. To check whether the differences in number of categories from the two sources across all projects are statistically significant, the Mann-Whitney U test is conducted.

4. Result

4.1. Result of pain-points and needs

Table 3 shows examples of pain-points and needs obtained from two-course projects. Table 4 shows a breakdown of the number of pain-points and needs identified from human-centric and design-centric sources in all course projects. The average number of pain-points gathered from human-centric sources is 15.167 (±7.5) and from design-centric sources is 10.5 (±3.21). In terms of needs, the average from human-centric sources is 14 (±4.147), and from design-centric sources is 10.3 (±2.875) across all the projects.

Table 3. Examples of pain-points and needs from design projects

Project Objective	Pain-points	Needs
Improving the user experience of the course registration process in ERP portal	1. Absence of detailed course descriptions and weekly schedules hinders users from making informed decisions about their chosen courses. 2. The excessive amount of textual information overwhelms users, making it difficult to quickly grasp key details necessary for registration. 3. Identifying and interacting with smaller-sized buttons presents a usability issue, potentially causing confusion and hindering the overall user experience.	1. The design needs to ensure secure sharing of credentials to enhance user confidence in the course registration process. 2. The design needs to include course descriptions directly within the portal for easy access and reference. 3. Reiterate the importance of securely sharing credentials to protect user information during the registration process. 4. The portal needs to ensure easy access to course descriptions with a single touchpoint for user convenience.
Enhancing the user-experience of furniture surrounding eateries and open spaces across institute campus.	1. Users encounter challenges juggling multiple food items and personal belongings. 2. Benches are impractical during rainy weather, causing inconvenience for users. 3. Benches become uncomfortable on extremely hot days, impacting user experience. 4. Limited seating capacity results in an inability to accommodate all users in the area.	1. Design should facilitate users in keeping their belongings while eating. 2. Design must allow users to use the area comfortably even in extreme rain. 3. The furniture design should be adaptable to diverse climates, including scorching heat. 4. Ensure an abundance of seating spaces to accommodate all users. Design should promote ease for large groups to hang out together. Implement a design that facilitates quick and efficient waste disposal.

Table 4. No. of pain-points and needs gathered from human-and design-centric sources for all the classroom projects

Project	No. of Pain-points		No. of Needs	
	Human-centric	Design-centric	Human-centric	Design-centric
1	7	7	14	13
2	29	10	12	6
3	13	15	15	13
4	11	11	18	10
5	15	7	7	12
6	16	13	18	8

4.2. Result of intercoder reliability test

Individual assessments of coder-primary researcher agreement were conducted, and multiple rounds of intercoder reliability were executed after extensive discussions to refine checklist definitions. Once a high rate of agreement, as indicated by the Kappa value, was achieved, the coding process for the remaining pain points and needs across all projects commenced. This rigorous methodology ensures the reliability and validity of the coding process, contributing to the robustness of the overall analysis. Table 5 shows the results of the intercoder reliability test. The Kappa value for the first round of intercoder reliability test varies from 0.689 to 1, i.e. moderate to very strong agreement as per Besar et al., (2012). After the first round of categorisation, the first author individually discusses with the researchers to understand the rationale in their coding and the source of differences. The reasons for the differences between the first author and the researchers are difference in interpretations of some categories of the checklist, namely, operation, confusion between ergonomics and safety, and transportation. Based on the discussions, the first author modifies the definition of some categories of the checklist and includes more contextual examples, for better understanding before the second round of categorization. The Kappa values varied from 0.785 to 1 which correspond to strong to very strong agreement.

Table 5. Intercoder reliability assessment conducted in two rounds involving both design researchers and the primary researcher

	Kappa value between author & 1st researcher		Kappa value between author & 2nd researcher	
	1st Round	2nd Round	1st Round	2nd Round
Pain-points	0.689	0.865	0.927	0.785
Needs	0.762	0.882	1	1

4.3. Comparison of categories covered by human- and design-centric sources

Table 5 provides an overview of the coverage of pain-points and needs identified through human-centric and design-centric sources across the 6 projects.

For the pain-points, in 3 projects (1, 3, and 4), the design-centric sources cover more categories from the checklist than the human-centric sources, but only in 1 project (6), the human-centric sources cover more categories than the design-centric sources. Across the 6 projects, on average, the human-centric sources cover lesser categories than the design-centric sources. However, the Mann-Whitney U test reveals the difference between these values is not statistically significant ($U_{statistical}$ = 15, $U_{critical}$ = 5, significance level (α) = 0.05 for 6 design projects; $U_{statistical} > U_{critical}$).

For the needs, in 5 projects (1, 2, 3, 4, and 6), the human-centric sources cover more categories than the design-centric sources, but in only 1 project (5), the design-centric sources cover more categories than the human-centric sources. Overall, across the 6 projects, the human-centric sources cover more categories than the design-centric sources. To ascertain whether the differences are significant, Mann-Whitney U-test is applied and it reveals that the difference is not significant ($U_{statistical}$ = 12.5, $U_{critical}$ = 5, α = 0.05; $U_{statistical} > U_{critical}$).

In summary, the statistical analyses affirm the absence of significant differences in the coverage of categories of requirement checklists between human-centric and design-centric sources, both for pain-points and needs, across the evaluated design projects.

Table 6. Categories covered by human-centric & design-centric sources

	Project No.	Categories covered by human-centric source		Categories covered by design-centric source		Common categories
Pain-points	1	Ot, Er	2	O, Er, Ot, Sc, Si	5	Er
	2	Er, Sc, Ot, Ma, O	5	Er, O, Ma, Ot, Sc	5	Er, O, Ma, Sc
	3	M, Sa, K, Er, O, F, T, E, G	9	G, Er, Ma, O, T, Sa, M, K, C, Ot	10	M, Sa, K, Er, O, T, G
	4	Ma, Sa, O, G, QC, Er	6	O, M, Er, Sc, C, Ot, Sa, Si, G, A	10	Sa, O, G, Er
	5	Er, G, O, Sa, K, A	6	QC, M, A, Er, G, T	6	Er, G, A
	6	Er, Ma, O, Sa, Ot, QC, G	7	O, Er, G, Ot, Ma, Sa	6	Er, Ma, O, Sa, G
Needs	1	Sa, Ot, Er, Sc	5	Er, Sc, Si	3	Er, Sc
	2	O, Si, Er, Ma, Ot	5	Ot, Er, O, Ma	4	O, Er, Ma
	3	Er, K, Ma, G, Sa, A, QC	7	Er, Ma, A, T, Sa, C	6	Er, Ma, Sa, A
	4	Er, O, Sa, G, A, E, M, Ma, Ot, Si	10	Er, Sc, Sa, O, C, Ot, G, Si	8	Er, O, Sa, G, Si
	5	O, T, Er, Sa, QC, G, K, A	8	QC, A, Ma, Er, Sa, T, K, Ot, M	9	T, Er, Sa, QC, K, A
	6	O, G, Er, Sa, E, QC, Ma	7	Er, G, T, A, F	5	G, Er

5. Discussion

This study aimed to determine whether human-centric or design-centric source helps identify pain-points and needs that cover more categories from the requirement checklist. The inherent assumption is that wider is the coverage of categories by the outcomes, the more comprehensive is the source from which the outcomes are developed. For pain-points, in 3 out of 6 projects, the design-centric sources covered more categories than the human-centric sources, whereas in only one project, the human-centric sources covered more categories than the design-centric sources. Although there is no significant difference in the number of categories covered by pain-points and needs identified individually through human- and design-centric sources, these sources do not cover the same categories. Therefore, a combination of both sources can potentially cover more categories than individual sources. Notwithstanding these differences, across the 6 projects, the difference in number of categories covered between the human-centric sources and design-centric sources, for both pain-points and needs, is not statistically significant. This infers that both these sources are equally good in terms of coverage of categories from the requirement checklist. This is an important finding of this research. However, it can be argued that for all the projects, irrespective of the outcome, using both these sources simultaneously can potentially cover more categories than using any one source (see Table 6). For example, in Project 3, the pain-points identified through human-centric sources cover the categories of Material, Safety, Kinematics, Ergonomics, Operation, Force, Transportation, Energy, and Geometry whereas the pain-points identified through design-centric sources cover the categories of Geometry, Ergonomics, Material, Maintenance, Operation, Safety, Material, Kinematics, Cost, and Other but a combination of both sources can potentially cover the categories of Geometry, Ergonomics, Material, Maintenance, Operation, Safety, Material, Kinematics, Cost, Force, Energy and Other categories. Similarly, in Project 1, the needs identified through human-centric sources cover the categories of Safety, Ergonomics, Schedule, and other categories whereas the needs identified through design-centric sources cover the categories of Ergonomics, Schedule, and Signal but a combination of both sources can potentially cover the categories of Safety, Ergonomics, Schedule, Signals and other categories.

The study conscientiously acknowledges and addresses several limitations integral to its methodology. Foremost among these considerations is the recognition of the potential influence that checklist selection may exert on the obtained results. The meticulous process of checklist selection can shape the findings and is duly acknowledged as a factor that warrants attention. Additionally, the study candidly acknowledges the exclusion of secondary and tertiary stakeholders from the scope of its investigation. This conscious choice to focus primarily on primary stakeholders, while deliberate, underscores a limitation in the comprehensiveness of the study's stakeholder analysis. The nuanced dynamics involving secondary and tertiary stakeholders might offer valuable insights, but their omission is recognized as a limitation.

The research's overarching goal is to assess the influence of human-centric and design-centric sources on the outcomes from various design stages. In this research, the coverage of categories of a requirement checklist by pain-points and needs developed through human-centric and design-centric sources is ascertained. In another research the criticality of pain-points and importance of needs developed through human-centric and design-centric sources is ascertained through a funded design project. In both these cases, no significant differences in outcomes are reported between the human-centric and design-centric sources. Consequently, a combined use of both these sources is advocated over individual use.

6. Summary, conclusion and future work

The objective of this research is to understand the difference between the human-centric and design-centric sources; the difference is studied in terms of the coverage of categories of a requirements checklist by the pain-points and needs identified individually through the sources. Data from 6 projects carried out as part of a course is used. Pain-points from human-centric sources are identified by interviewing, observing, playing roles of stakeholders, questionnaire survey. Pain-points from design-centric sources are identified by reviewing existing designs. The findings reveal that, despite variations in category coverage between the two sources in specific projects, the overall difference is not statistically significant across the six projects studied. This implies that both sources are equally effective in terms of category coverage from the requirement checklist. The study suggests that using both human-centric and design-centric sources simultaneously could potentially cover more categories than relying on either source alone. However, further investigation is planned to determine the timing for introducing these techniques to minimize the duplication of insights. Currently, research has not delved into the exploration of when and how these sources should be introduced in educational contexts. Additionally, instead of solely examining whether the integration of sources is beneficial, exploring how they should be combined to maximize output with minimal effort is an interesting avenue for further research. While the current study focused on investigating the influence of human- and design-centric sources on identifying pain-points and needs, it is yet to delve into the compositional aspect. The research acknowledges limitations, including the potential influence of checklist selection on results and the exclusion of secondary and tertiary stakeholders from the investigation. Despite these limitations, the study contributes valuable insights into the influence of different sources on design outcomes and advocates for the combined use of human-centric and design-centric sources in the design process. The overarching goal of the research aligns with a related study, emphasizing the importance of both sources in a funded design project, and collectively, these findings advocate for the integrated use of both sources in design processes.

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