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The Impact of Internet on Education: Towards an Emerging Paradigm

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Abstract

In today's e-commerce era, more than ever, we need to equip our students to be independent on-line learners. In this article, we will look into the use of online education as a means of understanding the emerging educational paradigm (from a teacher to a student-focus paradigm). Specifically, the focus is on the secondary school system in which the aim is to comprehend and explore the reasons behind the emerging trend, the flaws in the existing schooling system, the characteristics and effects of our proposed paradigm. Finally, we conclude that the proposed educational paradigm whereby online education is provided to supplement the current traditional classroom based teaching could become a reality sooner than expected.

Keywords: Internet-based Education, Information Technology, Secondary School Education

1. Introduction

In today's Internet era, it has become evident that Internet-based technology now plays a significant role in education, whereby it provides educators with the opportunity to implement a range of new teaching and learning philosophies. In particular, the Internet and the World Wide Web are providing students and teachers with a medium through which the development of information technology handling skills and the use of student-focused teaching paradigms can be a reality. With new software and networked multimedia packages, we see a real possibility of a revolution in the education field, whereby the student would now be the focal point of the learning and the teacher would play the role of facilitator, rather than transmitter. While this may make student performance evaluation difficult for teachers, it will certainly make learning much more individualized, interesting, and exciting for the pupils (Spender, 1995). Students who have such control over their own learning and topics of inquiry are more likely to be motivated because education takes on a much more intense meaning for them under these circumstances (Garner & Gillingham, 1996).

Currently, what schools are still practicing is to have students physically present at their place of study to receive their education. The distance traveled is determined by the school's location from their homes. Lessons are taught by a teacher standing in-front of the class wielding a generally accepted textbook and a ministry of education approved syllabus. The learning is passive. The teacher is merely a transmitter of knowledge, information and facts. If the transmitter is ineffective, the learning process will thus be prone to failure.

In order to ensure that our education system does not become outdated, we need to begin to understand the impact of the Internet on education. In this article, we will look into the use of online education as a means of understanding the emerging educational paradigm (from a teacher to a student-focus paradigm). Specifically, the focus is on the secondary school system in which the aim is to comprehend and explore the reasons behind the emerging trend,

the flaws in the existing schooling system, and the characteristics and effects of our proposed paradigm.

2. The Emerging Trend

There are several reasons why the emerging educational paradigm is taking place best at the secondary education level. For students in primary education, the main thrust of their education is to teach them the fundamentals of things, like mathematics and science that will form the foundation for their future education. As for students in tertiary education and above, they are often already engaged in some existing form of online education. At the same time, they will also be more resistant to any changes in their learning style, as well as the fact that by this time, it is much too late to try and move them onto paths tangential to what they are currently studying. As for secondary education, the timing is just right. Secondary students have the foundations on which to build to do their own self-study. They are still malleable enough to be taught new ways of learning (e.g. in using new interactive educational software, chat programs and in searching the World Wide Web).

Perhaps the most important reason for this emerging shift of paradigm from teacher-focused to student-focused is the changes brought about by technological advancement. In this fast-moving and technology-driven era, it is no longer enough to spoon-feed students with information because what they learn will soon be outdated. This has been followed by the emergence of more sophisticated interactive multimedia packages that offer true inquiry-based learning, where students must use to construct and demonstrate their solutions to a variety of in-class projects. On top of this, several schools around the world have also incorporated a variety of applications to complement the traditional form of teacher-focused education.

At the Foothill Middle School in Walnut Creek, California, an application called the CLP (Computer as Learning Partner) project has been used to provide software tools for classroom use that help students construct an integrated understanding of science. This has been achieved through the use of simulated experiments involving scenarios common to students (e.g. Is it faster to cook a batch of spaghetti by boiling it in one large pot, or two smaller pots?). This is another step towards incorporating technology in the education system.

At Rosewood Elementary in Rock Hill, South Carolina, fifth graders are exploring science, history and culture around the world with the help of the Internet and the KIDS '95 system. This system incorporates Internet Relay Chats (IRC's) features so as to allow students to supplement what they learn in class through conversations with over 37,000 students aged between 10 and 15 years from over 71 nations.

All these systems are a good indication of a growing trend that has begun to utilize the technology that is currently available to help bring about a shift in the education paradigm. This shift is something that has long been sought after and is finally coming true.

3. Flaws in Traditional Schooling Systems

The traditional method of teaching has been around since our grandparents' days, long before the Internet was introduced. Unfortunately, we still do not see much difference in the way lessons are conducted. For example, the syllabus is fixed to what the textbook offers. The education system is such that what is taught would fit the general student population, a one-size-fits-all policy. The students are not given full freedom for expression. Homework is given, marked and returned after a few days, with red ticks and crosses on the exercise book. What has been described may seem all too familiar, but what are the specific problems,

which encompass the traditional methods? We shall now look in detail into these specific problems.

The theories taught to students are based on the teachings in the textbook. The problem is that with the limited classroom time the teacher has, and the limited materials presented to the student, more often than not the student is not able to apply the knowledge learnt to different situations. Whitehead (1929) referred to this failure to apply learning as the "inert knowledge" problem. A number of studies have shown that traditional approaches to instruction often produce inert knowledge (e.g., Bereiter & Scardamalia, 1985; Bransford, Franks, Vye, & Sherwood, 1989; Gick & Holyoak, 1983; Perfetto, Bransford, & Franks, 1983).

The second problem is that the teacher is not able to monitor the progress of individual student during teaching. Imagine a scenario whereby the class of 30 students is being taught a new topic on Integration for Additional Math. The intellect of each of the 30 students will vary in some way or another. After a second explanation, probably half of the students would have grasped what is being taught on the board, whereas the other half would be lost. How would the teacher know when to repeat himself or herself, when to move on to the next topic and more importantly, how would the teacher know if the students really understood him or her? Being young adults, the students normally wouldn't approach the teacher for help even if they didn't understand the lesson. In the limited time given, the teacher normally has difficulty in monitoring the progress of each individual student in class. What can the teacher do even if he or she knows that some students are lagging behind? Can the teacher afford to make time for them and sacrifice the time of those who already understood the lesson?

Another problem is that the traditional teacher-focused paradigm uses a 'one size fits all' method, which does not cater to individual needs and ability. In the school environment, if the teaching were such that it adopts a 'one size fits all' policy to maximize resources, how would the school administration know if the student was being fitted with the correct 'measurement'? In the case of Singapore a student with artistic talents may end up being routed to study the sciences by his parents and the education system, thus neglecting their potential in other fields. The stream that a student may enter will ultimately determine the course, which he will be doing at the tertiary level. This streaming process begins at the secondary school level, where some students are still unaware of what their strengths may be, given the fixed curriculum and syllabus that the school advocates. For example, to be an engineer, the student would have to take subjects with a science focus. But not all students are born engineers, so how can they truly know during their teen years of what they would want to do in the future? How can we hope to maximize an individual's potential from young, merely through the common basic education that every student receives in school?

The fourth problem with the traditional system is that it does not encourage active knowledge seeking. The learning process is passive in nature. It goes through a very simple process, comprising of the teaching and explanation stage, the practice stage and the evaluation stage. The first stage is largely dependent upon the teacher's ability to impart knowledge to the students according to the teaching skills they have learnt during their own university days. The practice stage is mostly conducted in an independent manner, whereby the students will have to do their exercises on their own or in small groups. Whether they truly have learnt from these exercises will only be reflected by their test and examinations results. A major flaw in this process is the length of time between the teaching and evaluation stages. By the time the evaluation results are known, it may be too late for the teacher to do anything effective about it. The problem with this entire process is the passiveness and lack of responsiveness of the traditional system. It does not encourage active knowledge seeking. Rather, it tends to be just passive absorption of information and knowledge. This can give rise to loafing, a problem that would be hard to detect until the results of the student's test or

examination come out. It is hard to notice, in a class of 30, students who may be daydreaming or not catching up with the teaching.

To have a strong foundation in terms of knowledge is very important and in order to achieve that, materials for reference must be ample and of course, be of a certain acceptable standard. It is also important to show the students the relevance of what they are learning with what their tertiary level education demands, requirements that are not being adequately met at the secondary level.

4. Towards a Student-Focused Paradigm

The problems that we have identified can potentially be solved with the use of technology, complemented with the implementation of certain policies. Without a doubt, changing the whole education system to facilitate the use of the newest technology is not going to work. It might not only not eliminate the existing problems, but may create new ones as well. The human factor is still an important part of education, else we can simply buy education software and let children stay at home to be instructed in front of a computer monitor. However, what we are looking for instead, is how to use IT to supplement the traditional instruction methods. This proposed paradigm aims to alter a teacher-focused to a student-focused education system. The shift of the teaching paradigm will be facilitated by the use of modern Internet and software technologies. The integration of IT into the education system could be implemented by substituting 1 or 2 days of classroom teaching with remote teaching from the student's homes, via the Internet. Student motivation to do work is increased: "Technology rich schools report higher attendance and lower dropout rates than in the past. Students are found to be challenged, engaged, and more independent when using technology" (NatTechPlan, 1996).

In order to compliment these IT improvements, certain other changes need to be made to the current methods of teaching. In order to move towards a student-focused teaching environment, certain methods of practice need to be modified in conjunction with the technological changes. Project-based assignments could be assigned to groups of students who need to work together to gather information through some simple information searching and conclusive study. It gives the teacher better command and control, as managing 5 – 8 groups of students is definitely easier than 30 students at one go. These small groups within themselves can also learn from one another. At higher levels, we might upgrade these small project groups to form virtual workgroups. The students can then do assignments together, meet online to discuss the points and also exchange information by directly referencing the information from the Internet web pages.

Learning that occurs in a social context, such as collaborative learning, is gaining popularity. Therefore by implementing more project-based assignments to the students, they can embark on using collaborative learning using the Internet as a medium of communication. One remarkable factor for this move is the emergence of theories and perspectives emphasizing the social and situated nature of learning. The recognition of the importance of the social nature of learning, together with the advancement of educational applications of computer technology, have created innovative learning environments which challenge educational practices and research (Kumpulainen & Mutanen, 1998).

Students should not merely be passive recipients of information, but they should actively construct their knowledge and skills through interaction with the environment and through reorganization of their own mental structures. Consequently, as argued for example, by Scardamalia, Bereiter, McLean, Swallow and Woodruff (1989), computer-based learning environments should support the constructive acquisition processes in students (Vosniadou,

De Corte & Mandl, 1994). In line with this evolving conception of computer-based learning, there is a clear shift toward supportive systems that are less structured and less directive, that focus more on coaching rather than on tutoring, that involve student controlled tools for the acquisition of knowledge, and that attempt to integrate both tools and coaching strategies, in collaborative learning environments (Vosniadou, De Corte & Mandl, 1994). Instead of simply being assigned fact-based readings or provided with lectures, students begin their inquiry with challenging problems, and they learn information relevant to those challenges as the need arises (Schwartz, Brophy, Lin & Bransford, 1999).

In addition, embarking students on personal information gathering exercises is also beneficial in the sense that they will be exposed to a lot of information which may be relevant or not. They will then pick up the skill of critical thinking when they have to sift through the tons of information gathered from the World Wide Web, with the teachers as a guide. As students learn to sift through the vast amount of information on the Web, they exercise their critical thinking skills by judging the value of the information they find (Aggarwal, 2000). These critical thinking skills develop when the students are exposed to different perspectives and views with regards to their research topic. Some may be right and others may just show a different perspective. They then have to learn how to filter out the relevant and irrelevant or incorrect information from the web. In this way, they will not just sit in class and passively absorb information or even engage in social loafing.

In this way, the students actually adopt a more active approach; teachers will be devoting their time to working with students on interpreting, integrating, and structuring masses of information generated or accessed in digital form. Sense making, and asking the right questions in today's information-intensive, technology-mediated environments is extremely important to promote comprehension, critical thinking, and learning. In addition, using technology in the classroom empowers and engages the students in their own learning (Shneiderman, Borkowski, Alavi & Norman, 1998). And secondly, the research that they go through will allow them to access more materials and information on any particular topic. This will break the restriction of the limited content from the textbooks.

For this approach, teachers can first group students according to their different learning levels, trying not to put all the better students or the weaker students in the same group. After which, the teacher will e-mail the respective groups a list of links, which the students can follow and from there, start their information browsing with any available Internet Browser. Interaction among the group members online could be through software like MIRC or ICQ. With ICQ, live audio sessions can also be created for the group to discuss details during their research. These technologies can be sustained quite comfortably with the current standard of using 56.6K modems. The implementation of the Internet aided, project-based type of learning is not bound by location and time, and therefore can be conducted at the convenience of the students. Students can review their lessons and do exercises at their convenience. They can receive feedback from the exercises quickly so that they know what they need to focus on, thereby saving traditional classroom time, which would otherwise be used to correct and review homework assignments (Aggarwal, 2000). Monitoring software can also be installed to check the student's login sessions, to make sure that they are actually spending an appropriate number of hours online for educational purposes. The school could also maintain a proxy server whereby the students will have to login to the school's network for Internet access, which saves on the monitoring effort as scripts can be written to log each student's login period.

While the teacher can and may need to closely monitor each student, the use of IT actually removes the hassle of a one to one monitoring. With the monitoring and assessment software available, the teacher can effectively monitor the progress of each student without physically

being with the student or flipping through his past records. An implementation of this could be as follows.

Students will all log in to the school's network during the stipulated time on the online learning days, which the school may declare for students to stay at home and do their learning online. The software would automatically update the attendance to the teacher, who would be online herself also. Online discussions could then be conducted, as well as online quizzes. The teacher, with the help of this assessment software, can then view the marks of the quizzes that the student has done online. He or she can also monitor the speed and progress of all her students at once. In this way, the teacher can monitor the progress of each individual better and more effectively. Based on the assessment software, the teacher can also judge what aspects of the topic or syllabus the student is particularly weak in.

Students, in the meantime, can get an almost immediate feedback on the exercise or assessment they have just done, and need not wait for a few days before the results get to them. They can opt to seek help immediately from the teacher who is online to help the students with any problems they have, or seek to consult their own classmates who are online as well. This automatic feedback also makes for quick response time for students. They can see their correct answers and mistakes immediately after taking a test (Aggarwal, 2000). Alternatively, the software could provide online help or online tutorials, using multimedia to perform the teaching to them. The advances of web publishing supported by software like Flash and Shockwave, which incorporates rich multimedia with interactivity on the web, makes it easy to implement such online teaching aids.

The use of IT is about delivering the right information to the right people at the right time. The advent of the Internet has removed the barriers of time and space. Information is definitely in abundance over the Internet. With the use of the Internet, students will no longer be restricted to just textbook information and education videos. On the Internet, every topic will have a link to a related topic or a more in-depth discussion on the topic. It is almost endless.

The wide resources of information imply that students are able to learn more about their areas of interest, and by doing so, hopefully cultivate their own talents and strengths. A student taking Arts can learn about new drawing techniques, which the teacher may have failed to cover. Knowing more about their interests actually adds to the strength of the individual student, eradicating the problem of using a general focus on the students. The syllabus is expanded to fit different knowledge requirements, removing the 'one size fits all' phenomenon. It is up to the students to vary their depth of study into any particular area. By knowing more, students will probably have a better idea of what they may want to do in life. It also helps students to develop a more active form of learning. Passive learning could be a thing of the past as students enjoy the online learning program as described above.

Problems	Solutions
Student not able to apply the knowledge learnt to different situations.	Exposure to and required research from the Internet gives students exposure to variations of the same topic. The Internet provides the materials, but the filtering, selection and content depth of information gathered is up to the individual.
‘One size fits all’ in terms of syllabus being taught, neglects the individual’s potential in different fields.	
Does not encourage knowledge seeking, advocating only passive learning.	
Content of material limited by the standard textbook and knowledge of the teacher.	The use of small project groups to work on assignments whereby the students will work together like a virtual team, with discussions done on the Internet.
The teacher not able to monitor the progress of each individual during teaching. Social loafing.	Assessment software to be used to monitor the group’s progress.

Table 1: Emergence of Student Focused Online Education

5. The Proposed Schooling System

We have identified that the traditional teaching process comprises 3 basic steps, which are teaching, practice and assessment. The teaching process would be the explanation given by the teacher in the classroom, the practice process would be the homework assigned for the subject taught and the last process, assessment, would come in the form of continual assessments, test and examinations. The proposed system does not seek to change these 3 steps, but rather change the way these 3 processes are being carried out.

The first step will not be very much affected, and we still expect the teacher to explain to the class the subject syllabus via the board. But there will be an enhancement, whereby the student can go to the Internet and retrieve a multimedia version of the lesson being taught, to help them recap points that they might have missed. The second step, practice, would change from undertaking exercises from the textbook, to project work. This requirement to do a project-based homework, requiring the students to gather materials from the Internet will allow them to do their own research and customize their own learning. Lastly, assessment can now be done online. There is not much difference between filling-in-the-blanks on a sheet of paper to filling in the answers at a computer monitor, but the main difference is the response time. The student now need not wait for a few days later before they know their results. Assessment results can be made known almost instantaneous, as marking can be done by the software.

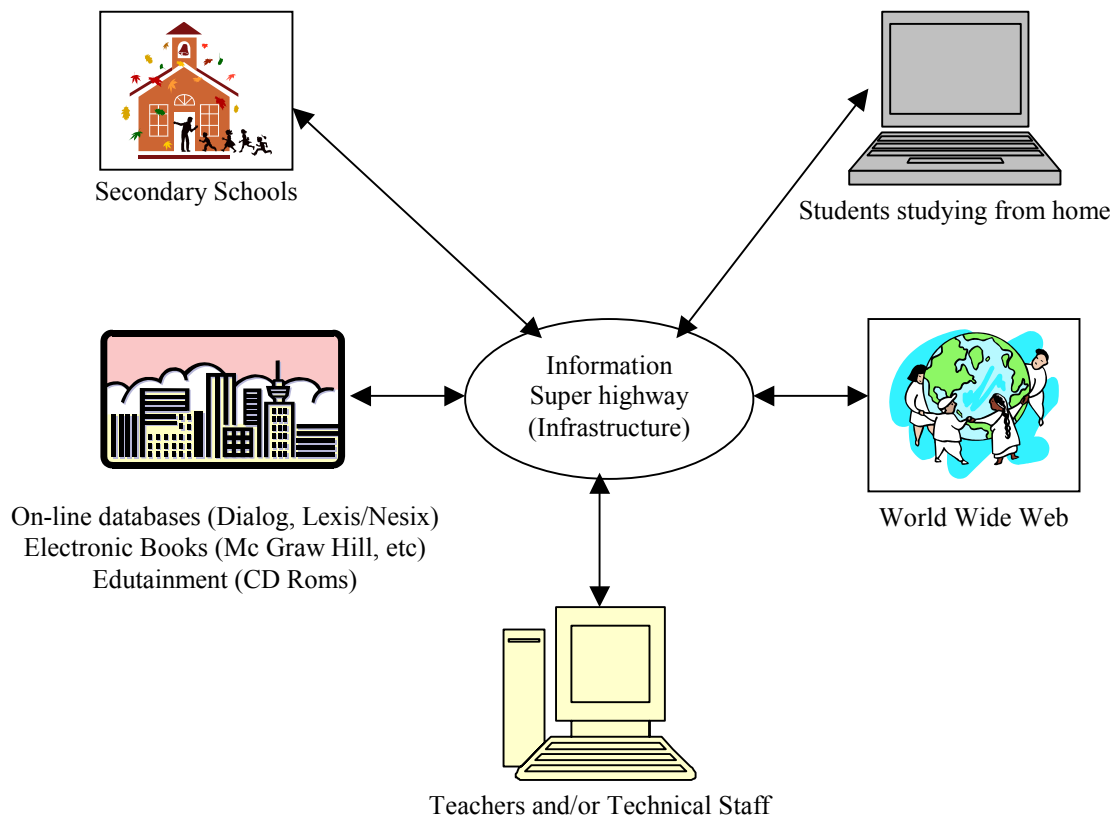


Figure 1: Components of our proposed system

Let us now provide a brief overview of the key factors that are affected by a change from the traditional schooling model to the proposed model, as well as the potential technical aspects that will accompany such a change. The factors covered include the mode of information delivery, the students' learning process, the methodology behind the teaching, the basic role of the teacher, and the material from which the students' will be able to get their knowledge.

Factors	Traditional Schooling Model	Proposed model	Technical Aspects
Information Delivery	Classroom lecture only	Classroom lecture + individual initiative and self-exploration	Networked computers with internet and on-line database access + CD ROM's
Learning	Passive absorption	Learning by doing or apprenticeship	Requires simulations for skill development and practical application
Methodology	Emphasis on individualism	Emphasis on collaboration and team learning	Require collaborative tools (email + egroups + chatting and conferencing)
Role of Teacher	Teacher knows all	Teacher as guide	Provide access to experts through internet
Material	Stable content (books (text + pic)) only	Rapidly changing interactive content (text + pic + audio + video + interactivity)	Require access to real-time news and publishing tools

Table 2: Traditional schooling model vs. Proposed model

By implementing a system such as the one proposed above, we can enhance the quality of education received by the students through the use of multimedia i.e. the use of text, pictures, video, and sound to present information. Within the last five years, there has been an explosion of computer-based multimedia applications in education. Some educators perceive multimedia to be the ultimate vehicle for improving education and reducing the dissatisfaction of students, parents, and teachers with schools (Gerlio & Jausoveo, 1999). With online education we can now harness the power of multimedia for the purpose of teaching, coupled in with interactivity and a vast database of readily available information.

Support for computer-based online multimedia applications develops from various cognitive theories. Schank and Cleary (1995), and Marsh and Kumar (1992) have emphasized that cognitive theories of semantic memory describe the structure of knowledge in a similar way to the manner in which information is presented in multimedia and hypermedia. Thus, the conclusion drawn is that online multimedia can enhance generative and natural learning. Rieber (1995) hypothesized that multimedia stimulates imagery and visualization. This direction is supported by a lot of historical evidence of how famous scientists and inventors have made their discoveries (Rieber, 1995; Gerlio & Jausoveo, 1999).

While normal traditional teaching does contain the element of multimedia, multimedia can be further utilized for online education. For example, by using computer multimedia, we can incorporate text, graphics, video and sound into one package, and these multimedia advantages could be viewed using a web-browser with normal HTML or more advanced tools like Flash or Shockwave. Interactivity is an additional feature, which can be added to the browser-based teaching or assessment.

However, research has shown that the most serious problems encountered in the application of multimedia are related to information access and retrieval. Particularly, novice users have been found to experience difficulty in processing information from multimedia and using the interface tools provided by the software (Kumpulainen and Mutanen, 1998). As such, there is

a greater need to train student when they are young on how to process and filter information gathered in this information-exploding age. With the advent of technology and the Internet, globalization is becoming a reality and unless our student population can effectively manipulate the information gathered from the Internet and learn to use the latest technology. Current Internet software has very comprehensive user interfacing and with the advent of free Internet access in some countries much of the anticipated worries are being taken care of.

Conclusion

Today, more than ever, we need to equip our students to be independent learners. To do so effectively, we need to begin early for reasons we have discussed. With the advancement of information technologies, we conclude that the proposed educational paradigm whereby online education is provided to supplement the current traditional classroom based teaching could become a reality sooner than expected.

There are a number of challenges, however, involved in implementing such a system that need to be highlighted and resolved. First, we have to consider the impact of such a system on other outcomes of traditional classroom education, such as social behavior, attitude and values. Second, we need to be careful about how much online education to implement and how the education of students may be adversely affected by a lack of personal contact and attention. Third, we also have to consider and ensure that parents are willing and able to take on this responsibility of having their children study online, as opposed to under the watchful eye of a teacher in school. Finally, we should be aware of the fact that by implementing such a system, we would require a change in the focus of the various key players in this system. These key players include the teachers, educational institutes, students, parents, authors and software providers, and publishers. The differences in these roles are highlighted in the following table.

Key Players	Traditional Role	New Role
Teacher	Provider of information	Facilitator in the pursuit of information
Educational institutions	Follow a standard syllabus while being stand-alone entities, with the main focus being to ensure that students meet a certain standard in attending classes, performing assessments and taking tests and exams	Follow a more flexible syllabus of education with a network of operations with other educational institutions, with the focus being on providing students with as much opportunity as possible to experiment and learn by themselves
Student	Passive receptacles of information whose education process is taken care of by the educational institutions and their teachers	Proactive seekers of knowledge, who now have the onus of ensuring that their educational process is personally enriching
Parents	Responsible for ensuring that their children go to school regularly where the school and teachers are responsible for giving them an education	Responsible for ensuring that their children do their work online from home, and that they learn the correct things from this experience, and not be waylaid by undesirable sites
Authors and software providers	Prepare general sets of textbooks and software to cater to the general student population	Prepare more detailed and diverse text and software to cater to the varied and specific needs of the students
Publishers	Publish textbooks	In addition, they also have to develop online databases, publish online materials and print CD-ROMS

Table 3: Change in role of key players

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