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## A Study Of Course Management Software Features

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**Keywords:** course management software, software tools, software capabilities

EDSIG activities include the publication of ISEDJ, the organization and execution of the annual ISECON conference held each fall, the publication of the Journal of Information Systems Education (JISE), and the designation and honoring of an IS Educator of the Year. • The Foundation for Information Technology Education has been the key sponsor of ISECON over the years. • The Association for Information Technology Professionals (AITP) provides the corporate umbrella under which EDSIG operates.

# A Study Of Course Management Software Features

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## Abstract

Educational institutions and businesses do have a variety of course management software to select from for developing and deploying distance delivery programs.  For this reason, selecting the one course management software for implementation can be quite a task for the end-user because these products can be quite different in their operating capabilities, systems requirements, and cost structures.  This study examines the operating capabilities of selected course management software.  Specifically, this research identifies the different types of components and their associated tools that are available in popular course management software packages.  Selected observations about needed systems requirements for implementing the software and their cost structures are also reported.

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### 1.  INTRODUCTION

The concept of education at a distance is not new because it is a practice that has evolved from the mid-19th Century (Neal 1999).  However, for most universities, distance education makes more sense now because their student bodies are changing to a more non-traditional clientele.  This is one of the main reasons why some 24 percent of distance education classes were held in computer-equipped classrooms and that 20 percent of the courses were already using e-mail before the year 2000 (Rahm & Reed 1997).  Most traditional classroom deliveries were using little to no computer technologies during the same period.  Given tighter budgets and the charge to educate more of the masses, distance education, especially those being delivered using Web-based technologies, can be a possible solution because of their impacts on the traditional teacher-to-student classroom structure.

To begin with, many of the obstacles to teaching and learning situations in which the instructor and the learner are geographically separated can now be minimized, if not eliminated.  Online learners now can have the luxury to access all forms of instructional files online and engage in independent study when desired and wherever there is a connection to the World Wide Web.  Contact with instructors and team members can be done with regular interactive technologies, live chat sessions, face-to-face discussions with posted messages and responses via electronic text-based messages, or using passive e-mails and attachments 24 hours a day, 7 days a week.  Best of all, among independent and mature learners, distance learning courses have been reported to compare favorably with classroom-based instruction and enjoyed high student satisfaction (Merisotis & Phipps 1999).

Distance education and e-learning has also gained acceptance in corporate America as well around the latter part of the last millennium.  Rapid advances in computing and information technology necessitates that employees engage in continuous learning or become obsolete.  To gain competitive advantages, many of these companies adopted e-learning into their training operations.  Currently, distance education instructions are delivered using electronic devices as well as materials that can be classified into four basic categories, namely audio or voice, video, data, and print (Kappel 1998).  Audio or voice technologies such as the common telephone and video conferencing are considered as interactive in nature because users can engage in real-time learning sessions.  Tapes and short wave radio are two common examples of passive audio tools.  Instructional video technologies include still images from slides, pre-produced moving images recorded in films, videotapes and DVDs, and real-time moving images via live telecast that can be viewed using a television or computer monitor.  Finally, print media refers to hard copies of books and journals.  In the Internet age, print media can also be defined to include all forms of online instructional material posted by instructors because distance education is now primarily in the form of Web-based delivery.

### 2.  STATEMENT OF THE PROBLEM

Access to education and education of the masses is a critical national priority because education is a significant factor in the socio-economic development and well

being of a nation. In the United States, the mandated education of a child from elementary to high school can be easily attained at little or no cost by selecting to attend a public institution. Beyond that, attaining a higher education can be a rather difficult task. Location can become a barrier for individuals living in states with small populations and where the citizens are residing in remote areas. For the non-traditional student who must work to maintain a family, for a physically-challenged but intelligent individual, getting an education from an institution of choice may be quite difficult. Another common major obstacle is money. Prior to the new millennium, more than half of the students attending a four-year institution were paying about $4,000 per year in tuition and fees. Some 25 percent of the total student population was paying tuition charges of about $8,000. Among public universities, the cost had risen from 9 percent of median family income in the mid-1980s to 15 percent of median family income (Neal 1999).

To begin with, corporate employees and their need for educational institutions to supply learning on-demand is a major reason for the cost increases. During the economic boom, about half of all people enrolled in higher education in the United States were participants in part-time classes or training. Universities, including prestigious institutions like Harvard, Stanford, Duke, Columbia, and The University of Chicago were quick to provide a variety of continuing education programs or extension schools that could generate lucrative revenues (Confessore 1999). However, since the new millennium, this cost has increased even faster than the rate of inflation despite the economic downturn.

Innovations in Web technologies and their applications into distance education provided an excellent option to academia to address those barriers indicated previously. Unlike traditional on-campus education delivery, end-users can participate in the learning process at a distance. Particularly in the case of Web-based educational systems, learners do not have to commute to any teaching facility (Becker 1999). Learners can access instructional material and obtain online assistance wherever they are and whenever they so desire. Web-based instruction, in particular, eliminates regular commutes to colleges and other teaching facilities. This movement toward Web-based distance education is definitely an easy concept for corporations to embrace as well. To provide employees with this access to education and additional training, corporate America spent some $100 million on Internet-based training prior to 2000. That figure is estimated to exceed $6 billion in the new millennium (Bechard 1999). The economic slowdown has not minimized this need for continuous workforce training. As a matter of fact, an estimated 75% of the workforce or 90 million people will need to be retrained by the year 2005 (Bersch 1999).

Obviously, quality software is a critical component in the delivery of Web-based instruction and the e-learning

experience. The good news is there is a wide variety of e-learning software available. As expected, some choices may costs more than others. Still others may offer more capabilities than the competition. As always, there are a few industry products that are more popular than the rest. However, there are numerous complaints about e-learning products as a whole. These include integration issues, interoperability concerns, bandwidth and scalability problems, and lack of features and functionality (Goodridge 2002). The latter items, complaints over features and functionality are particularly important because they affect the overall effectiveness of the learning process. It is therefore highly critical that users have an understanding of those features and their availability in those software packages considered.

## 3.   STATEMENT OF THE OBJECTIVE

As the popularity of Web-based course delivery programs and instructional products increase, more and more vendors are developing e-learning software to meet this need. Some products are free and can easily be downloaded from the World Wide Web. Those that required a purchase price are often based on a license specifying the number of users at a time. Whether it is free or has a cost for usage, the basic outcome or commonality among the diverse number of software is that these packages have the capabilities to enable learners to access instructional material and to be able to engage in independent learning anytime and anywhere that has a possible connection to the Internet. In short, it must support the learning function where the student and the instructor are geographically apart.

Apart from that common goal or function the software must enable or provide the capabilities for learning, there can be quite a difference in the way these software packages are put together. Some may run solely on one platform such as Microsoft OS or Mac OS. Others may run on a variety of platforms but at an additional cost. In some cases, the hardware system requirements may be minimal while in others, it could be phenomenal. On the one extreme, some software may offer unlimited technical support. On the other hand, there are software packages that require a highly competent in-house expert that can handle integration and scalability problems. Finally, the cliché "you get what you pay for" may be a fairly true statement in the world of e-learning software products and services. The more sophisticatedly designed packages may include all types of instructional support features and sub-attributes that are both end-user friendly to the student and the instructor. Less fancy packages may only have task-critical features. It must be pointed out here that more features and attributes does not necessary means it runs better. Rather, it does mean that additional options are present and advanced or expert users have a more comprehensive selection of features to become more effective and efficient instructional deliverers and learners.

This study examined the operating capabilities contained in selected course management software that are used for delivering distance education. Specifically, this research deals with Web-based software and the different types of features or components and sub-attributes or tools available. The variables studied included the variety of tools available, namely communication tools, productivity tools, student involvement tools, administration tools, course delivery tools, and curriculum design tools. General observations about needed systems requirements for implementing the software and systems pricing are also reported.

## 4.  METHODOLOGY

This study was targeted at all the course management software packages that are contained on the popular Website www.edutools.info/course. This Website was built to provide higher education users with a rational decision making process when reviewing and making selections about course management systems. Depending on the software, the assessment may exceed some 40 tools available. Their assessments are classified into the following six components, namely: (a) communication, (b) productivity, (c) student involvement, (d) administration, (e) course delivery, and (f) curriculum design. General descriptions such as technical specifications, terms of use or distribution, pricing, and version numbers are also examined.

Twenty-five course management packages were selected for inclusion in the sample used in this study. While it is true that the selected software packages were extracted from a diverse group, the software included here constituted those that are considered as industry leaders and had released new versions within the most recent period. The data gathering and analysis stages of this research are based on a software feature study by Raol, Koong, Liu and Yu (2002). Detailed descriptions of the steps are outlined below:

1    Identification of feature classifications. This step involved the gathering of key functions and their sub-attributes. In this study, the functions are the identified software components and the sub-attributes are the tools.
2.   Selection of major software vendors. The top course management software packages selected were based on their inclusion as industry leaders and having version updates within the latest 12 months.
3.   Extraction of features and sub-features from the descriptions contained in the reviews provided by www.edutools.info/course. From the list of selected software vendors, the components, along with the tools, were extracted from the classified reviews and tabulated.

The products selected are Angel 6.0; BlackBoard 6.0; Claroline 1.4; Click2learn Aspen 2.0; Coursemanager;

CourseWork; ECollegue AU+; Edusystem; Eledge 3.1; ETUDES; FirstClass 7.0; Internet Course Assistant 2.0; IntraLearn SME 3.1.2; Janison Toolbox 6.2; KEWL 1.2; KnowEdge eLearning; Learnwise; Manhattan Virtual; MimerDesk 2.0.1; Teletop; The Learning Manager 3.2; Unicom Academus; WebCT 4.1; WebCT Vista 2.1; and Whiteboard 1.0.2. Cumulative outcomes of the respective components and tools of the sample studied and of individual software products examined were presented in Tables 1. To contain all the data within the Table, symbols had to be used to represent the 25 course management software. A listing of the course management software and their associated abbreviations is contained in Appendix A.

## 5.  FINDINGS

Expert assessment reports of all the 25 products were available on the EduTools Website. Therefore, the results reported here are representative of 100 percent of the extracted products. Of the 25 course management software examined, 8 can be acquired for free. This group of software packages was listed as "open source" or course management products that are distributed under the terms of the GNU General Public License. One other free software product, ETUDES, required a fee for software hosting. Among the remaining software packages that required a purchase, the total cost is dependent on the number of users. Annual licenser fee, fee per server, and a flat price range were examples of other cost options indicated.

While it is true that most of the software examined indicated that it will require at least a Pentium III processor to run, the systems requirements will most probably need the capabilities of a Pentium IV processor. The lowest processing speed and storage memory were 700 MHz and 256 megabytes of RAM. However, the memory requirements for most of the software are quite different. They were in the 1 to 2 gigabyte range. Moreover, the types of database and client browser software incorporated into the course management software were rather recent versions so it is not likely that they will run well on a computer with just a Pentium III processor.

Microsoft software products appeared to be the dominating choice incorporated into the 25 course management systems. Over half the course management software systems have Microsoft SQL. The other more popular databases indicated were Oracle, MySQL, and Microsoft Access. IBM Lotus Domino, Macromedia Cold Fusion Professional, and Crystal Reports were found in a handful of the software.

As expected, the primary client browsers available in the course management systems were heavily biased in favor of Microsoft Explorer and Netscape. Most of the client browser requirements were also found to be within the last one or two versions. Mozilla 1.0 for Macintosh was found in two of the systems. Claroline

1.4 was the only software that claimed that their software supported any browser type or version.

A total of 31 tools were identified in the six components assessed. While it may be true that some of the software may have all the components, it must be pointed out that none of the 25 course management software packages have all the 31 tools identified. Seven of the course management tools have at least one component area where all the tools were missing. Among the 31 tools identified, their availability was extremely diverse. Content sharing, a curriculum design component, was available in only one course management software. At best, two tools were found in 23 of the software. They were discussion forum, a communication component, and authentication, an administration component. Other details about the outcomes in the respective components are indicated in Table 1.

The communication component consists of 7 tools. The number of tools present was quite diverse, ranging from 1 to 7. Only 4 software packages, Angel 6.0, Blackboard 6.0, ECollegue AU+, and KEWL 1.2, had all the tools. None of the course management software packages had all the 7 tools. Discussion Forum was the most common tool and was found in 23 of the online software packages. Video Services and Whiteboard were the least common of the seven tools.

Like the communication component, the number of tools present in the productivity component exhibited similar trends. The number of tools ranged from 1 to 5. Again, only 4 software packages, Angel 6.0, ECollege AU+, WebCT 4.1, and WebCT Vista, had all the tools. None of the software packages had all the 5 tools. Calendar/Progress Review, the most common tool, was in 21 of the software packages. Bookmark was the least common tool.

The student involvement component had only 4 tools. The number of tools present ranged from all 4 to none. Two software packages, Internet Course Assistant and Whiteboard 1.0.2, did not have any student involvement tools. Five software packages had all the tools. They were Angel 6.0, Blackboard 6.0, ETUDES, KEWL 1.2, and WebCT Vista 2.1. Self assessment, the most common tool was present in 20 of the software packages.

There were only 4 tools associated with the Administration component. The number of tools present also ranged from all 4 to none. One software package, Edusystem, did not have any of the tools in this component. A little less than half, 12 of the 25 software packages, had all the tools. Authentication and Registration Integration were the two most common tools. They were present in 23 and 22 of the software packages, respectively.

The course delivery component had 5 attributes. The number of tools present ranged from all 5 to none.

FirstClass 7.0 was the software package that did not have any course delivery tools. A little less than a third, 8 of the software packages, had all the tools. Automated Testing and Scoring was the most common tool and it was present in 21 of the software packages.

Finally, there were 6 tools associated with the Curriculum Design component. The number of tools present also ranged from all 6 to none. WebCT Vista 2.1 was the only software that had all 6 of the tools in this feature. Some one-fifth of the software packages did not have any of the tools in this component. Customized look and feel was the most common tool and it was present in 18 of the software packages. Content Sharing/Reuse was present in only one software package.

## 6. CONCLUSIONS, IMPLICATIONS AND LIMITATIONS

A number of interesting outcomes were identified from this simple examination of 25 course management system or distance education software. To begin with, the good news is that about 40 percent of these software packages are available free of charge to the public. Even though these complimentary software systems may not be as sophisticated as those sold by commercial vendors, many of them appeared to have sufficient, if not, as many components and tools. Without accounting for quality and the availability of support services, a mere evaluation of the components and tools offered by these free software developers indicate that, for the novice user or first-time developer of online degree and corporate training programs, these software packages can be a good resource for starting a Web-based course management system.

Without a doubt, database management system, and client browsers used by students to access online course delivery systems must be fairly new. All the client browser and database software requirements included current versions, and at the most, two other previous versions. Moreover, the hardware required also had the same trend. From processing speeds to memory requirements, they were all no more than two versions old. Given the way course materials are designed, the typical user must have at least 1 to 2 GB of RAM and disk space. Solaris users will need SPARC and multiple CPUs.

Microsoft products appear to be the dominating option in course management software. Internet Explorer and Microsoft SQL are used with a majority of the Web-based distance education software. In the area of distance education, Microsoft has a dominant market as far as browsers and support database are concerned. This trend is not surprising. After all, they are an integrated software provider and for the end-user, such transparencies are both convenient and efficient. The only other major browser provider is Netscape. For Macintosh OS

users, their choice is most probably constrained to
Mozilla 1.0.

Based on the six components and 31 tools examined, it
can be said that the selection of a course management
software package can be a very difficult one.  First,
while it is true that some 40 percent of the software
packages are free, there can be big differences between
their capabilities.  Even among the commercial pack-
ages, the number of tools available can be quite diverse.
In some cases, the software package may not even have
one of the six main components, much less any of the
tools.  Moreover, none of the software had all the tools
identified.  Users must therefore carefully examine those
components and tools carefully before settling down on
a preferred software.

On the positive side, it appears that there is a lot of room
for improvement for developers of e-learning software.
To begin with, there is a need to determine what basic
components should be included.  Then, there is a need to
determine what tools are critical and must be present.
Once this is done, optional components and tools can be
identified to serve niche markets.  Perhaps this is one
direction that this research can be expanded in future
studies.  Such an effort would definitely be of interest to
software developers, system integrators, and e-learning
educators.

Like all studies that are extracted from a segment of the
population, the research outcomes identified here should
be interpreted with a couple of limitations in mind.
After all, it was conducted on only 25 course manage-
ment software packages.  Including all the course man-
agement software available may have generated other
possible trends and observations.  However, a study on
all the software available may require a different re-
search design that was employed in this study.  More-
over, the information used for this study is based on the
assessment done by experts at EduTools.  Despite these
few limitations, the findings obtained can still be con-
sidered to be representative of the population at large.
The 25 software constitute about half of all the most
updated course management software packages avail-
able.  They are also the commonly accepted group of
software leaders.  Finally, EduTools is an independent
institution so their reviews are not influenced by com-
mercial incentives

### 7. REFERENCES

Arnold, M., 1999, The Virtual University.  Atena Jour-
nal, 13, pp. 85-100.

Bechard, T., 1999, "Training on the Web Helps Tailor
Learning."  Business Courier Serving Cincinnati,
16, p. 35.

Becker, G. S., December 1999, "How the Web is Revo-
lutionizing Learning."  Business Week, 40.

Bersch, C., 1999, "Making the Grade."  Communica-
tions News, 36, p. 18.

Chepesiuk, R. and M. Gorman, 1998, "Internet College:
the Virtual Classroom Challenge."  American Li-
braries, 29, pp. 52-54.

Confessore, N., October 1999, "The Virtual University."
The New Republic, 26.

Goodridge, E., April 2002, "Lessons Learned: Get
Smart about E-Learning Software."  Information-
Week, 884, p. 24.

Kappel, T. V., 1998, "An overview of Distance Learn-
ing."  School Planning and Management, 37, pp.
10-11.

Merisotis, J. P. and R. A. Phipps, 1999, "What's the
Difference?"  Change, 31, pp. 12-16.

Neal, E., 1999, "Distance Education."  National Forum,
79, pp. 40-44.

Raham, D. and B. J. Reed, 1997, "Going Remote: The
Use of Distance Learning, the World Wide Web,
and the Internet in Graduate Programs of Public
Affairs and Administration."  Public Productivity
& Management Review, 20, pp. 459-474.

Raol, J. M., K. S. Koong, L. C. Liu, and C. S. Yu, 2002,
"An Identification and Classification of Enterprise
Portal Functions and Features."  Industrial Man-
agement & Data System –Special Issue on Knowl-
edge Management, 102(7), pp. 390-399.

### 8. APPENDIX

| Alphabet | Name of Software |
| --- | --- |
| A | Angel 6.0 |
| B | BlackBoard 6.0 |
| C | Claroline 1.4 |
| D | Click2learn Aspen 2.0 |
| E | Coursemanager |
| F | CourseWork |
| G | ECollegue AU+ |
| H | Edusystem |
| I | Eledge 3.1 |
| J | ETUDES |
| K | FirstClass 7.0 |
| L | Internet Course Assistant 2.0 |
| M | IntraLearn SME 3.1.2 |
| N | Janison Toolbox 6.2 |
| O | KEWL 1.2 |
| P | KnowEdge eLearning |
| Q | Learnwise |
| R | Manhattan Virtual |
| S | MimerDesk 2.0.1 |
| T | Teletop |
| U | The Learning Manager 3.2 |
| V | Unicom Academus |
| W | WebCT 4.1 |
| X | WebCT Vista 2.1 |
| Y | Whiteboard 1.0.2 |

**Table 1:  Software Components and Tools**

### 1. Communication Component and Associated Tools:

| Software Vendor | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Discussion Forums | Y | Y | Y | Y | Y | N | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 23 |
| File exchange | Y | Y | Y | N | N | Y | Y | N | Y | Y | N | N | Y | Y | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | 19 |
| E-mail | Y | Y | Y | N | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | 22 |
| Online Journal | Y | Y | N | N | Y | N | Y | N | Y | N | N | N | Y | Y | Y | N | Y | N | N | Y | Y | Y | Y | Y | N | 14 |
| Chat | Y | Y | Y | Y | Y | N | Y | Y | N | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | N | 20 |
| Video Services | Y | Y | N | Y | Y | N | Y | N | N | Y | N | N | N | N | Y | N | N | N | N | N | N | N | N | N | N | 7 |
| Whiteboard | Y | Y | N | Y | N | N | Y | N | N | Y | N | N | N | N | Y | N | N | N | N | N | N | N | Y | Y | N | 8 |
| Total | 7 | 7 | 4 | 4 | 5 | 1 | 7 | 1 | 4 | 6 | 3 | 2 | 4 | 5 | 7 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 6 | 6 | 2 | |

### 2. Productivity Component and Associated Tools

| Software Vendor | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bookmarks | Y | N | N | N | N | N | Y | N | N | N | Y | N | N | N | Y | N | Y | N | Y | N | N | Y | Y | Y | N | 9 |
| Calendar/Progress Review | Y | Y | Y | N | Y | Y | Y | N | Y | Y | N | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 21 |
| Orientation/Help | Y | Y | N | Y | Y | Y | Y | N | Y | Y | Y | N | N | Y | Y | N | Y | Y | N | Y | Y | Y | Y | Y | Y | 19 |
| Searching within Course | Y | Y | N | Y | N | N | Y | Y | N | Y | Y | N | Y | Y | Y | Y | Y | N | Y | Y | N | N | Y | Y | N | 16 |
| Work Offline/ Synchronize | Y | Y | N | Y | N | N | Y | Y | N | N | Y | N | Y | Y | N | N | N | N | N | N | N | Y | Y | Y | N | 11 |
| Total | 5 | 4 | 1 | 3 | 2 | 2 | 5 | 2 | 2 | 3 | 3 | 0 | 3 | 4 | 4 | 2 | 4 | 2 | 3 | 3 | 2 | 3 | 5 | 5 | 2 | |

### 3. Student Involvement Component and Associated Tools

| Software Vendor | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Group Work | Y | Y | Y | N | Y | N | Y | N | N | Y | Y | N | Y | Y | Y | N | Y | Y | Y | Y | Y | N | Y | Y | N | 17 |
| Self-assessment | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | Y | Y | Y | Y | N | Y | N | Y | Y | Y | Y | Y | N | 20 |
| Student Community Building | Y | Y | N | N | N | N | Y | N | N | Y | N | N | N | N | Y | Y | Y | Y | N | N | N | Y | N | Y | N | 10 |
| Student Portfolios | Y | Y | Y | N | N | N | N | N | Y | Y | Y | N | Y | Y | Y | N | Y | N | Y | N | N | Y | Y | Y | N | 14 |
| Total | 4 | 4 | 2 | 1 | 2 | 1 | 3 | 1 | 2 | 4 | 2 | 0 | 3 | 3 | 4 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 4 | 0 | |

### 4. Administration Component and Associated Tools

| Software Vendor | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Authentication | Y | Y | Y | N | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 23 |
| Course Authorization | Y | Y | N | N | Y | Y | Y | N | N | Y | Y | Y | Y | Y | Y | Y | Y | N | N | Y | Y | Y | Y | Y | Y | 19 |
| Hosted Service | Y | Y | N | Y | Y | N | Y | N | N | Y | N | Y | Y | N | Y | N | Y | N | N | Y | N | N | Y | Y | Y | 14 |
| Registration Integration | Y | Y | Y | Y | Y | Y | Y | N | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 22 |
| Total | 4 | 4 | 2 | 2 | 4 | 3 | 4 | 0 | 2 | 4 | 2 | 4 | 4 | 3 | 4 | 3 | 4 | 2 | 2 | 4 | 3 | 3 | 4 | 4 | 4 | |

### 5. Course Delivery Component and Associated Tools

| Software Vendor | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Automated Testing and Scoring | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | N | N | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | 21 |
| Course Management | Y | Y | N | N | N | Y | Y | N | Y | Y | N | Y | Y | N | Y | Y | N | Y | N | Y | Y | N | Y | Y | N | 16 |
| Instructor helpdesk | Y | Y | Y | Y | N | Y | Y | N | N | Y | N | N | N | Y | Y | N | Y | Y | N | Y | Y | Y | Y | Y | N | 16 |
| Online Grading | Y | Y | N | N | Y | Y | Y | N | Y | Y | N | N | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | 18 |
| Student tracking | Y | Y | Y | N | Y | N | Y | N | N | Y | N | N | Y | Y | N | N | Y | Y | Y | Y | Y | N | Y | Y | Y | 16 |
| Total | 5 | 5 | 3 | 1 | 3 | 4 | 5 | 1 | 3 | 5 | 0 | 1 | 3 | 4 | 4 | 3 | 4 | 5 | 1 | 5 | 5 | 3 | 5 | 5 | 3 | |

### 6. Curriculum Design Component and Associated Tools

| Software Vendor | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Accessibility compliance | Y | Y | N | Y | Y | Y | Y | N | N | Y | Y | N | Y | Y | Y | N | Y | N | N | N | N | Y | Y | Y | N | 15 |
| Content Sharing | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | Y | N | 1 |
| Course Templates | Y | Y | Y | Y | Y | Y | Y | N | N | Y | N | N | Y | Y | N | N | Y | N | N | Y | Y | Y | Y | Y | N | 16 |
| Curriculum Management | Y | N | N | Y | Y | N | N | N | N | N | N | N | Y | N | N | Y | Y | N | N | Y | N | N | Y | Y | N | 9 |
| Customized look and Feel | Y | Y | N | N | Y | Y | Y | N | N | Y | Y | N | Y | Y | Y | Y | Y | N | N | Y | Y | Y | Y | Y | Y | 18 |
| Instructional Design Tools | Y | Y | N | N | Y | N | Y | N | N | N | N | N | Y | N | Y | N | N | N | N | Y | Y | Y | Y | Y | N | 11 |
| Total | 5 | 4 | 1 | 3 | 5 | 3 | 4 | 0 | 0 | 3 | 2 | 0 | 5 | 3 | 3 | 2 | 2 | 0 | 0 | 4 | 3 | 3 | 4 | 6 | 1 | |