The Role of Personalized Integrated Educational Systems in the Information-Age Paradigm of Education

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Abstract

Reigeluth, Watson, Watson, Dutta, Chen, and Powell (2008) identified major and secondary functions of technology for the information-age paradigm of education. Major functions include record keeping, planning, instruction, and assessment for student learning. Secondary functions are communication, general student data, school personnel information, and technology administration. Based on these functions, seven classroom teachers and one technology coordinator from three high schools were interviewed to reveal how they used technology systems with respect to these functions. The results revealed there were discrepancies between the current use of the systems and the ideal use for the information-age paradigm of education. Based on the results, recommendations are offered to teachers, policy makers and technology system designers for better meeting students’ information-age educational needs.

Introduction

A shift from the industrial age to the information age has happened (Toffler, 1980, 1990) and has been changing our social and economic lives more than we may have realized. The needs and expectations of students are very different than before. Similarly, the responsibilities and roles of teachers have been changing dramatically. Changes in the needs of students and teachers require changes in the supportive technologies that they use to meet their new needs. According to Gilhooly (2001) and Watson, Lee, and Reigeluth (2007), recent developments in educational technology can help meet these needs in the information-age paradigm of education.

The information-age paradigm of education, which is currently implemented in very few schools, has a number of characteristics. First, it requires criterion-referenced assessment, which involves the assessment of student learning compared to what the student should attain or can handle with regards to the learning objectives (Knight, 2001), instead of ranking, ordering and comparing individuals with their classmates, which is an industrial-age practice (Smith, 1973). In addition, attainment-based student progress is essential in an information-age learning environment. According to Reigeluth (1995), achievement needs to be a “constant” at the competency level, but time should vary based on the progression of each individual student. This competency-based progression accommodates students’ different paces of learning.

In addition, customized learning is another important characteristic of the information-age paradigm of education. In order to customize students’ learning, individual data such as a student’s goals, objectives, characteristics, and attainments mastered need to be kept. In this sense, each student will have a number of individualized attainments that need to be met. Since students have different interests, attainments, learning styles, and paces of learning, the role of the teacher needs to change in order to accommodate the new learner needs.

Thomas (2000) promotes project-based learning as a way of creating a realistic constructivist environment where students are actively involved in an authentic learning environment and intrinsically motivated. Therefore, project-based learning can be utilized in the classroom in order to help students attain individualized objectives by doing the projects that are aligned with their personal learning plans. The teacher plays a role of facilitating and coaching students’ learning rather than delivering content.

Theoretical Framework

So what functions should a technology system perform in order to meet learners’ needs and accommodate these changes in the emerging information-age paradigm of education? According to Reigeluth et al. (2008), administrators, teachers, and students need a system that can facilitate and enhance four major information-age
functions for student learning: record keeping, planning, instruction, and assessment. The system also needs to perform several secondary functions, such as communication, general student data handling, school personnel information handling, and technology administration (Reigeluth et al.). These functions and their sub-functions are highlighted in Table 1.

Table 1.
Four Major Functions & Secondary Functions of an Information-Age PIES Proposed by Reigeluth et al. (2008)

<table>
<thead>
<tr>
<th>Record-Keeping</th>
<th>Planning</th>
<th>Instruction</th>
<th>Assessment</th>
<th>Secondary Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Standards Inventory</td>
<td>- Long Term Goals</td>
<td>- Project Initiation</td>
<td>- Presenting Authentic Tasks</td>
<td>- Communication</td>
</tr>
<tr>
<td>- Personal Attainments Inventory</td>
<td>- Current Options &amp; Requirements</td>
<td>- Instruction</td>
<td>- General Student Data</td>
<td></td>
</tr>
<tr>
<td>- Short-Term Goals</td>
<td>- Project Support</td>
<td>- Instructional Development</td>
<td>- School Personnel Information</td>
<td></td>
</tr>
<tr>
<td>- Personal Characteristic Inventory</td>
<td>- Projects</td>
<td>- Instructional Development</td>
<td>- Providing Immediate Feedback</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Teams</td>
<td></td>
<td>- PIES Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Roles</td>
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</tr>
<tr>
<td></td>
<td>- Contracts</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Certification of Attainments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Developing Students’ Assessment</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Improving Instruction &amp; Assessment</td>
<td></td>
</tr>
</tbody>
</table>

Watson et al. (2007) point out that the information-age paradigm of education requires a kind of computer system that has built-in components to support the information-age functions mentioned above. While the term Learning Management System (LMS) was initially used for this kind of information-age system, it was often confused with Course Management Systems (CMS) and Integrated Learning Systems (ILS), so the term Personalized Integrated Educational System (PIES) was adopted.

**Methods**

**Research Question**

The major research question of this study is:
1. How are classroom teachers using their technology systems with regards to the information-age functions identified by Reigeluth et al. (2008):
   a. Major Functions
   b. Secondary Functions.

**Research Context and Design**

This research study was a qualitative case study with semi-structured interviews. It took place in all three high schools, which we call High School A, High School B, and High School C, in a relatively homogeneous small city in the Midwestern United States. The school district had approximately 10,000 students attending elementary,
middle, and high schools. In the three high schools teachers used technology systems relatively actively. At the time of this study (2008-09), High School A had approximately 1,600 students, High School B had about 1,700 students, and High School C had around 80 students (ninth and tenth grades only), but increasing one grade level each year until it includes 12th grade). Technology use and resources varied across the three high schools. For instance, the curriculum in High School C was highly technology-focused and team-project oriented.

In these high schools, Moodle was the predominant technology system used to foster student learning. Therefore, the features and use of Moodle were investigated for this study, but another system, Skyward, was also investigated. Moodle is a free system that has open-source architecture. It can be used for developing, managing, and utilizing learning sites for students' learning. It has a flexible interface, which allows teachers to customize it to meet their classes' needs. Skyward is a proprietary system used only for administrative issues, such as storing and managing the data related to student management. It is widely used for K-12 settings, being used in over 1,300 school districts around the world (Skyward, 2010).

Participants

The purposive sampling technique was used to select the participants from the three high schools. The criterion for selection was a high level of usage of Moodle to support student learning. A preliminary interview was conducted with the technology coordinator, who was responsible for managing Moodle in all three schools, to identify all teachers who met this criterion and also to get a general understanding of how teachers used Moodle in the school district. The technology coordinator identified eight classroom teachers from different subject areas and grade levels who actively used Moodle. While we would like to have had more participants, this was all who met the criterion in this school district’s high schools, and it provided a sufficient number for triangulation of results. Invitational e-mails were sent to all eight of them, and seven agreed to participate in this study, as well as the technology coordinator. Table 2 outlines general information about these participants, their schools, and their subject areas.

Table 2
Research Participants, School and Subject Area Information

<table>
<thead>
<tr>
<th>Participant pseudonyms</th>
<th>High school pseudonyms</th>
<th>Subject areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cody (Male)</td>
<td>A</td>
<td>Technology Coordinator</td>
</tr>
<tr>
<td>Amber (Female)</td>
<td>A</td>
<td>Math teacher</td>
</tr>
<tr>
<td>Laurie (Female)</td>
<td>A</td>
<td>Japanese &amp; ENL teacher</td>
</tr>
<tr>
<td>Joshua (Male)</td>
<td>A</td>
<td>Math teacher</td>
</tr>
<tr>
<td>Michael (Male)</td>
<td>B</td>
<td>Math teacher</td>
</tr>
<tr>
<td>Clint (Male)</td>
<td>B</td>
<td>Language Arts</td>
</tr>
<tr>
<td>Jake (Male)</td>
<td>C</td>
<td>American History teacher</td>
</tr>
<tr>
<td>Angela (Female)</td>
<td>C</td>
<td>Software technology and careers</td>
</tr>
</tbody>
</table>

Data Sources/Data Instruments

Data were gathered from the seven classroom teachers and one technology coordinator through semi-structured interviews. These interviews took about an hour to an hour and half for each of the participants. All interviews were audio-recorded, and transcribed verbatim. The interview questions focused on gathering data about how teachers were using their technology systems, such as Moodle and Skyward, and whether these uses were aligned with the four major functions as well as the secondary functions of an information-age PIES. For member checking, seven of the eight participants reviewed the transcription of their interviews by email correspondences. The other participant was out of contact.

Data Analysis

The primary analysis method was content analysis. The coding sheet was prepared according to the theoretical framework of the PIES functions. Three researchers coded the transcribed data of all eight interviews independently using separate coding sheets for each interview in order to check inter-rater reliability. After completing individual coding, the three researchers discussed their results to reconcile their differences and created a
final coding sheet with a 100% level of agreement. Using this final coding sheet, the researchers analyzed the data and induced emerging themes.

Results

Results for Major Functions

Based on our findings, Moodle was not used for the record keeping function. All of the seven teachers used Skyward to keep their students’ grades for each course, but they did not utilize it to keep track of personal attainments, personal characteristics, or standards for students. In addition, there was limited evidence that suggests Moodle was not utilized for creating customized learning plans. Two teachers out of seven suggested that there were two major factors that constrained them. First, the central office discouraged teachers from setting individualized learning goals. Second, teachers had not found any functions they could utilize for planning in Moodle or had not figured out how to use the functions.

The third function of PIES is instruction, and it includes four sub-categories: project initiation, instruction, project support, and instructional development. Overall, it was found that a few interviewed teachers had used the instruction function to a small extent. For the first sub-function, project initiation, two out of seven teachers had used Moodle, however, their use of Moodle was very limited for this sub-function. In addition, evidence of using Moodle for other sub-functions of instruction such as project support and instructional development were almost entirely absent from the interviews.

In addition, use of Moodle to assess students’ academic achievement was limited to formative evaluation, which had been used by only three teachers. Only these three teachers had used the quiz function to provide feedback on students’ performance and had utilized the results to improve their instruction. However, none of them had used Moodle for summative assessment.

Results for Secondary Functions

Teachers used different tools to communicate with parents and students. They frequently used asynchronous chat to communicate with students instead of instant messaging and used Moodle to give feedback to the students. Our findings suggest that there was no use of Moodle for communication among teachers.

The technology coordinator stated that in these three high schools, they used Moodle to record each of the students’ information to the database. However, these records did not include information related to the information-age components mentioned above. These records were initiated at the beginning of each school year, and then they were static during the school year.

As general student data were not kept in terms of the learner-centered approach, school personnel information was just kept for documentation. There were no data gathered about administration of Moodle. The implications of these results are discussed in the paper. The study identified the following implications:

• Discrepancies between the current use of Moodle and ideal information-age functions,
• Different uses of technology and tools for different tasks (e.g. Skyward for keeping grades),
• Different uses of Moodle in different subject areas.

Conclusion & Discussion

Research findings suggest that there were discrepancies between the current use of technology systems and the identified functions of PIES in the information age. None of the seven teachers utilized Moodle for keeping students’ personalized record. Also, there was no evidence that Moodle was being utilized for creating and storing a customized learning plan for each individual student. The interviews with the teachers indicated that the standardized education system discouraged teachers from setting individualized learning goals, and they could not locate enough features that supported individualized learning in Moodle. Although the teachers frequently used Moodle for sharing resources and instruction, and utilized the discussion-forum, chatting, and glossary features for instructional purposes, evidence of project support and instructional development were scarce or nonexistent. The quiz function was frequently used to formatively assess students’ knowledge, but the means of assessing students’ knowledge was far from that of the information-age learning paradigm. Moodle was partially used for secondary functions. General student data and school personnel data were kept in Moodle for documentation. Instead of Moodle, Skyward was used for one-way communication with students and parents, and email was used for two-way communication.
In addition, it was found that the teachers used different types of technologies for different tasks. This was mainly because of the schools’ policies on the use of technology systems and the teachers’ preferences. The teachers had to use what the school district required. When they had freedom to choose, they used more familiar technologies. Also, teachers in different subject areas used different kinds of technologies. They identified useful features based on the characteristics of their subject content, and utilized those functions. For example, an American studies teacher and Japanese and ENL teacher frequently used the discussion forum and chatting functions. On the other hand, math and technology teachers found those irrelevant to their subject areas, and found other features that could be easily adopted for their subjects, such as the quiz function.

Based on the findings, the following suggestions to teachers, technology system designers, and policymakers were made. Teachers need training both in instructional methods for customized, learner-centered instruction, and in use of a new technology system, and they need more time to develop instruction and tests during their first year of using a new system. In order to facilitate teachers’ uses of a technology system, technology system designers should make it easier to learn and use, make it interoperable with other technology systems, as well as incorporate more functions into their system tailored to the various subject areas. Educational policymakers need to find a way to better facilitate and support the customized, learner-centered educational paradigm, including providing funding for technology systems and teacher training, and letting teachers devote additional time to developing customized instruction and assessments.

References