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Variations of "Human Computer Interaction" syllabus in Computer Science area

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***Abstract*—In theory, course curriculum, also known as course syllabus, should play an important role in the success of learning. However, in practice course syllabus are often far from playing this role. In this paper, we analyze several course syllabus in order to better characterize learning expectations in the field of HCI (Human Computer Interaction) and Computer Science. We start by analyzing variations of course syllabus descriptions in that field. We report the results of a case study using simple statistics to automatically extract relationships from syllabus documents of HCI courses described online. We further provide some requirements for future syllabus descriptions that seem to be missing in all the syllabus descriptions analyzed. Our aim with this work is to urge further discussions and future work to enhance the content and practice related to course syllabus.**

***Keywords*-curriculum; HCI; CS; syllabus;**

I. Introduction

Amongst its various objectives, the project "e-nuance" aims at discussing the articulation between various courses involved in possible curriculum of computer science (CS) area. One particular focus of previous discussion has been the articulation between courses in human computer interaction (HCI), Computer Graphics, and Web Science [1].

Several curricula of CS have been proposed and maintained by ACM and other organisations. Sometimes, these curricula are shared across CS departments and other related disciplines. For example, the ACM has published a conceptual framework of HCI curriculum and course variations [2], [3]. Some departments of CS use the curriculum structure and course contents even though the actual course contents are often shifted because of instructors research interest or their relevance considering a given audience.

Recently, many postgraduate courses have also been created, HCI is instructed to students simultaneously in both undergraduate and the articulation between postgraduate and undegraduate courses over the same department have to be considered.

The survey and analysis of course contents may facilitate the emergence of advanced and valuable well articulated curricula. This position paper proposes a simple analysis of HCI course contents to provide some elements of discussions in this direction.

Table I
Course codes, locations and levels

Course code	Course location and level
NA1	Dalhouse univ., CA, CS, Undergraduate
NA2	Univ. Iowa, USA, CS, Undergraduate
NA3	NC state Univ., USA, CSC454, Undergraduate
NA4	Pacific Univ., USA, CS315 CS250, Undergarduate
NA5	Stanford, USA, CS147, Undergraduate
NA6	Northeastern Univ.(Boston), USA, CS5340, Graduate
NA7	Penn State, USA, IST521, Graduate
EU1	Univ. of Oslo, Norway, Info, Undergraduate
EU2	Umea Univ. Sweden, Info, Graduate
AP1	Monash Univ., Au, CS, Undergarduate
AP2	TokyoTech, Japan, CS, Graduate

Two different syllabus for HCI are currently in use. The first syllabus [3] is the oldest and specifically devoted to HCI. The second syllabus comes from the ACM more comprehensive curriculum for computer science released in 2008 [2].

In the first syllabus of HCI by the ACM, the course contents of HCI were classified into four types (cf Table II) regarding the emphasis of features by ACM, such as CS1, CS2, PSY and MIS. This suggests the common essences of HCI courses.

In the more recent ACM CS curriculum 2008 [2], the course contents of HCI are organized into ten courses (cf Table IV).

To extract deviations of course contents in HCI, course syllabi were gathered from the Internet web sites. A Google search with request "human computer interaction syllabus", was performed to retrieve 11 top course information for both undergraduate and postgraduate from regions: North America (NA), EU, and Asia Pacific (AP). The course descriptions were stored as text description for automatic analysis. The urls corresponding to the analyzed courses are summarized in Table III and the code, location and level of courses are summarized in Table I

Most university present course syllabus which describes the goal of course, summary, and session contents.

Table II
COURSE EMPHASES ON THE CONTENT OF HCI [3]

CONTENT AREAS (course length assumed to be 14 weeks with 42 contact hours total)		CS1: UI Design & Devel.	CS2: Phen & Thy of HCI	PSY1: Psych of HCI	MIS1: Human Aspects of IS
N	**The nature of HCI**				
	N1 (Meta-)Models of HCI	2	2	2	1
U	**Use and Contact of Computers**				
	U1 Human Social Organization and work	2	4	4	4
	U2 Application Areas	1	1	1	1
	U3 Human-Machine Fit and Adaptation	2	2	4	3
H	**Human Characteristics**				
	H1 Human Information Processing	1	9	4	1
	H2 Language, Communication and Interaction	1	5	2	2
	H3 Ergonomics	1	2	1	1
C	**Computer System and Interface Architecture**				
	C1 Input and Output Devices	2	0	3	2
	C2 Dialogue Techniques	3	0	4	3
	C3 Dialogue Genre	1	0	1	1
	C4 Computer Graphics	1	0	1	1
	C5 Dialogue Architecture	1	0	1	0
D	**Development Process**				
	D1 Design Approaches	4	2	4	4
	D2 Implementation Techniques	5	2	2	4
	D3 Evaluation Techniques	5	6	4	3
	D4 Example Systems and Case Studies	3	2	2	4
P	**Project Presentation and Examinations**	7	5	2	4

Table III
URLS AVAILABLE AT THE TIME OF THE STUDY [15TH OF FEBRUARY 2014]

Course code	Urls of the description
NA1	https://web.cs.dal.ca/ jamie/CS3160/Course/HCI-3160-syllabus.pdf
NA2	http://homepage.cs.uiowa.edu/ hourcade/classes/fa13hci/syllabus.html
NA3	http://www4.ncsu.edu/ stamant/454/syllabus.html
NA4	http://zeus.cs.pacificu.edu/shereen/cs315s13/
NA5	http://hci.stanford.edu/courses/cs147/2014/
NA6	http://www.ccs.neu.edu/course/csg170/
NA7	https://online.ist.psu.edu/ist521/syllabussp12
EU1	http://www.uio.no/studier/emner/matnat/ifi/INF9260/
EU2	http://www.umu.se/english/education/courses-and-programmes/course?currentView=syllabus&code=2IN037
AP1	http://www.monash.edu.au/pubs/handbooks/units/FIT3063.html
AP2	http://www.ocw.titech.ac.jp/index.php?module=General&action=T0300&JWC=20081226716025

Unfortunately the format of syllabus is not standardised though the open course is spreading. Therefore, only text analysis of text descriptions of the HCI syllabi can be conducted without accounting for potential structural information. The Table IV is a summary of these course descriptions.

All nouns were extracted from the texts using morphological tool [4], then term-document matrix was created.

II. TERM ANALYSIS

The size of text descriptions analyzed are summarized in Table VI where the column m of the table indicate the total number of morphological forms (including punctuation) and the column n of the table indicates the total number of nouns (without proper nouns) in the automatically analyzed text descriptions.

Regarding the term-document matrix, 345 nouns were extracted. Top 10 terms and their frequencies are summarised in Table V. There is no significant difference in frequency across departments, and also no dependency with region and undergraduate/postgraduate, though the low frequency terms are unique across departments.

III. CLUSTERING

All eleven course descriptions and the ten syllabus descriptions from ACM may share some topics, see Table V. To determine relationships across syllabi of HCI, cosine similarities between two courses were calculated using term frequency vectors of the term-document matrix.

To extract some groups from these 21 descriptions of real courses and courses templates, hierarchical clustering was conducted using a cosine similarity. Figure 1 illustrates the resulting dendrogram.

The first large cluster (depicted at the top of 1), contains almost exclusively syllabus descriptions from the ACM.

Table V
FREQUENCY OF TOP 10 TERMS IN SYLLABI ACROSS 11 DEPARTMENTS.

	CS08-HCI/										University syllabi										
	01	02	03	04	05	06	07	08	09	10	NA1	NA2	NA3	NA4	NA5	NA6	NA7	EU1	EU2	AP1	AP2
user	4	7	7	4	2	1	0	0	1	1	11	5	11	6	6	1	4	1	1	0	0
design	10	2	1	0	4	5	3	1	3	1	5	1	6	2	4	3	7	6	5	4	0
interface	4	5	1	3	0	0	1	0	1	1	5	1	6	5	7	3	7	0	2	14	0
evaluation	3	1	9	0	0	0	0	0	0	0	4	1	4	0	2	0	1	2	1	7	0
interaction	4	0	0	0	7	1	0	4	4	0	1	1	2	0	1	2	3	1	1	0	1
course	0	0	0	0	0	0	0	0	0	0	0	2	0	3	9	3	1	5	2	1	1
usability	0	0	4	2	0	0	2	1	1	2	2	3	2	0	1	0	0	0	0	0	0
system	2	2	0	0	0	0	1	0	1	0	0	0	8	0	0	0	3	3	0	0	0
information	0	0	0	0	0	0	5	0	0	0	2	0	0	0	0	1	0	2	1	6	3
principle	0	2	0	0	1	0	0	0	0	0	0	3	3	1	0	0	1	0	1	5	0
model	5	0	0	0	0	2	0	0	0	0	2	1	0	0	0	0	1	0	0	4	2

Table IV
SURVEY OF SYLLABI FOR HCI

Code	Course/Department	Region	Level
CS08-01	HC/Foundations	-	-
CS08-02	HC/BuildingGUIInterfaces	-	-
CS08-03	HC/UserCenteredSoftwareEvaluation	-	-
CS08-04	HC/UserCenteredSoftwareDevelopment	-	-
CS08-05	HC/GUIDesign	-	-
CS08-06	HC/GUIProgramming	-	-
CS08-07	HC/Multimedia & MultimodalSystems	-	-
CS08-08	HC/Collaboration & Communication	-	-
CS08-09	HC/InteractionDesignForNewEnvironments	-	-
CS08-10	HC/HumanFactors & Security	-	-
NA1	Computer Science	NA	U
NA2	Computer Science	NA	U
NA3	Computer Science	NA	U
NA4	Computer Science	NA	U
NA5	Computer Science	NA	U
NA6	Computer Science	NA	G
NA7	Computer Science	NA	G
EU1	Information Science	EU	U
EU2	Information Science	EU	G
AP1	Computer Science	AP	U
AP2	Computer Science	AP	G

NA:North America, AP:Asia Pacific
G:Graduate course, U:Undergraduate course

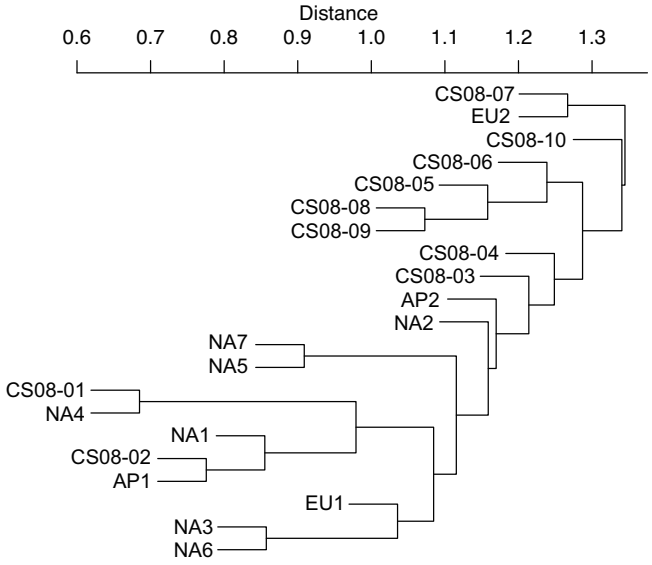

Figure 1. Dendrogram of cluster analysis using cosine similarity across syllabi.

The second large cluster contains most surveyed courses. However, both *CS08-01* (minimum core coverage time: 6 hours) and *CS08-02* (minimum core coverage time: 2 hours) are clustered in this large cluster, even though these are syllabus description from the ACM. These clustering results suggest that the surveyed courses may be explicitly or implicitly designed regarding the core template courses represented by *CS08-01* and *CS08-02* descriptions.

The second large cluster presents another detail worth commenting: a postgraduate course, *NA6*, is gathered with an undergraduate course, *NA3*. This is not surprising since the levels are not explicitely accounted for by the clustering algorithm. Furthermore, different levels of courses may share similar topics in their contents. In such conditions, it is particularly important that the articulation between the two courses be made carefully. This type of significant information is missing from our data and opens the space for future work.

Lastly, as mentionned previously, since the automatic analysis was made without any structural meta-information, practical information appearing in course description was treated the same way as syllabus description. However, the nature and role of practical and semantic information is significantly different in knowledge acquisition and future work may better account for these differences.

IV. LEARNING OUTCOME AND SYLLABUS REQUIREMENTS

It is a truism to say that learning outcome is as important as difficult to capture. Our analysis or syllabus descriptions aims at revealing learning expectations which may or may not be reached as learning outcome of current HCI courses.

Table VI
SIZE OF THE TEXT DESCRIPTIONS

Course	m	n
CS08-01	352	101
CS08-02	130	33
CS08-03	219	72
CS08-04	175	61
CS08-05	188	55
CS08-06	160	41
CS08-07	148	50
CS08-08	187	51
CS08-09	162	41
CS08-10	97	26
NA1	318	101
NA2	211	56
NA3	215	59
NA4	280	91
NA5	193	48
NA6	371	117
NA7	184	57
EU1	115	36
EU2	96	27
AP1	285	99
AP2	306	102

Our approach is motivated by the fact that, in theory, a syllabus can be considered as an explicit and detailed form of agreement about expected learning outcome amongst the various actors : students, lecturers, administrators and more generally people. Lecturers and students are further implicitely committed toward the learning outcome described in the syllabus.

However, so far, in practice, syllabus are very secondary factors in learning outcome. In many situations, for example, learning objectives are considered as more important than syllabus. Even though for many contextual reasons, learning objectives are often implicit, misleading or insufficiently detailed. Student assessment can also play a more important role in learning outcome in practice than the syllabus itself. However, assessment has several nested aims and the articulation between assessment and syllabus description is worth better attention than is usually the case in practice.

In order, to successfully play their part, syllabus should probably meet the following requirements:

1) **scalable** - syllabus descriptions should remain short in many occasions, but detailed information is also useful in other occasions. Scalable syllabus descriptions e.g. syllabus descriptions that can be read at different levels of details would be helpful
2) **actively readable** - syllabus description should be easy to actively read, e.g read and annotate. In particular, useful annotations might be cross references of associated useful ressources or readers comments
3) **questionnable** - questions about the motivation behind syllabus items should be facilitated
4) **debatable** - debates about the syllabus choices should be explicited
5) **evolutive** - syllabus evolutions are frequent and useful and they have to be facilitated
6) **tracable** - since syllabus evolutions can impact student and lecturers involvments and learning organization, evolution should be tracable
7) **open** - since syllabus descriptions may be used for coordination and organization, inter-operability should be facilitated. Linked data initiatives such as, for example [5] can be considered as a step in this direction.

V. CONCLUSION

This position statement briefly presents a comparison of worldwide university course descriptions in the field of HCI and Computer Science. The courses analyzed are the top 11 course descriptions retrieved from a Google search with the query ”human computer interaction syllabus”.

Automatic keyword extraction from these 11 course descriptions was performed. The analysis has shown that top eleven courses according to Google ranking have a lot in common with the minimum core of HCI curriculum of the ACM even though varieties of teaching contents are systematically required in both under/postgraduate levels.

The results of the analysis also suggest that the ten top terms extracted from these course descriptions show no significant difference accross location, courses, or levels.

On the other hand the analysis has shown that low frequency terms are unique across Universities.

One possible interpretation of these results is that syllabus descriptions do not, in practice, really play the part they should actually play and that a lot remains to be done in that area. Considering syllabus description as a form of implicit contract that is, by nature, never compulsory but always important enough to be considered with attention and respect, we have provided requirements for syllabus descriptions to hopefully lead to future discussions and work in this direction.

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