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AN EXPLORATORY STUDY INTO THE USE OF HYPER-INTERACTIVE TEACHING TECHNOLOGY IN THE LOGISTICS AND TRANSPORTATION CLASSROOM

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ABSTRACT

New technologies are being developed that can assist professors in the classroom. One is the Hyper-Interactive Teaching Technology or H-ITT. This is a system that allows instructors to gather instantaneous feedback from students for a variety of topics. The article examines the benefits and disadvantages of using H-ITT in the classroom and presents some initial findings.

INTRODUCTION

New technology is introduced into society on a daily basis. Some of this technology is generating new tools for the classroom. In many cases, the classrooms of today differ greatly from those of a few years ago. In the last ten years, faculty have incorporated the Internet, various computer applications (i.e., PowerPoint, Access, Excel, Supply Chain Pro, etc.), computer labs, smart boards and other items into the learning process. While none of these are designed to replace the traditional learning process, students have come to expect a technologically enhanced educational experience (Day, 1996). To meet student expectations, faculty should try to identify additional new technologies that can be applied in the classroom that continue to support and improve learning.

One of these emerging technology tools for the classroom is Hyper-Interactive Teaching Technology (H-ITT). H-ITT is an excellent example of using new technology to improve on sound, existing teaching techniques. H-ITT does not change any fundamental methodologies in the classroom. It does improve tested methods and improves the timeliness of feedback for both the instructor and students.

This article provides a detailed description the H-ITT system, an examination of the strengths and weaknesses of H-ITT, the areas of teaching supported by H-ITT, and finally some exploratory data from business logistics and global logistics classes. Finally, some conclusions concerning the effectiveness of technology in the logistics and transportation classroom are presented.

H-ITT TECHNOLOGY

Consider the television show, "Who Wants to be a Millionaire?" At some point, the contestant may decide to use a lifeline and asks the audience for help. The studio audience votes on the four possible answers to the question and the responses are instantly presented to the contestant. The contestant has immediate feedback to make a better choice. The H-ITT uses the same basic idea, but with many additional pedagogical tools incorporated into its system.

Hyper-Interactive Teaching Technology (H-ITT) is a system designed to collect information from respondents in a real-time setting. Each student is required to purchase a H-ITT device (Figure 1). The device costs about \$30, has an "On/*" button and five response buttons: A through E. The H-ITT device uses an infra-red light to transmit the letter response (A-E) and its unique five or six digit identification code (Figure 2). This data is collected by receivers positioned within the classroom. The company recommends one receiver per 25 transmitters. Each receiver costs about \$180. Finally, the data is sent to any computer that is connected through a communications port. There are two software programs that come from the company: H-ITT Acquisition and H-ITT Analyzer. The end result is an accurate, real-time collection method that identifies each individual user's response by question.

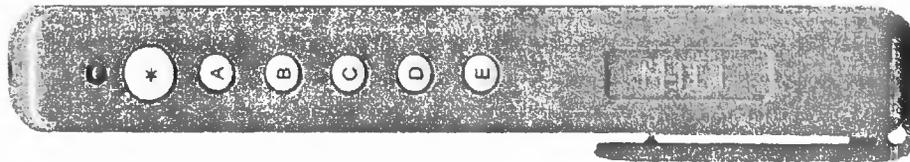
The H-ITT Acquisition program is used to collect the students' responses. By using Microsoft PowerPoint to prepare the question slides prior to class, the H-ITT Acquisition software displays the questions in sequence. The instructor can incorporate most types of media that can be placed on a PowerPoint slide into the question (i.e., text, graphics, pictures, etc.) Next, the professor can set up a number of options about the data collection. These options include the length of time that the question will be displayed, use of a H-ITT transmitter to identify the correct answer, point values of correct and incorrect responses, display of response histograms, and a host of minor options.

An example of the H-ITT Acquisition software is provided from a traditional introductory logistics course (Figure 3). A simple calculation is required from the students. Each student then sends his or her answer to the system. As they respond, their individual number is displayed at the bottom of the screen (an option). Also, this example is set to "memorize location." Therefore, the students' numbers will be in the same location each time. Also, a student may change his or her answer. A count is shown after the student's identification number for each answer change (see student number 396 on the bottom row).

Once the preset time period is over or when the instructor chooses to end the question, the results of the question can be displayed. This is an available option and would not make sense in a traditional testing format. However, if the goal is to improve interaction, feedback and effective learning, it can be a useful tool. Figure 4 presents the results for the actual question given in a business logistics class. Eighty-one percent of the students correctly choose "D" as their answer. This allows the instructor to assess whether the students understand the issue, or in this case, whether they are able to calculate a simple days-of-inventory type problem. Had a much larger number of students missed the question (e.g., greater than 50%), it would have been an indication that the class was not adequately prepared for the question. In that case, the professor could take immediate steps to correct the learning deficiency.

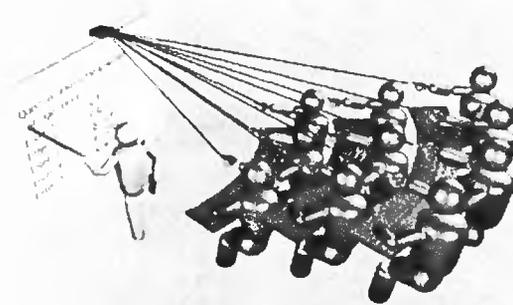
The H-ITT system supports interaction in a number of ways in the classroom. The second portion of the process is to use the H-ITT as an evaluation tool. It is possible to collect various types of data from the students using this system. A simple example is to take a number of questions as demonstrated in Figures 3 and 4 and have quizzes at various times during a course. Also, some mass lecture sections in the physical sciences are giving exams using the H-ITT devices. They have chosen this strategy due to the large number of students per section and the relative ease of grade entry.

**FIGURE 1
H-ITT TRANSMITTER**



(Source: www.h-itt.com)

**FIGURE 2
TYPICAL CLASS DATA COLLECTION**



(Source: www.h-itt.com)

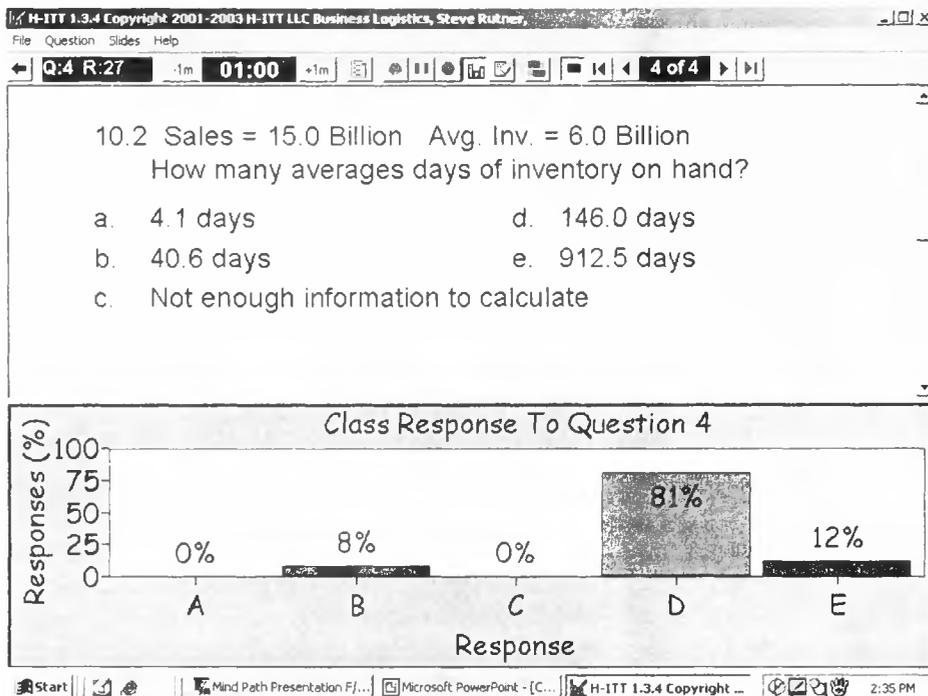
**FIGURE 3
EXAMPLE BUSINESS LOGISTICS H-ITT QUIZ QUESTION**

10.2 Sales = 15.0 Billion Avg. Inv. = 6.0 Billion
How many averages days of inventory on hand?

a. 4.1 days d. 146.0 days
b. 40.6 days e. 912.5 days
c. Not enough information to calculate

277	237	667	122	
703		421	442	048
001	368	172		711
	147		221	819
	398	789	798	

FIGURE 4
EXAMPLE BUSINESS LOGISTICS H-ITT QUIZ RESULTS



The H-ITT Analyzer software provides a good tool to evaluate various items about an individual student's responses. Figure 5 presents a hypothetical set of results from students to maintain grade confidentiality. It demonstrates that every response by every student is recorded and stored. This data is easily converted to a traditional spreadsheet format such as Excel. Figure 6 also gives an additional example of the usefulness of the H-ITT system by showing how responses to an individual question can be analyzed. With this type of software, the professor may choose to make adjustments to the point values of individual questions.

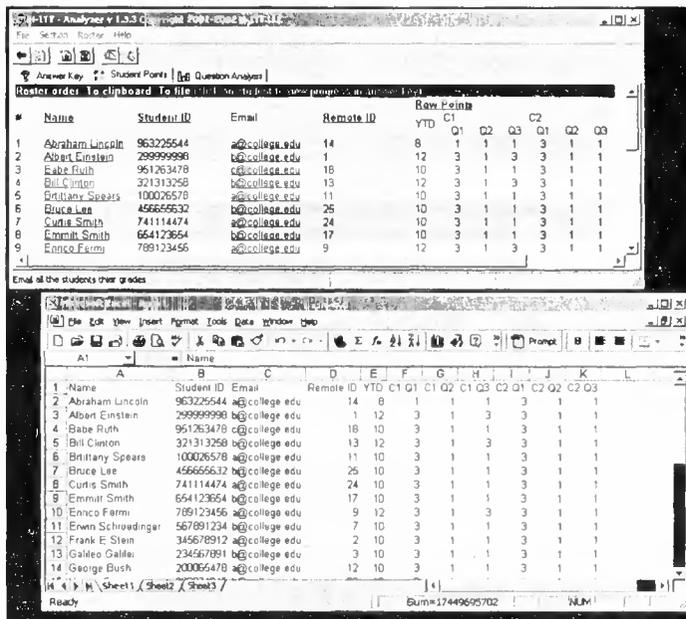
Therefore, the H-ITT devices and software provide a sound system to use in the classroom to gather data from students. The collection

software provides instantaneous feedback to both students and professors using a number of methods. It provides a tool that can be used to support various teaching techniques to improve learning.

PEDAGOGICAL FRAMEWORK

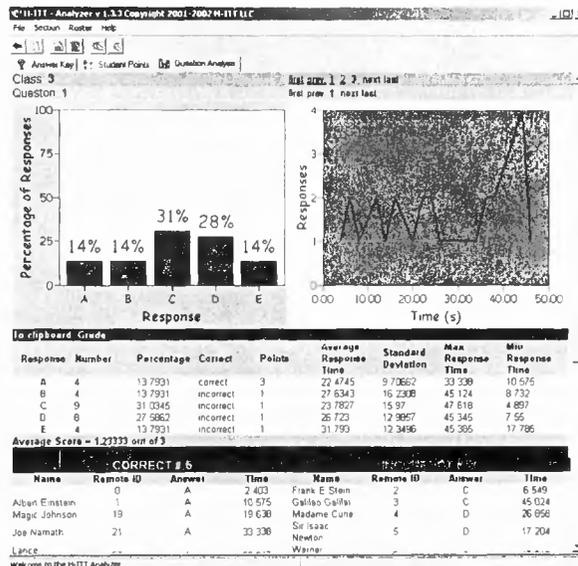
While the H-ITT system provides multiple opportunities for use in the classroom, the key criteria for success center on the specific pedagogical areas that H-ITT could improve or support. The evolution of today's classroom is from traditional professor-led lectures to a more interactive experience. In many cases, this changing learning environment is based upon improved technologies (Smith, 1996). This is further supported by students' increased expectations

FIGURE 5
EXAMPLE RESULTS



(Source: www.h-itt.com)

FIGURE 6
EXAMPLE RESULTS



(Source: www.h-itt.com)

that the learning process include other methods beyond the traditional lecture format to help maintain interest in the subject material (Smart, Kelley and Conant, 1999). The H-ITT system does an excellent job of supporting these basic tenets. It is a relatively new and unique method to employ technology in the classroom.

The next major question to consider is whether the H-ITT is an effective tool to improve the learning process, or merely a "cool gadget" to amuse the students. The first important step in an improved learning experience is that it is interactive (Egemen, Edwards, and Nirmalakhandan, 1998). The H-ITT requires each student to participate with each question. Furthermore, the technology must support the learning objectives and be integrated into the curriculum (Zeon et al., 1999). The H-ITT device provides a tool that can support the curriculum if used properly. However, the instructor's choice of how the H-ITT is applied within the course will determine its success.

The final major pedagogical issue deals with the implementation of technology as a testing tool in class. There are numerous studies on the value of short quizzes in the classroom. However, there are two studies that specifically address short quizzes and using technology similar to the H-ITT. The first was performed using students in Georgia and Tennessee. Slough and Lane (1995) used a keypad system to gather responses from students. They found that both students' interest in subject matter and grades improved. The second study suggested that the use of "on-the-fly" questions with immediate feedback worked with various levels of students including MBA's (Marien, 1995). This study also suggested that the implementation of technology in the classroom improved learning when used for non-quiz type interaction.

An additional pedagogical point is the appropriateness of using a H-ITT like system in a university setting and specifically a logistics or transportation class. Previous studies had success with both undergraduate and graduate students. However, none of the studies applied the

learning methodology in a logistics classroom. The closest example was a study performed on international marketing students (undergraduate and graduate). The results included a statistically significant improvement on test scores for students using the interactive technology. Also, the students enjoyed using the interactive tools (Ueltschy, 2001). Ueltschy's study supported the concept of using "fun" tools in a marketing course. The H-ITT technology is similarly used to create "edutainment" as a learning tool in logistics and transportation classes (Rutner et al., 1997).

In summary, the concept of interactive technology does not create a new learning paradigm. Rather, it supports a number of proven, traditional pedagogical methodologies. The H-ITT system can be used to improve the effectiveness of quizzes, interactive surveys, etc.

H-ITT STRENGTHS AND WEAKNESSES

Given that the H-ITT system supports traditional learning models, it is appropriate to examine both the benefits and disadvantages of the technology. As with any new technology, there are a number of shortcomings with the current system. The first disadvantage is the capacity of the system to capture responses. The largest complaint students have is that they "cannot get their answer in (sic)." In other words, often the large number of responses to the system in a short period of time causes students to be unable to immediately input their answer into the system. There are three solutions to this problem. First, the instructor can limit responses to one side of the class at a time. Also, by lengthening the response time, students are less likely to all respond at one time. The final solution is to add response receivers in rooms with large numbers of students.

Adding receivers to the classroom highlights a second potential problem with the H-ITT system. There is a financial cost to implement this system. Each receiver costs approximately \$180. A typical classroom (approx. 50 students) will require a minimum of two receivers and a

number of support items. Therefore, a college will spend about \$500-\$1,000 per classroom depending upon size. This assumes that the class is already equipped with a PC. Each student also needs to purchase a H-ITT transmitter. Although the cost is approximately \$30, this is in addition to textbook, materials, etc. that a student must bear. However, this cost can be reduced. After two semesters in use at one university, on and off campus bookstores began to buy back H-ITT transmitters and resell them at a reduced price. Also, MBA students at this same university set up a secondary market for the H-ITT transmitters among the graduate students. A final point is that a student can use one H-ITT transmitter in multiple courses during a term and across terms. The best analogy is that the transmitter is much like a calculator. It can be used in many classes, but only by one student at a time. Although it is not possible for students in a given class to share a transmitter, it is possible to share across different classes during a term.

Another disadvantage to this system is the requirement that the student bring the transmitter to class each day. It is very likely that some students may lose their transmitter during the term. This adds to the individual's cost for the course. However, the collection software is able to assign multiple transmitter numbers to a single student. Therefore, a student will retain all of his or her points when multiple transmitters are used during a semester. Beside the permanent loss of a transmitter, the instructor can expect one or more students in each class to forget to bring the transmitter on any given day. The H-ITT program has an option for a "loaner" transmitter for students for a single class period.

The final disadvantage of the H-ITT system is the investment of time needed to use the system. The instructor should expect to have two to three hours of training before implementing the system in the classroom. Furthermore, it requires approximately five additional minutes per question to prepare quiz questions using H-ITT and PowerPoint. Finally, the quizzes take approximately one minute per question.

However, these times are relatively low given the benefits of the system. The collection of individual scores removes any grading requirements for the instructor. Therefore, the time needed before class for question preparation is more than offset in reduced grading time.

While there are some disadvantages, the H-ITT system has many positive attributes. The first is the ability to provide instantaneous, interactive feedback. As identified in the previous section, there are positive learning outcomes from instantaneous feedback. The H-ITT gives both the students and professor important information at the end of each question. The students learn the correct answer and the instructor learns if students have understood the concept or problem. For example, Figure 4 suggests that the students understood the relevant material, since over 80 percent were able to correctly answer the question. The professor can then move on to another topic or problem. However, if only 20 percent of the students had answered the question correctly, the instructor could choose to return to the previous material.

Another benefit of the H-ITT is in supporting the idea of in-class quizzes. The students appear to be more attentive throughout the class, since a quiz may occur at any time over any subject.

A hidden benefit of the H-ITT system can be an increase in class attendance. Students quickly become aware of the H-ITT process and expect it in each class. They know that they must be present to participate in a daily quiz and that there is a penalty for missing a quiz. However, instructors must be aware that it is possible for a student to operate a second H-ITT for a student not present. This is not a problem in a smaller classroom. However, in large, mass lecture types of classes, the professor must be careful to ensure that each student only uses one H-ITT device.

An additional benefit of the H-ITT system is that it provides an alternative method for evaluating in-class participation. Every professor recognizes

that soft-spoken, shy student that always comes to class, does well on tests and assignments, but rarely answers questions. The H-ITT provides students with another method for participating in the classroom. The quizzes are a form of participation and the results are recorded. Also, depending on how an instructor uses the H-ITT, it can help to draw out students for discussion. For example, the H-ITT can be used to gather opinion type data that can then be used to foster discussion between various factions of students in the class.

There are a number of minor benefits of using the H-ITT system as well. One is that students appear to enjoy using the devices. However, this may be a temporary response that dissipates once the technology becomes commonplace. Another minor benefit is the ability to collect other types of feedback in class. The most common can be collecting accurate "votes" on various issues (i.e., what type of test would you like? or what is the best date to make up a class period?) The only limit to the use of the H-ITT appears to be the creativity of the instructor.

A basic evaluation of the H-ITT system highlights a number of benefits and disadvantages. Table 1 presents a summary of these items given in the academic literature and the company's website.

INITIAL STUDY

Based on the potential benefits of using an interactive system in the classroom, it seemed appropriate to collect exploratory data for use in evaluating the H-ITT system. The data were collected on both student opinions and actual examination results. Both groups of data can be used to provide insight into the value of using the H-ITT in logistics and transportation classes.

Student Opinions

To evaluate the students' views of the H-ITT system, a few simple questions about the system were asked of two groups. One group of students

TABLE 1
SUMMARY OF H-ITT

Advantages

Instantaneous Feedback
Improved Attendance
Increased Attention
Alternative Method to Evaluate Participation
Student Enjoyment

Disadvantages

Cost – Student and University
Preparation Time – Primary Daily
In Class Time and Distraction
Technological Problems – Too Many Inputs,
System Crash, etc.

Source: Leidner, 1995; Rutner, et al., 1997;
Slough & Lane, 1995; www.h-itt.com,
2003

was a class of undergraduates taking an introductory course in business logistics. The second group consisted of graduate students taking a course in global logistics. These two groups represent a good cross section of potential users of the H-ITT. The two classes were asked a number of basic questions about the H-ITT system. The demographics of the sample appear in Table 2.

The students were asked to give their opinions on a number of issues about the H-ITT system. The first group contained a series of 5-point scale questions from "loved" to "hated" or "strongly agree" to "strongly disagree." For reporting purposes, all the responses have been converted to 1 = the most negative finding to 5 = the most positive response. Table 3 summarizes the overall responses to these questions grouped by class level. Also, the table identifies statistically significant differences at the .05 level between the two groups.

The students do not appear to feel strongly about the use of the H-ITT. Most of the responses were

TABLE 2
STUDENT DEMOGRAPHICS

Variable	Responses
Male	65.8%
Female	34.2%
Undergraduate	60.5%
Graduate	39.5%
Major	
Logistics & Trans	42.1%
Other Business	42.1%
Non-Business	15.8%
1st Time H-ITT User	
Yes	44.7%
No	55.3%

in the middle ranges of the 5 point scale. One interesting difference was between the undergraduate and graduate students when considering additional information about the system. Both groups were told that past classes using the H-ITT had scored approximately one-half letter

grade higher on examinations. For that question, the undergraduates were much more supportive of the H-ITT than the graduate students (i.e., undergraduates may be much more grade focused.) The other area of significant difference between graduates and undergraduates concerned the belief that the H-ITT system had improved their understanding of class material. Again, the undergraduates had a much higher perception of the value of the H-ITT as an instructional tool.

There appeared to be no major differences between genders for any of the survey items. Also, there were no differences between first time users and students who had used the H-ITT in a previous class. The results imply that effectiveness of the H-ITT system is not affected by either gender or previous experience with the device. The instructor can be fairly confident that the H-ITT will not create a bias in any data gathered.

Two other questions focused on the specific strengths and weaknesses of the H-ITT system. The questions asked the students to identify the best and worst things about the H-ITT system. Tables 4 and 5 provide the results of these questions.

TABLE 3
STUDENT REACTIONS TO H-ITT SYSTEM

Question	Graduate	Under-Graduate	Sig.
How do you feel about the H-ITT system?	2.40	2.77	-
How do you feel about the H-ITT system with the knowledge that it improved previous students' grades?	2.47	3.22	.008
I think the H-ITT was fun to use.	3.33	3.22	-
The H-ITT helped me to better understand the class material.	2.53	3.91	.000
Recommend the instructor use the H-ITT in this and other classes.	3.33	3.65	-

**TABLE 4
STRENGTHS OF THE H-ITT**

What was the best thing about the H-ITT?	%
Reviewed material/questions	39.5
Increased class participation	23.7
Made me come to class	13.2
Nothing	13.2
Fun	10.5

**TABLE 5
WEAKNESSES OF THE H-ITT**

What was the worst thing about the H-ITT?	%
Too expensive	55.3
Forget to bring to class	23.7
Did not work in class	10.5
Too many people trying to enter results at once	7.9
It was just stupid	2.6

The students were pleased with the ability to review their knowledge of the subject material. Another recognized benefit was the system helped them to remain more involved in the class and improved their participation.

The students identified cost as the overwhelming weakness of the system. This is based on a price of \$30 for the transmitter at the university bookstore. The cost of the H-ITT transmitter is actually higher, given that approximately five to ten percent of the students lose the transmitters each semester. These students must purchase a second device.

There are a number of solutions to the cost issue. As identified previously, a secondary market between graduate students helped to reduce the cost (approximately \$15). Also, after two semesters in use, the off campus bookstores were

buying used H-ITT devices and selling them at a reduced price. Finally, students in different class sections have shared a single transmitter. Therefore, while cost will always be a key issue with students, it is not an insurmountable obstacle.

There were a few open-ended comments that are useful in summarizing students' opinions. Also, they helped to shape the author's views on the value and future use of this technology in the classroom.

- "I liked the instant feedback, but there might be a better use of it than for a quiz."
- "I don't like giving or getting instant feedback from the class."
- "May we have more time to answer the questions? Forty seconds is not enough."
- "The Hitt Stick is a very efficient method."
- "It doesn't always work on the first try."
- "I would utilize it to motivate class discussion."

Examination Results

The H-ITT system was also evaluated based upon student examination results. One instructor's introductory logistics courses provided the data set. The current and previous two semesters of classes had used the H-ITT system. The data set included raw test scores by exam for three classes using the H-ITT system and two classes without the system. Scores on each exam for classes with H-ITT were compared to scores on the same exam for classes without H-ITT.

Although not a perfect comparison, the choice of one instructor's classes did hold most of the possible variables constant: little change in material, same instructor, same style, same university, same textbook, same assignments, etc. Also, students were not allowed to keep the tests. Therefore, each current examination

included approximately 80 to 90 percent of the previous term's questions. This provided a useful dataset for comparison. Finally, all of the classes included four examinations and each exam covered the same material in the same period. Given this set of data, four t-tests were performed to evaluate any differences based upon the usage of the H-ITT system.

The first examination covered some of the basic principles and concepts of logistics, materials management, outbound logistics and supply chain management. The comparison of the raw test scores included three sets of students using the H-ITT and two sets that had not. The results indicate significantly higher scores for the students that used the H-ITT (Table 6).

The second examination covered the concepts of inventory carrying costs, EOQ, total annual costs, changes in the number of distribution centers and warehouse design. The material in this section is very quantitative and the exam involves a large number of calculations. The results of the t-test produced a surprising finding (Table 6). There is a negative relationship between H-ITT use and test scores. The implication is that the H-ITT works well in conceptual applications (Exam 1), but not when quantitative skills are involved (Exam 2). This may have been partly due to the fact that the H-

ITT questions used in class were focused toward qualitative issues and very few of the in-class questions required calculation.

The third test was similar to the first exam. It was conceptually based and covered topics such as international logistics, logistics information systems, and transportation management. In this section of the course, the H-ITT system appeared to have a positive impact (Table 6). Once again, the classes using the H-ITT system scored significantly higher on the exam. While all the differences appear small, the result is a measured three to five percentage change in the overall class average.

The final exam was non-comprehensive, covering both quantitative (i.e., facility location) and qualitative (i.e., SCM, 3PL, etc.) topics. Unfortunately, some of the material in this section of the course was changed during the most recent term, limiting the usefulness of the comparison. However, the results mirror the previous three findings. There is some improvement in test scores (Table 6), but the change is not statistically significant. This can be partially explained by the change in course material. Also, there were some calculation-type problems on this exam which appear not to benefit from using the H-ITT system as it was being applied at that time.

TABLE 6
SUMMARY OF T-TEST FOR EXAMS 1 THROUGH 4

	Exam 1		Exam 2		Exam 3		Exam 4	
	HITT	WO/HITT	HITT	WO/HITT	HITT	WO/HITT	HITT	WO/HITT
Mean	26.340	25.311	29.416	30.741	25.406	24.090	23.796	23.367
Variance	16.404	14.934	25.365	14.671	10.797	8.9341	17.371	17.720
t Stat	1.763		-1.821		2.513		0.606	
P (T <= t)	0.039		0.035		0.007		0.273	

The overall findings support the claim that the H-ITT system can positively impact interactive learning in the classroom. The H-ITT is popular with students and provides opportunities for increased learning in some cases. However, the negative results from Exam 2 suggest a need for more research and multiple samples.

CONCLUSIONS

The findings generated in this study provided some valuable insights into the use of the H-ITT system. While much of the literature strongly supports the benefits of various interactive teaching tools, the findings reported here suggest strong support in some areas and cautious interpretation in others. The negative results on the second examination and comments from the graduate students caused the instructor to carefully consider future H-ITT use. The results indicate that H-ITT is not a "magic bullet" that can cure all instructional problems. The H-ITT system must be applied like any other instructional tool. It has strengths and weaknesses. The H-ITT system can be a valuable tool when applied properly.

Based upon the findings of this study, the subject instructor will make the following changes in the

logistics and transportation courses. For undergraduates, there will be little change in the process. The H-ITT system will remain a method to check learning progress and understanding with review-type questions on a daily basis. However, in the highly quantitative sections of the course, more problems will be included as H-ITT questions. Also, fewer H-ITT quizzes will be used in the quantitative sections and more traditional teaching tools will be emphasized.

For graduate students, there will be a dramatic change in how the H-ITT is employed in the classroom. It will be used more to facilitate discussion. For example, based upon homework readings concerning a controversial subject, H-ITT quizzes will be used at the beginning of the class to assess student opinions on the issues. This can then be used to generate discussion of that topic. It will help to integrate reading assignments and improve class participation.

With these and other minor refinements, the H-ITT system can evolve into an excellent tool to help both students and instructors. The key to successful integration in the curriculum is the methods that instructors use to implement the technology in the classroom.

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