PIES - Personalized Integrated Educational System

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Abstract

Due to the shift from the industrial age to information age, new educational needs require a new paradigm of education, one that is focused on learning rather than sorting students, one in which student progress is based on mastery, not on time. This new paradigm requires that technology serves new roles or functions. Reigeluth, Watson, Watson, Dutta, Chen & Powell (2008) identified four major functions and several secondary functions for technology to serve in the new paradigm. While the authors used the term Learning Management System for a system that serves all those functions, that term is often used to refer to course management systems and other systems that do not serve all those functions. To avoid confusion, we now call this system “PIES – Personalized Integrated Educational System”. This paper elaborates on the PIES functions identified by Reigeluth and his colleagues (2008) and addresses issues of system architecture and interfaces, including open educational resources and Web 2.0 tools. The paper describes recent advances in the design of a modern, information-age educational technology system that incorporates many vital functions to meet educational needs, including record keeping, planning, instruction, assessment, communications, administration, and more. It incorporates the latest Web 2.0 tools and resources available. Having a flexible, open-source architecture, it has backward, current, and forward-looking capabilities to guide and assess students’ progress and help make available and deliver personalized instruction.

Overview

In recent years, a shift of the education paradigm from the industrial age to the information age has been discussed among educational researchers (Reigeluth & Duffy, 2008; Watson & Reigeluth, 2008). Reigeluth and Carr-Chellman (2009) proposed that a true paradigm shift in education could be realized by two developments: advanced technologies and the advancement of learner-centered psychological principles and methods of instruction. Technology plays a central role in the learner-centered paradigm (Reigeluth & Carr-Chellman, 2009). Reigeluth et al. (2008) identified four major functions and several secondary functions for technology to serve in the new paradigm. While the authors used the term Learning Management System for a system that serves all those functions, that term is often used to refer to course management systems and other systems that do not serve all those functions. To avoid confusion, we now call this system “PIES – Personalized Integrated Educational System”.

Moreover, the term “Web 2.0” became popular when O’Reilly Media and MediaLive hosted the first Web 2.0 conference in 2004. In his famous paper What is Web 2.0: Design Patterns and Business Models for the Next Generation of Software, O’Reilly elaborated on the term “Web 2.0” (O’Reilly, 2005). A wide variety of Web 2.0 applications have been investigated by practitioners and researchers from different disciplines, including Wikis, Blogs, podcasts, simulations, serious games, virtual reality, mobile devices, social bookmarking, and social networking sites (Berlanga, Sloep, Van Rosmalen, Bitter-Rijpkema, & Koper, 2007; Boyd & Ellison, 2008; Farrelly, 2008). The rapid evolution of Web 2.0 Technologies has generated a new level of communication and interaction among learners.

This paper elaborates on the PIES functions identified by Reigeluth et al. (2008) highlighted in Table 1 and addresses issues of system architecture and interfaces, including application and integration of open educational resources and Web 2.0 technologies.
Table 1.

Four Major Functions & Secondary Functions of an Information-Age PIES identified by Reigeluth et al. (2008)

<table>
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<tr>
<th>Record-Keeping</th>
<th>Planning</th>
<th>Instruction</th>
<th>Assessment</th>
<th>Secondary Functions</th>
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<td>- Long Term Goals</td>
<td>- Project Initiation</td>
<td>- Presenting Authentic Tasks</td>
<td>- Communication</td>
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<td>- Personal Attainments Inventory</td>
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</table>

Major Functions of PIES

The four major functions of PIES include (1) record keeping, (2) planning, (3) instruction and (4) assessment for student learning.

1. Record keeping: In the new paradigm of education, one of the most important functions is to keep a record of what each student has mastered. Current report cards only serve as tools for sorting the students, and they do not indicate what a student has actually achieved. The record keeping function has a number of sub-functions: (1) a standards inventory, which identifies and maps all the required standards and many optional standards in all domains, (2) a personal attainments inventory, which portrays the standards each student has mastered, and (3) a personal characteristics inventory, which identifies each student's learning styles, profile of multiple intelligences, interests, major life events, and anything else that is useful in improving the learning experience for a student.

2. Planning: Based on the data in the record keeping function, decisions must be made to plan for student learning. The planning function of PIES has many sub-functions to (1) help students, parents and teachers to set long term goals; (2) figure out current learning options that will help students to achieve their long term goals; (3) pick some of the current options and set them as short-term goals; (4) identify projects for achieving the short-term goals; (5) set project teams based on students' interests; (6) decide on the roles that the teacher, parents and others will play to support the student's learning in the projects, and (7) develop a contract that identifies goals, projects, teams, roles, deadlines, and milestones.

3. Instruction: The instruction function of PIES helps students and teachers to (1) initiate each project, (2) provide resources/tools/guidance for instruction, (3) provide project support by monitoring and managing the project teams, and (4) guide teachers for developing new instruction, if needed. These sub-functions provide customized and learner centered instruction to maximize student learning.
4. Assessment: In the new paradigm teaching and testing are fully integrated. The sub-functions help teachers to (1) present authentic tasks for student assessment; (2) evaluate student performances based on those tasks, (3) generate immediate feedback on student performances, (4) provide certification when an attainment has been met, (5) develop student assessments such as rubrics, tests, etc., and (6) improve instruction and assessments based on their effectiveness.

Secondary Functions of PIES

There are also some secondary functions that are not directly related with student learning but can play a great role in facilitating student learning. (1) The communication function involves teacher communication and collaboration with other teachers, with students’ parents, and with students. It also allows students to communicate and collaborate with each other to facilitate their learning. As mentioned at the beginning of this paper, Web 2.0 technologies integrated in PIES will help generate a new level of communication and interaction among students, teachers, and parents. (2) The general student data function provides access to such data as the student’s name, address, birth date, parent information, health information, attendance, student’s mentor and other teachers, records of major life events, the school or learning community the student belongs to, the student’s home room, and community organizations with which the student is involved. With this function, PIES will gather, secure and allow convenient management of data such as those described above in order to support the learner-centered learning environment. (3) The school personnel information function provides access to such information as a staff member’s name and address, assigned students, certifications and awards received, professional development plan and progress, and the teacher’s physical location. Appropriate management of the school personnel information will support the role of teachers as facilitators, coaches, and mentors that is required in a learner-centered environment (McCombs & Whisler, 1997). (4) The PIES administration function oversees the whole system, including restricted access to sensitive information about students.

System Architecture and Interfaces

The PIES concept is envisioned to be a comprehensive, fully-featured, open-source software application that is free for anyone to develop, modify, and redistribute. Many of the functions and features mentioned could be developed into an actual working PIES application using and combining smaller, separate and currently available open source applications. Some of these applications might include Linux (base operating system), MySQL (database), Drupal (content management), Moodle (base LMS - if it can be extended), and Firefox or Flock (web browser). PIES would also include smaller built-in applications for chat, playing and authoring media, collaboration and social networking, and data integration and analysis.

In terms of instructional content, PIES would also provide easy portal access to the growing number of open educational resource (OER) repositories such as Curriki, Connexions, TeacherTube and MERLOT. OERs are free educational resources that have been developed by a growing community of teachers, authors, and content producers, and are also open to customization and continual improvement for individualized student instruction. This cost-effective open curriculum of free resources would be owned by public taxpayer dollars and allow school funds to be released from textbooks and other commercial products and put toward more worthy education expenses like teacher salary and other more urgent expenses that better serve student needs (Wiley, 2009). The quality of this OER content may be easily peer-reviewed and rated by users.

PIES would offer a flexible, customizable, easy-to-use, homepage interface such as in Elgg, Facebook, Ning, and iGoogle that would connect all PIES functions. The layout, basic functions, and preferences (RSS, text messages, chat, email, built-in media player, discussion boards, records of student attainments, teacher and course evaluations) would be highly customizable. The interface provides teachers and students with progress data, time on task, and many other metrics, while providing for social interaction and the “network effect” (Bush, 2009) of powerful mass-participation and collaboration. PIES would be ported and available to any internet-enabled device (PC, laptop, cell phone, PDA, etc.). Content could be downloaded, stored and made available “offline” for use without Internet access. All of these components of PIES are illustrated in Figures 1, 2, 3 and 4 below.
Figure 1. PIES - General Components

Figure 2. PIES – Hardware Technology Components

Figure 3. PIES – Information-Age Functions
Future Activities

Based on the PIES conceptual framework and design architecture, additional work needs to be done to further design and develop PIES. To this end, a group of researchers in our research group is in the process of finding funding to design and develop a true PIES, which will incorporate information-age functions and open educational resources in one integrated platform.

References


