Enhancing Management Education Using Hybrid Learning Nets: A Perspective From Working Adults

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Distance learning has come a long way since Sir Isaac Pitman initiated the first correspondence course in the early 1840's. Today the number of working adults who are returning to the classroom is growing rapidly as a result of globalization and technological developments. These dynamics call for new and innovative learning systems. One promising approach involves hybrid learning nets which combine both traditional classroom and Internet based content delivery. The purpose of this paper is twofold: 1) to highlight the design of a hybrid learning net (HLN) and 2) to present the results of a survey of working adults that utilized a HLN in a graduate level management course. The results show that two-thirds of the students surveyed found the HLN more effective than a traditional classroom format and that nearly 70% reported that the course fully met their expectations. The experience gained from this study suggests that implementation of HLN on a school wide basis will require a coordinated effort to a degree not seen in the past among faculty, IT technologists and administrative staff.

The demand for students who can compete in the expanding global marketplace and the number of working adults who are returning to the classroom is growing rapidly. The working business student is interested in a practical curriculum that focuses on results and convenience. To meet these demands, the traditional method of knowledge transfer that features the constraints of a fixed location, time, and learning

is being replaced with more user friendly and customized learning nets (Smith, 2001). The Internet is the key ingredient in this new delivery stratagem. Many working adults who have been exposed to Internet supported instruction tend to favor this delivery approach over the traditional classroom-centric model (Lundgren, 2003).

The nature of modern business practice calls for students to have both an integrated as well as a results oriented learning experience (Schelfhaudt, 2005). This approach is particularly appropriate for working adults, since many already possess a rich work related experiential base that can contribute to the collective learning environment (Monks, 2001). In an integrated pedagogy, the focus is on understanding how basic management functions such as operations, finance, and marketing are linked. Furthermore, it has long been recognized that active, participatory learning is more effective than passive learning and that learners need feedback early and often (Smith, 2002). These principles provide the impetus for web based learning systems (Boticario, 2002). These systems provide content and know-how outside the walls of the traditional classroom at a time and place of the student's choosing (Jorgensen, 2002). One learning stratagem that supports this perspective is the Instructional Management System (IMS) cooperative initiative (Graves, 1999). This initiative is designed to promote systematic thinking regarding the delivery of higher education to improve learning outcomes and to increase return on instruction investments. Specific principles of the IMS initiative are as follows: 1) education involves more than a single course; 2) a course is more than content; 3) content is more important than lecture notes; 4) convenience is a priority and 5) quality assurance requires an integrated learning approach. One Internet based approach that embodies the IMS initiative are learning nets (LN). These systems are receiving increased attention because they offer students engaged in management education both a customized and an integrated learning experience (Kathawala, 2002).

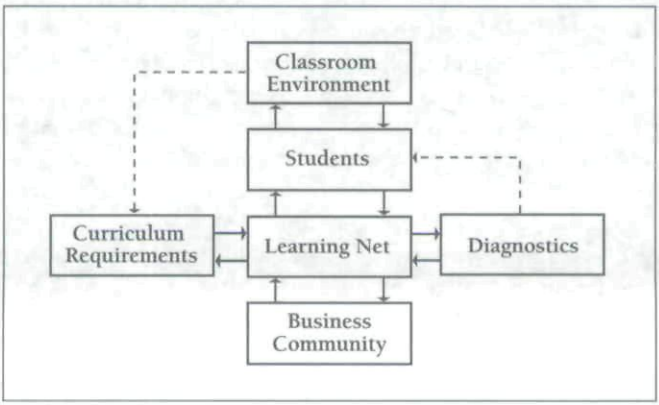
Literature Review

Learning nets (LN) are Internet-based platforms that provide educational content on a 24/7 worldwide basis. Basically, there are two learning net formats: Hybrid and exclusively Internet (Harvey, 2003). The hybrid model features a combination of in-class and Internet based learning. A recent survey of Internet oriented MBA programs indicates that approximately 60% are hybrid (Ubon, 2002). Figure 1 illustrates the structural design of a hybrid learning net (HLN). In this context, the learning net serves as a conduit that connects students with the course content, peers, instructors and the external business environment.

Today, the general pedagogical direction in higher education is moving increasingly towards a learning-centric perspective (Driver, 2002). Constant feedback via on-line assessment is consequently a must for effective distance learning (Creaser, 2002). The roadmap to effective learning in a distance-learning environment is a customized lesson plan. Learning nets provide a 24/7 environment that supports interactive learning and delivers customized content. It has been recognized that working adults do not learn at the same pace (Kasworm, 2003). Therefore, providing self-paced "customized" instructional content, as part of the overall course design, can further

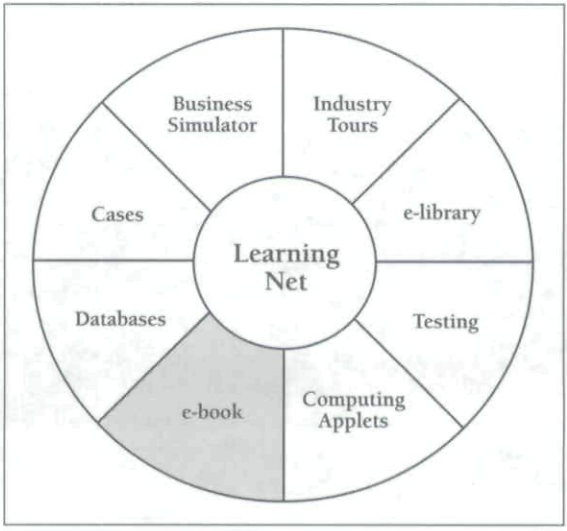
enhance the learning experience. Generally, students tend to participate more in learning systems that are content rich and that feature extensive variety (Neo, 2004).

Figure 1: *Hybrid System Design Concept*



In a learning net environment students can access course material through one convenient portal site. Thus, a working adult on travel status can remain current with the course material and team members via the Internet. Additionally, course assignments such as team examinations, homework, and term projects can be submitted electronically. This approach offers many advantages, including "real time" feedback and multiple archived copies of team assignments for subsequent use. Figure 2 illustrates the structural design of the management education learning net (LN) used in this study.

Figure 2: *Learning Net Structure*



A central element of the LN design is the e-book. An e-book is a digitized learning resource that is both readable and downloadable from the Internet. One primary advantage of an e-book is that it can be customized to meet specific course requirements, thus avoiding the one size fits all approach of the past (Chen, 2003). A customized e-book was used through the hybrid course. Unlike print books (p-books), e-books are designed to support the feedback process through interactive student participation. For example, after reading a section on regression the student would be connected to an on-line regression simulation. Navigational enhancements are a key ingredient to increased e-book acceptance throughout academe (Shiratuddin, 2005).

Another important feature of learning nets are the availability of virtual facility tours (Pettijohn, 2000). The Internet offers a wide range of virtual sites that can be easily integrated into the lesson plan. These tours provide students with direct insight into the integrative nature of business management. In the near future, learners will be able to experience real time guided facility tours that feature the ability to interact directly with onsite management and staff. A key to effective distance learning is a customized lesson plan wherein the specific strengths and weaknesses of each student are identified, measured, and appropriate feedback is provided. On-line testing offers one approach for enhancing this assessment process (Erwin, 2002). Specifically, web-based exams not only expand the range for measuring students' skill levels, but they also provide a platform for real time, in-depth feedback. The development of a student performance database using on-line test results provides the opportunity to further improve the learning process through the delivery of customized content.

Business simulations have long been found particularly effective in developing both individual and team management skills (Aquino, 2005). Furthermore, evidence has shown that students engaged in simulations retain about 75% of the material compared to 5% for lectures, 20% for audio-visual presentations, and 50% for discussion groups (Johne, 2003). One specific simulation that has been used in the hybrid operations management course is the Internet based MIT Beer Game (Hong-Minh, 2000). This simulation is used to teach supply chain management principles in an interactive environment. The hybrid course also provides access to the digital library, Harvard business cases, and large databases such as the Bureau of Labor Statistics. Virtual computing applets were used extensively throughout the course. Virtual computing provides the student with direct access to a wide range of analytical models (e.g., regression) and is receiving increased usage throughout the industry (Vizard, 2002).

A number of surveys have been conducted on student perceptions of learning nets (LN) (Miller, 2003; Shih, 2003; Wang, 2003). The general consensus of these investigations, particularly for working adults, is summarized below:

- LN offer a high degree of interaction and collaboration that can be more effective than traditional classroom methods.
- LN represent a long sought solution to the ongoing challenges associated with adult education. Students can enjoy a dynamic, personal and scaleable experience for continuous learning in a flexible learning environment.

- LN provide the learner with a purposeful entry to Internet resources and thus to a new era of learning technologies.
- LN connect learners and instructors on a 24/7 basis.
- LN also underpin the development of new patterns of relationships between education and business through virtual arrangements such as faculty tours.

The following hypotheses were developed based on the foregoing literature review and the hypothesis testing of Internet learning systems by Changchit (2003).

- **Hypothesis 1**: Students reporting that a hybrid format course is more effective than a traditional format course is positively correlated with meeting student expectations.
- **Hypothesis 2**: Students reporting that a hybrid format course supports job demands is positively correlated with meeting student expectations.
- **Hypothesis 3**: Students reporting an interest in taking another hybrid course is positively correlated with meeting student expectations.
- **Hypothesis 4**: Students reporting a change in studying habits is positively correlated with meeting student expectations.

To test these hypotheses, a survey was conducted of working adults who had recently participated in a hybrid operations management course. The results of the survey are presented in the following section.

Student Response Survey

A 10-question instrument was developed to assess the student's overall response. The cohort group consisted of working managers enrolled in a 15-week graduate level operations management course. The course format consisted of both Internet as well as a number of in-class learning activities (Hybrid Learning Net). Some specific demographics of this cohort group are reported in Table 1. The data shows that nearly two-thirds of the students surveyed do not have an undergraduate business degree. The wide range of student academic backgrounds, coupled with students returning to the classroom after many years in the work place, provide a significant classroom challenge in terms of the appropriate level of content delivery. This is one area where Internet learning nets can help by providing customized and remedial content outside the classroom.

A pre-test of the instrument was conducted using a similar hybrid based class which was not included in the survey. Following the pre-test, the questionnaire was distributed via the Internet to 175 students that had taken the HLN based course over three trimesters (a total of seven classes). The number of respondents totaled 105 (60% response rate). An Excel database was developed from the questionnaire responses. Table 2 provides descriptive statistics for selected survey variables.

Table 1: *Cohort Group Characteristics*

Factor	Mean
Age	32
Years of Working Experience	7.8
International Students (%)	9
GMAT	566
Gender (% female)	34
Undergraduate Business Degree (%)	35
Annual Salary ($)	64,200

Table 2: *Selected Descriptive Survey Statistics*

Variable Description	Percent
First time learning net user	80%
Gender (female)	34%
Hours studying/week	4.83
Numerical class grade	88.9
More effective than traditional course format	67%
Increase digital library usage	67%
Supportive of work schedule	93%
Interest in another hybrid course	89%
Interest in an "all" Internet course	13%
Changed study habits	35%

These statistics show that approximately 80% of the respondents indicate that this was their first hybrid based course and that they spent an average of 4.83 hours/week reviewing the course materials on-line. Additionally, 67% of the students found the hybrid course design more effective than traditional instructional methods. Furthermore, 93% of those responding to the survey indicated that they found this course design supported their work schedule. This positive response can be attributed to the fact that nearly 75% of the students missed one or more classes due to business activities, yet they were able to remain engaged in the course. Also, 69% of the students found that the HLN course fully met their expectations while only 5% indicated that it did not. Finally, only 13% of the students expressed interest in an all Internet based course.

The survey's open-ended question revealed the following general observations:

- Students were able to remain current with the assignments and content even while on extended travel status.
- Students found the linked facility tours helpful in understanding basic operational principles, e.g., how supply chain management is used in the automotive industry.

- Students enjoyed access to large-scale Internet-based databases, e.g., Bureau of Labor Statistics.
- Students valued the insights gained into the dynamics of business management via on-line business simulations.
- Students appreciated the availability of all course material at one accessible site.
- Students felt that real time practice testing increased their understanding of the subject material.

The correlation coefficient between actual midterm exam scores versus average practice Internet test scores was 0.78. Additionally, there was a very strong positive correlation between the number of times the student took the practice tests and their practice test scores. This data lead to the conclusion that consistent practice testing yields higher actual test scores. The demographics of the survey participants were consistent with the overall student population as measured by age and gender.

While one would expect similar results for in-class practice exams, the Internet provides a more efficient testing environment, e.g., Internet-based testing does not take up valuable class time. The testing system provided both weekly practice quizzes (10 questions per quiz) and timed 90-minute mid term and final exams (50 questions per exam). Students averaged approximately five hours in practice test taking over the trimester. Additionally, the testing system offered a layered response structure consisting of three feedback elements: 1) the correct answer, 2) a tutorial on the question's subject matter and 3) a web link to additional supportive material.

Results Analysis

Table 3 summarizes the hypothesis testing results. The first hypothesis suggests that a hybrid course that is found more effective than a traditional course is positively related to meeting student expectations. The results support this hypothesis ($r = .43$, $p < .01$). The second hypothesis, that a hybrid course that is supportive of job demands is positively related to meeting student expectations, was found to be statistically significant ($r = .30$, $p < .01$). Hypothesis 3 states that students who show an interest in taking another hybrid course is related to meeting student expectations. The results support this hypothesis ($r = .57$, $p < .01$). The final hypothesis states that a change in studying habits is related to meeting student expectations. The results do not support this hypothesis ($r = -.03$, $p = 0.73$).

Table 3: *Hypothesis Testing Summary*

Hypothesis	p-value	r	Conclusion
1	0.00	.43	Supportive
2	0.00	.30	Supportive
3	0.00	.57	Supportive
4	0.73	-.03	Non-supportive

Table 4 presents zero-order correlation coefficients for the database.

Table 4: *Correlation Matrix (Pearson)*

Variables	1	2	3	4	5	6	7	8	9	10	11
1. First	-										
2. Gender	-.04	-									
3. Hours	-.05	-.09	-								
4. Grade	-.05	-.19	.10	-							
5. More	.06	-.19	.32*	.06	-						
6. Library	-.10	-.10	.16	-.06	.26*	-					
7. Supportive	-.13	-.13	.12	.03	.39*	.22*	-				
8. Another	-.03	-.12	.25*	.25*	.26*	.26*	.50*	-			
9. All	-.08	.07	-.04	.07	.15	.03	.10	.14	-		
10. Habits	.20	.18	.12	-.23*	-.21*	.22*	-.20*	-.17	-.11	-	
11. Expectations	-.06	-.05	.22*	.04	.43*	.22*	.30*	.57*	.05	-.03	-

*Significant at 0.05

The correlation data revealed, among other things, that interest in taking another similar hybrid course is positively correlated with:

- The number of hours spent studying on the Internet ($r=0.25$, $p < 0.01$)
- The final numerical grade ($r=0.25$, $p < 0.01$)
- The view that a hybrid course is more effective than a traditional course ($r=.46$, $p < 0.01$)
- Increased digital library usage ($r=0.26$, $p < 0.01$)

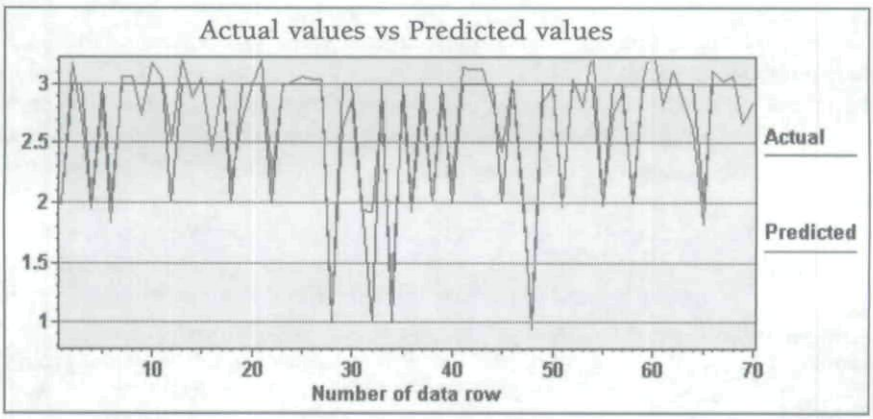
The database was more fully explored using neural net analysis. A neural net predictor model was developed based on a "training" set of 75 observations randomly selected from the database where the target (dependent) variable was student expectations (Huang, 2002). The candidate predictor variables are listed in Table 2. Neural networks have seen increased use in educational applications (Choi, 2001). Specifically, neural nets appear as the analytical tool of choice when the underlying relationships between variables are somewhat ill defined as in the case of e-learning (Gonzalez, 2002). The resultant R^2 was 0.95. Table 5 presents the relative importance of the input factors. The variables "first Internet course" and "interest in taking another similar course" account for more than 50% of the relative importance of the factors considered.

Table 5: *Relative Variable Importance*

Variable	Importance
First HLN course	0.301
Interest in another hybrid course	0.275
Changed study habits	0.169
Higher grade	0.152
Increased library usage	0.047
Considered more effective	0.040
Interest in an all Internet course	0.014
Supportive of job demands	0.001
Hours studied	0.000
Gender	0.000

Figure 3 shows a plot of the actual versus predicted target variable values for the training database.

Figure 3: *Comparison of Actual versus Predicted Values for Target Variable*



The developed neural net model was then tested using a holdout dataset of 30 observations. The resultant R^2 was 0.14. This outcome can be attributed to the small sample size. Typically, a sample size on the order of 750 to1000 observations should yield improved performance results (Nguyen, 2001).

Neural nets can also be used for classification analysis wherein the target variable is characterized into two or more categories. Specifically, neural nets have been found to have superior performance relative to other classification methods over a wide range of situations (Kiang, 2003). An example of neural net classification application is college admissions in which the target variable categories could consist of accept, reject or hold for further consideration (Hoefer, 2000). The target (dependent) variable for the current classification study is defined as follows:

- 1=Students found the course to be more effective than a traditional MBA course
- 0=Students found the course not to be more effective than a traditional MBA course

The neural net classification model was "trained" using 70 random observations from the database. This model correctly classified 100% of the observations. This model was then tested with the holdout group of 35 observations. The results of the holdout group classification analysis are reported in Table 6.

Table 6: *Classification Analysis of Target Variable (percent)*

	Classified 0	Classified 1
Actual 0	60	8
Actual 1	40	92

As can be seen from this data, the model was able to accurately identify those students from the holdout group that found the HLN course more effective (92%). However, the classification performance for the other group yielded a relative high level of type I errors (40%). A type I error in this case is defined as classifying a student who actually found the HLN more effective than a student who did not. The type I problem can be attributed to the relatively small sample size for the holdout group particularly with respect to the first category (sample size = 10). Enhancing the size of the database over time as additional students are exposed to the HLN course should lead to a more accurate classification model (Kiang, 2003). The overall accuracy rate of the neural net is 83%. This statistic is defined as the proportion of correct classifications across all categories (29/35). This performance result compares favorably with similar studies on preference classifications (Wong, 2000). The above classification model can be used to identify those students that may require additional preparation attention prior to and during the HLN course. Further, the model can be extended to pinpoint those instructor controlled tasks that are viewed as important by the students, e.g., e-mail feedback.

System Implementation Issues

A fundamental tenet of the HLN design is that one size does not fit all. That is, students do not learn at the same pace and they are impacted differently by the learning environment. While considerable attention is now being given to the development of e-learning content, there are a number of other structural components that need attention. These include system implementation and operation. Some specific administrative challenges in implementing an HLN are highlighted in the following:

- Training faculty for successful system deployment and usage
- Providing worldwide access with the highest quality standards

- Setting specific performance goals and metrics for measuring student performance and expectations
- Maintaining format consistency across departments and educational programs
- Preparing students for entry and ongoing use of learning nets
- Establishing the overall school culture that fosters learning net innovation

Successful system implementation requires a coordinated effort to a degree not seen in the past among faculty, IT technologists and administrative staff. One implementation strategy is first to deploy a prototype system using a specific cohort group such as an executive MBA program where the number of students is relatively small and the content is standardized. Based on the experience gained from the prototype, the HLN can then be expanded driven primarily on resource availability and content development. Student acceptance is also another significant factor (Martins, 2003). Arguably, the single most important operational issue is that the learning net must be available on a 24/7 basis. Anything less undercuts the basic notion of knowledge on demand. Developing the internal capability to deploy a learning net can be complex and expensive. Furthermore, an internalized approach may not take advantage of the ongoing developments in delivery technology, e.g., search engine technology. One emerging implementation strategy that is designed to help overcome the aforementioned issues consists of developing institutional partners with both content and application service capabilities (Sorel, 2001). This approach focuses specifically on the basic ideas behind supply chain management and is consistent with the increased use of suppliers in large volume operations such as those found in most business programs. Measuring ongoing system effectiveness and performance is required to help insure a viable and cost/effective learning net (Bersin, 2002).

Conclusions

Learning nets are on the rise in higher education (Coppola, 2002). The purpose of this paper was twofold: 1) to highlight the design of a hybrid learning net (HLN) for management education applications and 2) to present the results of a survey of working adults that utilized a HLN in a graduate level operations management course. The HLN combined both Internet-based content delivery with specific in-class learning exercises. The overall student response as measured by a number of survey dimensions was positive. The results revealed that nearly 70% reported that the course fully met their expectations. More specifically, the survey results indicated that the presentation of course content and assignments via the Internet were found to be more effective than traditional methods and that the HLN design was supportive of student job requirements. Furthermore, student usage of digital library assets increased. These results are consistent with the notion that HLN fosters new and robust learning patterns (Miller, 2003). HLN provides a vehicle for moving from a teaching-centric towards a learning-centric educational paradigm which is particularly attractive for graduate management education for working adults. The evidence suggests subject mastery is not eroded as a result of Internet based learning as long as students remain persistent (Mclaren, 2004).

The overall goal of HLN is to optimize the use of the Internet to provide effective distance learning while enhancing faculty and peer interactions. HLN provides an opportunity for collaborative learning that often yields a positive impact on the educational experience (Graham, 2001). Another essential feature of HLN is real time feedback. Real time feedback can be provided in a variety of ways, including testing and simulations. This capability presents both the instructor and student with insights into subject areas that require more attention. Providing the broadest range of tutorial instruction optimizes the opportunity for effective learning. Asynchronous real time feedback is particularly attractive for working adults who have difficulty maintaining an ongoing presence on the campus. The HLN stratagem outlined herein is designed to replace the three pillars of traditional instruction - fixed time, fixed location, and fixed learning pace – with a flexible and customized learning process. Specific benefits of HLN include the following:

- Integrated perspective on the course/program
- 24-7 access to content including real time testing with feedback
- Courses designed for specific learning applications with real time updating
- Convenience which is particularly important for working adults
- Improved content linkage

Additionally, an HLN based curriculum permits more working adults access to the growing body of management know-how that will allow them to remain competitive in an ever-increasing global marketplace. There are a number of developmental tasks that need to be accomplished to further enhance the effectiveness of the HLN in business education. These include enhanced interactive simulations, real time videos and student performance diagnostics. One promising technology to support the latter are called artificial agents (Cheung, 2003). These Internet based systems can be used to design lesson plans and learning experiences based on student test performance and background characteristics. Similar systems are being used throughout industry to improve both productivity and effectiveness and could play a similar role in enhancing student learning (Casteluccio, 2001).

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