Automated curriculum alignment standards in K-12 schooling system

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Abstract. The use of computer media (ICT) in the development of education in United States through the implementation of the K-12 framework system was intended to develop the standards and curriculum as a means of curriculum alignment. The operation of this system was studied in order to establish how information is refined until it conforms to given curriculum standards. Through the literature review, the analysis in this article found that the concept of K-12 framework system can be seen from the point of view of grand band (according to classes), concepts and the development that allows teachers to filter the concepts and basic practices based on classes level, basic concepts, basic practice or integration of the three. The computerized basic practices of K-12 system showed computational behaviors and literacy thinking which enabled teachers and students to be connected with the world through collaboration in a computerized process and solving computational problems.

1. Introduction
In an efforts to push educators to ensure that the students could get some success in an education process in general schools, the US Federal in Washington enacted an automated school curriculum alignment based on Information and Communication Technology (ICT) that was called K-12 (Kindergarten to grade 12) [1][2]. The development of this system was initiated by US National Science Foundation or NSDL [3][4].

The system was developed following the US national education system’s 21st century vision which emphasized that the students are not just computer users, but are also creators in the utilization of the literature and they also master the concepts and practices of the use of computer science [5]. The use of computer media (ICT) in the development of education, especially in science and computer field, states, districts and other organizations in US used K-12 framework system to inform the development of standards and curriculum, capacity building of computer learning and the steps of implementing computer science [6]. Beside, this system was also developed as a Curriculum Alignment Tool (CAT) and Standard Alignment Tool (SAT) [5][7], in which CAT was implemented to align curriculum learning materials with state standards automatically [2].

Furthermore, SAT was intended to harmonize standards to the domain of teachers and institutions service alignment grip [8]. How to operate the K-12 framework system was very interesting and had to be examined in relation to many information that was available in network systems that could be utilized with a variety of form and search systems [9][10]. Therefore there was need to filter that information automatically that corresponded and aligned with standards or curriculum [6].
2. Method
Concerning the process of operating K-12 framework system, the technique that was implemented in this article was intended to describe the process, through navigating information that could be used as learning materials. Literature review was chosen to compare some views and findings of previous researchers that are related to the implementation of K-12 system and its implication in education, especially in general schools in US.

3. Results and Discussion

3.1. Learning Standards in K-12 System
In sciences, since 2015, the Washington legislature demanded the application of the K-12 framework standard as a manual to design, assess and prepare the teachers in learning which focused on five basic concepts [2], that is computerised system, network and internet, data and analysis, algorithm and programming, and computerized impact.

K-12 learning standards enabled students to understand the science concepts and practice in which the students of the ages ranging from kindergarten to grade 12 were able to develop problem solving capabilities related to applying higher order thinking skills on implementing a computerized system that is concerned with a wide range of science disciplines [2].

Practically implementing this system had vast potential of improving teacher’s confidence on information and instructional development in line with learning competences of each level of education that is from kindergarten up to grade 12 [11]. Through the implementation of this system, teachers could develop lesson plans, establish specific and intentional learning objectives to guide teaching and learning, conduct ongoing formative and summative assessments to check students understanding and efficacy of instruction, integrate computational thinking into their curriculum, and create an equitable environment [2]. The basic comprehension of computational methodology in implementing K-12 system depended on the capability to use a computerized system [12].

The framework of this computational thinking that is based on the understanding of a computerized system offered an opportunity to develop computational thinking in which its practice was applied in many subjects such as science and math and the revision was initiated by International Society for Technology in Education Standards for Students (ISTE) [11].

3.2. Navigating Concepts in K-12 System
Concepts framework in K-12 system could be seen in three ways namely grand band, concepts and development that the teacher could be able to filter the basic concepts and practices based on class level, basic concepts, basic practices or a combination of them [11].

Basic concepts framework in K-12 system included: (1) sub-concept which presented some concepts through grade level; (2) elaboration and examples added details and depth to the concept statements; (3) boundary statements were included to clarify what was not expected to be learned at that grade level; (4) cross-cutting concepts illuminated thematic connections across the different core concepts and were integrated into concept statements as relevant and appropriate [11].
This cross-cutting concepts were listed under a statement, as follows:

1) Abstraction: An abstraction is the result of reducing a process or set of information to a set of important characteristics for computational use.

2) System Relationships: The parts of a system are interdependent and organized for a common purpose.

3) Human–Computer Interaction: The design and use of computer technology, focusing on the interfaces between people (users) and computers.

4) Privacy and Security: Privacy is the ability to seclude information and express it selectively. Security refers to the safeguards and protective measures surrounding information systems.

5) Communication and Coordination: Computing processes are characterized by reliable communication between different agents that coordinate toward common outcomes.

3.3. Navigating The Practices in K-12 System

The basic practices of computerisation in K-12 system described the behaviors and ways of thinking that computationally educated students to fully engage in today’s data-rich and interconnected world [11].
The basic practices included:
1) Fostering an inclusive computing culture.
2) Collaborating around computing.
3) Recognizing and defining computational problems.
4) Developing and using abstraction.
5) Creating computational artifacts.
6) Testing and refining computational artifacts.
7) Communicating about computing.

4. Conclusion
Implementing the K-12 system was one of US Federal effort to enable educators to ensure that the students succeeded in educational processes in general schools in the form of enacting an automated school curriculum alignment based on Information and Communication Technology (ICT). The basic framework concepts in K-12 system included sub-concepts, elaboration and example, boundary statements and cross-cutting concepts. The basic practices of computerisation in K-12 system described the behaviors and ways of thinking that computationally educated students to fully engage in today’s data-rich and interconnected world.

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