A Graph-based Approach to Analyze and Compare Computer Science Curricula for Primary and Lower Secondary Education

Stefan Pasterk
Alpen-Adria-Universität Klagenfurt
Universitätsstraße 65-67
9020 Klagenfurt, Austria
stefan.pasterk@aau.at

Andreas Bollin
Alpen-Adria-Universität Klagenfurt
Universitätsstraße 65-67
9020 Klagenfurt, Austria
stefan.pasterk@aau.at

ABSTRACT

A growing number of countries start to introduce computer science related topics in primary education, but their curricula or educational standards significantly differ in various aspects. This contribution introduces a way to analyze and compare curricula, education standards and competency models, using a graph-based representation form and several graph-theoretical metrics.

CCS Concepts

•**Social and professional topics** → **Computer science education; K-12 education;** *Model curricula;*

Keywords

Curricula, primary education, graph-based, comparison

1. INTRODUCTION

As information technology (and computer science) deeply affects everyday life, more and more countries start to teach topics of computer science in kindergarten or primary schools. For this purpose, curricula, educational standards and/or competency models were developed and in some countries, like Switzerland or Australia, already established. These models show differences with regard to focus, content, structure and number of skills or competencies which makes a comparison a complex task. This contribution introduces a technique and framework to comprehensibly evaluate different curricula, standards and competency models for computer science education in primary and lower secondary schools.

2. A GRAPH-BASED APPROACH

The idea behind this new methodology is to establish 'requires' or 'expands' relations between individual knowledge elements within a curriculum, educational standards or competency model for computer science. The knowledge elements are represented as vertices of a graph and the relations as the connections between them. Similar approaches were used [1, 2], but focus on curricula in higher education and do not consider different types for vertices or relations. Our approach uses a graph database for analyzing the data via simple queries. We consider graph-theoretic measures like vertices with the highest degree, the number of vertices without dependencies, the overall number of relations of one model, the amount of different relations within a curriculum, or the number of cross-theme dependencies in an analysis.

3. RESULTS

First results show that our graph-based representation clearly illustrates the main focus of different curricula. In one study that took place end of February 2017, experts categorized the knowledge elements of different curricula into *'digital literacy'* and *'computer science'* and the results were mapped to our graph representation. The analysis clearly depicted that the Australian curriculum for the subject 'Digital Technologies' has a very balanced distribution of the topics concerning *computer science* and *digital literacy*, whereas the curriculum from Switzerland for 'Media and Informatics' strongly focuses on *digital literacy*. Further descriptions and results can be found on the project-homepage[1].

4. CONCLUSION AND FUTURE WORK

This approach gives an interesting overview of structural components and offers the possibility to analyze and compare them. As further steps the content of the curricula, educational standards and competency models will be broken down to their basic competencies and knowledge items and they will be categorized into knowledge areas.

5. REFERENCES

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[1]See IT-SG project at iid.aau.at/bin/view/Main/Projects

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