**FUNDAMENTALS OF HUMAN-CENTERED DESIGN AND STUDENT-CENTERED LEARNING IN HIGHER EDUCATION**

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**ABSTRACT**

This paper investigates the fundamentals of human-centered design (HCD) and student-centered learning (SCL) in higher education by means of a systematic literature search. The method results in an overview of the state of knowledge on these subjects whereupon this study provides an analysis of significant approaches and possible gaps, which are considered opportunities for further research.

**Keywords:** human-centered design; student-centered learning; higher education.

1. **INTRODUCTION**

There are many studies focusing on human-centered design or student-centered learning in higher education; however these concepts have not been directly integrated in scientific research. Since they are still diverse, an understanding of the fundamentals of each subject would be necessary to achieve this integration.

Therefore the current study presents a systematic literature search as means to determine the most frequent approaches to these subjects as well as gaps in the current literature about them. This analysis results not only in a state of knowledge overview but also the identification of opportunities for further investigation, including an integrative treatment that could relate both subjects.

1. **METHOD**

This study is based on a systematic literature search performed on the database of Science Direct, which was chosen for its international relevance for the subjects. Books were not included as content type because of its restricted access; therefore all research was based on papers published in international journals.

First the search was performed using the complete set of search strings: “human-centered design” and “student-centered learning” and “higher education”. Then new searches were executed substituting some of these strings for their synonyms or using them separately to increase breadth of research.

The search strings “student-centered learning” and “higher education” were always put together to exclude studies focused on basic education. The terms “user-centered design” and “human-centered design” were both used as search strings since the “human” approach in still recent and they might be understood as synonyms.

Some filters were necessary to achieve the best results. Since this study do not intend to perform an exhaustive historic inquiry but rather a review of the most recent takes on the subjects, publications dating earlier than the year 2010 were dismissed from the search. Also a field search filter was applied to limit results to the ones containing the search strings in title, abstract or author keywords (tak). This omits works that only loosely mention the terms and therefore do not contribute to the study.

The results obtained from these search parameters were firstly evaluated by reading the title, abstract and conclusions of each paper. These must be cohesive, pertinent to design and/or education matters, and directly related to the search subjects. The ones seemingly most relevant according to these criteria were then fully read and again a screening process was performed based on the same standards. These selected works are presented on the following topics as fundamentals of the subjects of this study.

1. **RESULTS**

The complete set of search strings: “human-centered design” and “student-centered learning” and “higher education” returned no results. Removing the string “higher education” or “student-centered learning” made no difference, neither replacing “human” for “user”. Thereby the search was performed separately.

Regarding the search on “human-centered design”, there were found 31 results, 14 of which dating the years of 2015 and 2014. Another 7 were from 2013 and 10 from earlier than that. After screening as described on the methods sections, 3 papers were detected as most relevant sources for this study: Van Pelt & Hey (2011); Kelly & Matthews (2014); Bujak et al. (2013).

The same search performed using the string “user-centered design” returned 151 results, 49 of them dating 2015 and 2014, another 28 dating 2013 and 74 published prior to that year. Some of them were already found on the previous search but among the new ones 4 were selected as references: Santos et al. (2014); Sluis-Thiescheffer et al. (2011); Nelson et al. (2013); Routarinne & Ylirisku (2012).

The search strings “student-centered learning” and “higher education” led to 18 total results, 6 of them from 2015 and 2014, another 4 from 2013 and 8 before that. From these, 5 were listed as relevant results: Baeten et al. (2010); Kim & Davies (2014); Šafranj (2013); Nicoleta (2013); Nielsen & Yahya (2013).

1. **DISCUSSION**

The absence of results using the full set or even pairings of the search strings and its variants indicates that the concepts of human-centered design and student-centered learning are still not directly and formally related in scientific research. This suggests an opportunity for integrative studies either (1) applying tools and strategies from these subjects for a mutual interest or (2) exploring and comparing their bases of knowledge.

During the screening of search results it was noticed that 40% of studies on UCD concern software, mobile app, game and website interfaces, probably due to its origin on computer systems development. Also 33% of papers on SCL in higher education address virtual learning environments. These papers were not necessarily selected for complete review for failing screening criteria but the fact points that (3) there is an existing connection between subjects, although not yet formalized with the specific terms and (4) there are opportunities for studies applying the UCD concept on other types of products and services in education, foreseen by the use of “human” instead of “user” centered design.

Concerning that, the numbers of the human and user-centered design search show that the use of the term “human” is still recent although crescent. The results are not numerous but their content also indicates that HCD and UCD are not synonyms since (5) the human-centered approach tends to be more holistic, considering all people involved as stakeholders and not only the user.

This point of view is central to Kelly & Matthews (2014), who suggest that there are relevant relationships between objects and people other than the user, and that must be taken in consideration in design process. They perform a medical device case study to affirm that displacing use can be a valuable strategy for broadening contexts.

Also on product development, Van Pelt & Hey (2011) state that HCD can benefit from TRIZ methods, and vice versa, considering the framework of use, usability, and meaning. After theoretical study of fundamentals of each methodology the authors propose a case study to enrich comparison and describe opportunities for integration of these concepts.

Still on the subject, Nelson et al. (2013) argue that creativity tools may be used to assist the anticipation of future product use in UCD, based on the assumption that dependence on references to existing products and activities is an obstacle to innovation design. The authors point benefits of the tools application derived from two case studies focused on ergonomics.

In the realm of education Bujak et al. (2013) approach HCD in the use of augmented reality as a teaching aid in mathematics classrooms from physical, cognitive, and contextual perspectives. The study considers very specific math knowledge but is regarded in the current review for its approach on education from a SCL perspective although not addressing the term.

Now on teacher education, Routarinne & Ylirisku (2012) study a UCD method known as Video Card Game as a tool for bridging the gap between theory and practice on educational psychology learning. The authors perform an experiment based on collaborative knowledge construction, which integrates the perspectives of individuals, tools, and social situation.

On a virtual perspective of education Santos et al. (2014) explore how UCD methods can be applied along the e-learning life cycle to enrich personalization, assuming it has to be constructed in a process that involves learners’ needs. The authors found that UCD principles can be aligned to web-based educational systems recommendations and return positive results. This is another example of SCL principles being considered although not mentioning the term itself.

Finally Sluis-Thiescheffer et al. (2011) address UCD in the context of designing with children. The authors develop a framework of design methods in terms of required design skills and apply it to investigate what method would work optimally with children of a specific age. Although focusing on children, the authors base their study on the Theory of Multiple Intelligences which is valuable for education research on any level. As a result of this study they also present an overview of skills that are characteristic for a design activity: linguistic, interpersonal, spatial-visual and bodily-kinesthetic.

From these selected papers 42% refer to product development, all of which use case study as a method. Another 42% have an education bias, although not addressing directly SCL but still aligned to its principles. 71% of them explore the use of specific UCD tools and 40% of these also propose a reflection upon the methods.

It is also noted that the papers worked specific concepts under the HCD theory such as: participatory design; critical design; interaction design; design with intent; co-design; co-creation. These subjects can be (6) considered fragments of the broader area of knowledge that is human-centered design, each one of them having its specific arrangement.

From the five papers retrieved from the student-centered learning search, one performed an analysis and evaluation from data collected in literature search; two offered a specific case overview and two proposed new strategies based on the concept.

Baeten et al. (2010) use a systematic literature search to find and describe encouraging and discouraging factors of adoption of a SCL approach, and how these factors influence students’ approaches to learning considering the students’ individuality, context and the role of the professor.

The reflective action research performed by Kim & Davies (2014) focused on tourism and hospitality educators’ point of view. It presented the student-centered approach as positive – even though some difficulties were identified – based on four main indicators: content structure, individual engagement with learning, peer interactions, and student reflection on the learning process.

Šafranj (2013) also studied a specific case comparing blended learning to traditional teaching on English classes for Mechanical Engineering students. The study indicated significant improvements in students’ results and experiences when exposed to the first method.

A more complete scenario comes from Nielsen & Yahya (2013) who address virtual learning environments as means of co-creating a curriculum based on the student-centered approach which promotes ownership, engagement and collaboration.

From another perspective, Nicoleta (2013) focus on professors’ performance and proposes a training program for beginner academics, addressing training methodology in higher education and SCL. The scope of study is the author’s country Romania but it brings up institutional policies from different countries which justify the relevance of SCL in different contexts.

It is noted that 80% of these studies have the level of students’ participation as a great concern. Four out of five point student-centered learning approaches returning positive results and the other one was neutral about it, for its aim was to point both positive and negative factors.

The five papers also brought up specific terms related to the SCL approach such as: student-activating; minimal guidance; open-ended learning environment, collaborative and cooperative learning; problem-, project- and case-based learning; blended learning. These findings evidence that – just like human-centered design – (7) student-centered learning is also a broad area of knowledge with many possibilities regarding concepts, methods and tools.

It is hard to establish deeper connections between the selected works mostly because HCD and SCL are great areas of knowledge that can be worked through many different perspectives, approaches and disciplines. This makes it difficult to perform such a generic research on papers, a type of writing which usually explore a specific aspect of the subjects, unlike books which generally settle foundations for them.

Nevertheless many of the selected papers had common author references, from both journals and books, which might point them as relevant representatives of their study areas. Although not contemplated in the current literature search due to incompatibility to research method criteria, these writings remain as possible references for deeper future investigation on the theoretical foundations of their subjects.

1. **CONCLUSION**

This paper intended to investigate the fundamentals of human-centered design and student-centered learning in higher education as basis for further research on possible connections between the two subjects. After a systematic literature search it was possible perform a quantitative analysis and draw some conclusions about recurrent and still unexplored approaches in recent literature, as follows:

(1) There is opportunity for cross-applying tools and strategies from both subjects for a mutual interest;

(2) Another possibility is exploring both concepts theoretically and comparing their bases of knowledge;

(3) There already is a connection between UCD and SCL when it comes to virtual learning environments (VLE), just not yet formalized with the specific terms;

(4) There is opportunity for studies applying the broader HCD concept on other types of products and services in education besides VLE;

(5) The human-centered approach tends to be more holistic in its concept, so it should not be replaced with UCD;

(6,7) HCD and SCL are broad areas of knowledge with many possibilities regarding concepts, methods and tools.

Based on this analysis we suggest that on further research these two great subjects could be dissected and assorted in their specific approaches, tools and methods. This would result in better understanding of them and possibly lead to meaningful connections.

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