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Creating Educational Technology Curricula for Advanced Studies in Learning Technology ★

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Abstract

Curriculum design and content are key factors in the area of human resource development. To examine the possibility of using a collaboration of Human Computer Interaction (HCI) and Educational Technology (ET) to develop innovative improvements to the education system, the curricula of these two areas of study were lexically analyzed and compared. As a further example, the curriculum of a joint course in HCI and ET was also lexically analyzed and the contents were examined. These analyses can be used as references in the development of human resources for use in advanced learning environments.

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1. Introduction

A recent learning system innovation has been developed which combines Information Communication technology and widely available resources, such as Massive Open Online Courses (MOOCs) or Open Educational Resources (OERs) [1]. To enhance the learning opportunity within these learning environments, appropriate development of learning system platforms and user interfaces which go beyond the system's educational functions are desired, such as facilitation of the assessment of learning. The study of these topics is promoted by research of Educational Technology (ET), while Human Computer Interaction (HCI) plays a major role in promoting the creation of these environments and their learning materials, such as the development of cool or appealing interfaces for learners.

In order to promote and enhance the learning system, collaboration in the fields of research concerning HCI and ET should be required in regards to these innovations, as human resource development is a particularly important factor. The curriculum for HCI has been developed and delivered [2, 3], though there are few joint course. Therefore, an appropriate collaborative curriculum should be developed for use worldwide.

This position paper reviews some current curricula in the areas of HCI and ET, in order to establish the necessity of collaboration between HCI and ET. Following topics are addressed in this paper.

- The content of HCI and Educational Technology curricula are compared using a simple lexical analysis.
- A combined curriculum is analyzed and its further possibilities are discussed.

2. Current HCI course

The current content of an HCI course in a curriculum standard known as CS2013 is shown in Table 1, as proposed by ACM-IEEE CS [4]. The content consists of ten topics, including two core-tier topics which consist of conventional concepts [5]. The CS2013 also introduced a series of course examples which corresponded with the course guidelines. The assignment of course examples according to unit number is summarized in Table 2. Most courses focus on core-tier topics.

To illustrate the conceptual structure of the course guideline, a lexical and cluster analysis was conducted

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Table 1. HCI course in CS2013

Unit	CS2013[4]
1	Foundations (Core-Tier1)
2	Designing Interaction (Core-Tier2)
3	Programming interactive systems
4	User-centered design & testing
5	New interactive technologies
6	Collaboration & communication
7	Statistical methods for HCI
8	Human factors and security
9	Design oriented HCI
10	Mixed, augmented and virtual reality

Table 2. Course examples for HCI in CS2013 [4]

Unit No.	Course Example						
	Ex1	Ex2	Ex3	Ex4	Ex5	Ex6	Ex7
1	4	4	4	1	4	4	1
2	2	4	4	2	2	-	1
3	2	-	-	-	-	-	-
4	4	4	4	2	2.5	-	1
5	-	2	-	2	-	-	-
6	-	-	-	-	-	-	-
7	6	-	-	-	1	-	-
8	-	-	-	-	-	-	-
9	-	-	-	1	-	-	-
10	-	2	-	-	-	-	-
Others	-	-	-	-	-	2	8
Hours	18	16	12	8	9.5	6	11

[1]. The analysis was conducted using a text-based comparison, and thus it should be noted that some interpretations were influenced by the text descriptions. The resulting dendrogram is shown in Figure 1 [3]. The dendrogram reflects the development of the curriculum, as some of the most modern topics overlap the core-tier topics. This guideline was designed for HCI learners, thus any concerns regarding Educational Technology are not presented or addressed.

3. Curricula for Educational Technology

3.1. AECT curriculum standards

Used as a major curriculum for Educational Technology, the curriculum standard established by AECT (The Association for Educational Communications and Technology) was the first model employed in this study. The curriculum was designed using a top-down approach. First, domains for five areas of learning were defined, and then 21 sub-domains were created to further categorize the course subjects [2].

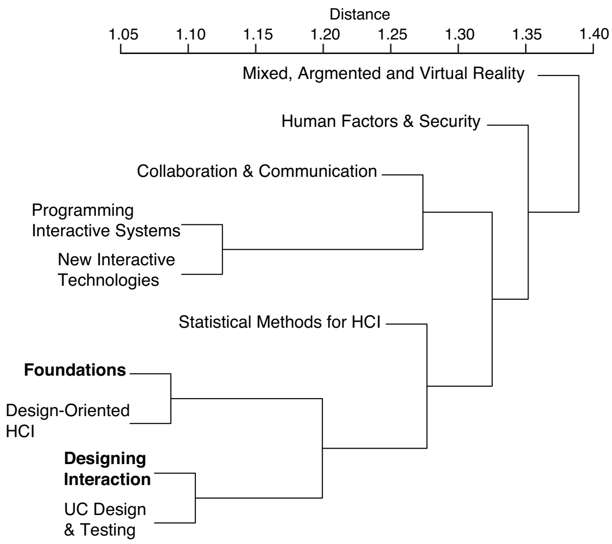

Figure 1. a dedrogram of an HCI guideline in CS2013

Table 3. Domains for AECT curriculum standards

Domain	Sub-Domain
Design	Instructional System Design, Message Design, Instructional Strategies, Learner Characteristics
Development	Print Technologies, Audiovisual Technologies, Computer-Based Technologies, Integrated Technologies
Utilization	Media Utilization, Diffusion of Innovations, Implementation and Institutionalization
Management	Project Management, Resource Management, Delivery System, Management, Information Management
Evaluation	Problem Analysis, Criterion-Referenced Measurement, Formative Evaluation, Summative Evaluation

The contents of the courses were listed using the sub-domain descriptions and a clustering technique, and then summarized as shown in Figure 2. As the contents were designed using a top-down approach, each domain produces clusters which include sub-domains with their respective topics. The five domains are categorized into two clusters with the top Cluster consisting of Design, Development, and Evaluation, and the bottom Cluster consisting of Management and Utilization. In the course descriptions, most courses are concerned with instructional design concepts such

[1] Summary descriptions for each BOK are analyzed morphologically, and all nouns are then extracted. Regarding the term frequencies of these descriptions, a term-document matrix was created. The cosine similarity is calculated across term frequency vectors, and cluster analysis was conducted using the similarities as an index of distance (the range is 0 to 1.4)

[2] http://www.aect.org/standards/initstand.html

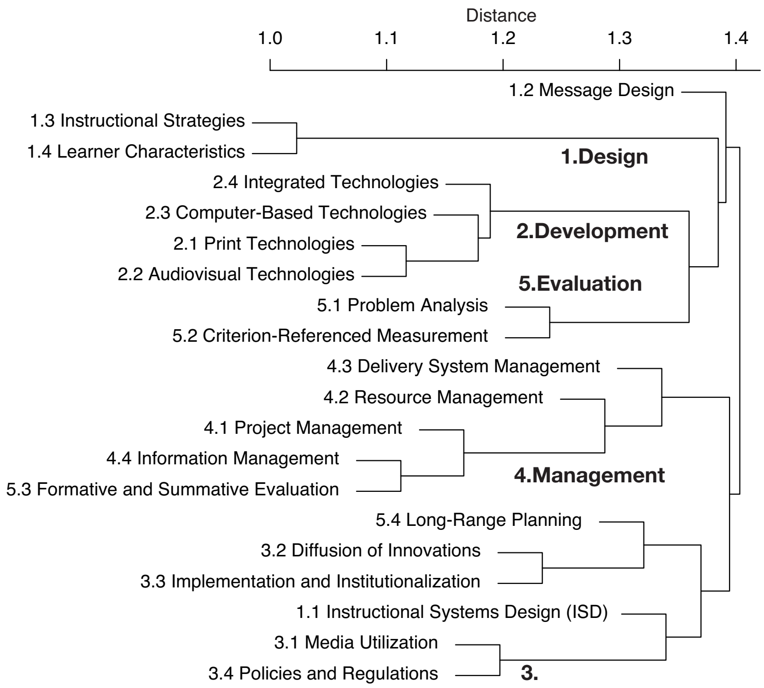

Figure 2. A dendrogram for subdomains of AECT curriculum standards

as course design, development of materials, or the evaluation and management of learning.

3.2. Learning Technology courses in the UK

There are several organizations concerned with Educational Technology or Learning Technology in the UK. The UK is also a major educational resource provider worldwide, through online sources such as FutureLearn, OpenLearn and others [3]. In order to explore human resource development in these various environments, information about the curriculum used in university courses was surveyed. Fortunately, the Association for Learning Technology (ALT) provides a list of courses related to Learning Technology, such as courses in Technology Enhanced Learning (TEL) [4]. The syllabus information from all six postgraduate courses taught in the UK were analyzed, using a bottom-up approach type. The courses are offered at major universities in the UK, namely Bristol, Edinburgh, Leicester, Manchester, Open, and Oxford.

There were 24 core subject courses offered by the six universities. The texts of the syllabi were analyzed in the same way as mentioned in the above section, and the resulting structures were summarized as a dendrogram in Figure 3. Names of subjects together with their course symbols are provided in Figure 3. There are four clusters in the Figure: "Design", "Research Methodology", "Learning Technologies", and "Practice-based Research". The inclusion of "Research Methodology" in courses taught in the UK is typical, and in contrast to the AECT's curriculum standard, which does not include "Research Methodology" as a subject. Though most "Practice-based Research" courses in the UK are taught by the Open University, other clusters contain subjects which are taught by various other universities also. This means they are common Learning Technology course topics.

4. HCI contribution to Learning Technology

In the above sections, the curricula for HCI and Educational Technology were reviewed. Since terminologies in the two fields may be not be identical, common topics seem to be limited. Most curricula for Educational Technology and Learning Technology courses mentioned in the above sections appear to continue to be about traditionally designed educational subjects, without any HCI topics included. Additional technological enhancements may be required to design, plan, and organize a more flexible learning environment which uses HCI and computing such as Information Technology.

Recently, a specialized joint course in HCI and Psychology, known as CMU METALS Course, was introduced [5]. The core courses consist of general HCI and Educational topics and include a course project. The electives are in the areas of Technology, Learning

[3] www.futurelearn.com, www.open.edu/opelearn/
[4] http://wiki.alt.ac.uk/index.php/TEL_Courses
[5] http://metals.hcii.cmu.edu

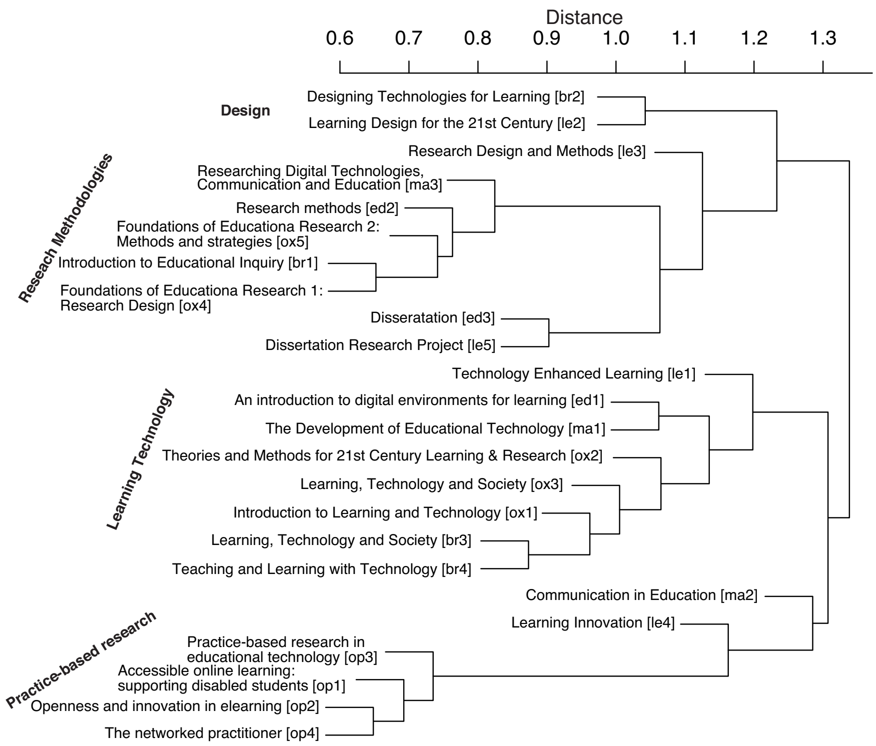

Figure 3. A dendrogram of subjects which are described as syllabi at UK universities

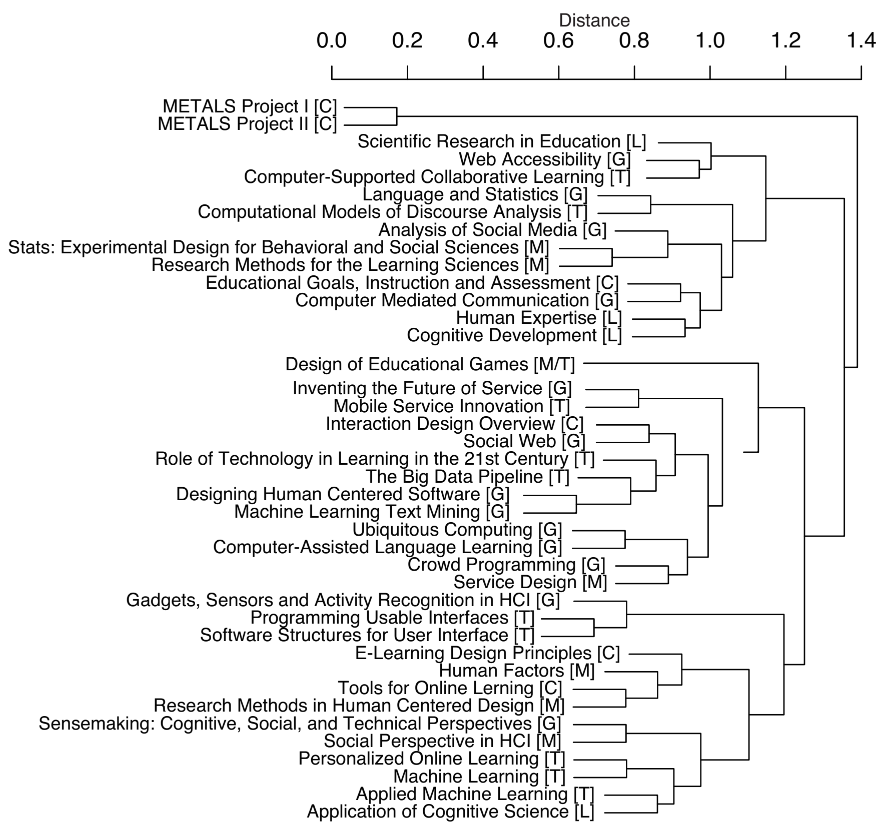

Figure 4. A dedrogram of subjects which are described as syllabi at CMU METALS ([C]:Core, [T]:Technology, [L]:Learning Sciences Theory & Industrial Design, [M]:Methods & Design, [G]:General Electives)

Sciences Theory & industrial Design, Methods & Design and General Electives. Therefore, the outline of the course is designed to give an overview the curricula of HCI and Educational Technology.

In an examination of the course contents, the syllabus of the course was lexically analyzed, using the same method mentioned above. Figure 4 shows the structural content of the core and elective subjects. There are three major clusters in addition to the METALS project subjects. As all clusters include all of the electives, a more detailed analysis may be required to summarize the contents of the courses. Specific joint courses may be preferred when the development of human resources is required, in order to create more advanced learning environments. Unfortunately, this type of course is still rare, and even newly developed guidelines or frameworks need to be considered in order to encourage greater learning opportunities in the areas of HCI and Education Technology, for learners and researchers alike.

More detailed confirmation, such as cross-analysis between curricula, may reveal the lexical relationships between HCI and ET. These points will be subjects of our further study.

5. Conclusion

The curricula of current HCI and Educational Technology courses were explored in order to examine the relationship between human resource development and the demands of online learning environments. Lexical analysis of the course syllabi revealed that collaboration between these two areas should be promoted. In addition, a course based on a collaboration of these two areas of study has already been introduced.

This new type of course will stimulate conventional courses in these areas to be upgraded in the future.

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