

**An ADEPT Learning Cycle
Enhances Intermediate Accounting Student Learning Success**

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1-20-2006 VERSION

Intermediate accounting courses cover a variety of challenging topics, and are widely considered the most difficult courses in the accounting major. Some refer to intermediate accounting as a “weed-out” course that determines which students really have what it takes to be accounting majors, and ultimately, professional accountants. Even in programs that attract primarily promising, successful students, dropout rates in intermediate accounting courses tend to be high, and excellent performance is the exception, not the rule. Different professors, including the author, have tried many different approaches to the course over many years in attempts to improve students’ success in and satisfaction with the course without “watering down” the requirements. Such attempts have met with little success.

This article introduces readers to an approach to teaching (and managing) an intermediate accounting course that helps students know the point at which they have achieved sufficient understanding of and proficiency with a topic. The diagnostic exam-oriented approach incorporates a teaching and learning cycle (the ADEPT Learning Cycle—Analysis of Diagnostic Exam Prompted Teaching and Learning Cycle) that involves one-on-one targeted teaching outside of the classroom that addresses individual students’ misunderstandings and misconceptions about topics covered. It also provides them with timely feedback on their level of mastery without grade penalty. The approach requires students to take responsibility for learning the material covered in the class. The article reports an exploratory study with impressive results regarding student success, student satisfaction, and rate of completion of the accounting major.

Exhibit 1 presents the grade distributions for two first semester intermediate accounting classes (Intermediate I) taught at the same institution (Virginia Tech) by the same professor in two different terms. [Place Exhibit 1 approximately here.] The first class was taught in Fall 2003 using a fairly traditional approach not unlike what the professor has used for many years. The same professor taught the second class in the first summer term of the same academic year (Summer 2004) using the approach (hereafter referred to as the diagnostic exam approach) that is presented here.

Virginia Tech attracts promising students to its accounting program. Yet, in spite of these promising students, the grade distribution of the Fall 2003 class is not dramatically different from the grade distributions in other first intermediate classes taught there over the years. Such grade distributions might reasonably cause one to ask, “What went wrong?” The grade distribution for the Intermediate I class using the diagnostic exam approach (Summer 2004) is starkly different from the norm and might cause the opposite query, “What went right?”

Searching for the answer(s) to the question of “What went Right?” leads to numerous possibilities:

- Were the students in the diagnostic exam approach class (Summer 2004) simply significantly better students to begin with than the normal Intermediate I class (and the Fall 2003 class in particular) at this institution?

- Did the professor simply “teach to the exam” (or prepare easier exams or grade easier) to such a level that the grades were so improved?
- Is there any evidence other than the grades assigned in the class that these students were more successful or understood the material better?
- Was the retention of accounting majors any better for students in the diagnostic exam class, or did these students simply decide to change majors later in the process than is normal?

Evidence addressing these questions is presented after explaining the diagnostic exam approach.

The Analysis-of-Diagnostic-Exam-Prompted Teaching and Learning Cycle

The key unique feature employed in the course was the diagnostic-exam-directed teaching and learning cycle (i.e., the ADEPT Learning Cycle) outlined in Exhibit 2 and illustrated in Exhibit 3. The philosophy was to create a system under which

- The penalty for nonconformance was severe enough and immediate enough to cause the vast majority of students to implement good study habits and commitment
- Feedback to students was timely, extensive, and provided an early alert if students’ mastery was not adequate so that they could work to achieve an acceptable level of knowledge and proficiency without direct grade penalty
- Outside-the-classroom, one-on-one, faculty-student interaction caused student deficiencies to be assessed and addressed on a regular, timely, focused basis

The central features of the diagnostic exam approach are highlighted in Exhibit 2. This exhibit shows the general progression of the traditional teaching and learning approach normally implemented in intermediate accounting courses in the middle column. [Place Exhibit 2 approximately here.] The features added by the diagnostic-exam-based teaching and learning cycle are presented in the third column, and the active participants in each step in the traditional process and in the additional steps of the diagnostic exam approach are indicated in the first column. Note that most outside-the-classroom, professor-individual-student interaction is left to the student’s discretion in the traditional approach. Too, the student must determine the need for additional study of the topic based solely on the student’s own assessment of whether the student has mastered. The diagnostic exam approach (a) mandates significant, regular, professor-student interaction outside of the classroom and (b) centers much of the responsibility for determining if the student needs to continue studying a topic on the professor—who likely has better understanding of the proficiency that represents mastery of the topic. This approach is illustrated in more detail in the schematic presentation of the ADEPT Learning Cycle in Exhibit 3. Note in Exhibit 3 that while the student’s own assessment that a topic has been mastered initiates the student’s entry into the ADEPT Learning Cycle, the professor’s agreement that the student has mastered the topic is required to exit the cycle successfully.

Details of the diagnostic exam approach used in the Summer 2004 course are described more fully in an excerpt from the course syllabus in Exhibit 4. [Place Exhibit 4 approximately here.]

Mandatory diagnostic exams were the most significant feature of the pedagogical approach employed in the course. (Note in the syllabus excerpt, however, that students were required to complete homework satisfactorily or they were not allowed to take the diagnostic exams.) Students were given challenging, often even demanding, diagnostic exams on from 1 to 4 (typically 3) major topics identified in each chapter.

Each student had to successfully complete each diagnostic exam at an 80% or higher level prior to the related exam. Diagnostic exams could be taken more than once but students who did not achieve the 80% performance level on each diagnostic exam topic before exam time were not to be allowed to take the exam and were to receive a zero for that unit.

Students were expected to prepare for diagnostic exams as if taking an exam and to take the diagnostic exams outside of class. Typically, a student's diagnostic exam was graded as soon as the student completed it. Any errors were discussed with the student upon completion of the grading, and students who made less than 80% were asked to return after additional preparation to be retake a diagnostic exam on that topic again. Students could go through this "cycle" as many times as needed on a topic. In spite of the fact that students were required to complete and submit significant homework assignments and made some effort to prepare for a diagnostic exam on a specific topic, many students had to take the majority of diagnostic exams more than once. In rare instances, a student had to take a diagnostic exam 5 or 6 times before performing at the 80% level.

The topics covered by the diagnostic exams are listed in Exhibit 5. The text used in the course was the eleventh edition of Kieso, Weygandt, and Warfield. (The same text used in the Fall 2003 course.) There is not any reason to expect that using the approach described would be more or less successful using other textbooks.

Insert Exhibit 5

Applying the ADEPT Learning Cycle requires substantial time from a faculty member (perhaps as much as 75% to 100% more in the initial term that this technique is used in a course. To ameliorate the impact of the additional time spent preparing and evaluating diagnostic exams and engaging in one-on-one teaching, the professor implemented a self-reporting system for homework that largely eliminated the need to spend significant time reviewing students homework. Students were required to prepare and submit a self-report on their homework each day. Homework of three to four randomly selected students was reviewed each day to ensure that self-reports were consistent with work actually completed. A false self-report would have been an honor code violation subject to significant penalty. Students were not given access to homework solutions until after the due date for the homework. Homework did not have to be completely correct to satisfy the homework requirement.

RESULTS

As reported in Exhibit 1, the success of the diagnostic-exam-based teaching and learning cycle was dramatic. Its success can be evaluated both in terms of student performance success and student satisfaction. Performance can be evaluated in terms of student performance in the

Intermediate I course, student performance in the second semester intermediate financial accounting course (Intermediate II), and student completion of the accounting degree. Student satisfaction is reflected in student evaluations and informal feedback and in students continuing in the accounting major.

The diagnostic exam approach students clearly earned higher grades in Intermediate I than did the non-diagnostic exam Fall 2003 students, as presented in Exhibit 1. But, was the diagnostic exam approach the primary reason? Was the benefit limited to student performance and satisfaction in the Intermediate I course, or does it appear to carryover beyond the course? Several such questions were posited at the beginning of the article. The following sections address each of those questions or concerns.

Were the Students Better Students?

The relative quality of the students in the diagnostic exam group could be evaluated from various perspectives. Perhaps the most pertinent perspective is to compare the grade point averages and principles of accounting grades of the students in the diagnostic exam class with those of the students in the Fall 2003 class. This comparison should indicate whether the Summer 2004 class's performance was the result of a coincidence in which particularly high performing students happened to enroll in the same section of the course. Exhibit 6 provides this comparison. [Insert Exhibit 6 approximately here.] The average grade point average of the students in the Fall 2003 class (3.27) exceeded that of the Summer 2004 class (3.09) by 0.18, or almost two-tenths of a letter grade. Even stronger evidence is provided by the principles of accounting comparison. Only 1 of the students in the Fall 2003 class had a grade (a C) in one or more of the principles classes that was lower than a B-. Six of the Summer 2004 students had a C in at least one of the principles courses. Further, the average principles grade of the students in the Fall 2003 class (3.61) exceeded the average principles grade of the Summer 2004 students (3.07) by more than half a letter grade (0.54).

These data provide no indication that the Summer 2004 students were simply higher achievers than the Fall 2003 class. If anything, the opposite might be argued. The difference in the quality of students does not explain, or even correlate positively with, the difference in performance of the two first intermediate classes.

Did the Professor Bias the Results?

Another possible explanation for the improved results is that the professor "taught to the exams" in the diagnostic exam approach class in a way that was not done in the previous term. Alternatively, perhaps the exams were simply easier or graded more leniently.

For the record, the author will assert that the Summer 2004 course was taught in substantially the same manner as the Fall 2003 course with the exception of the incorporation of the diagnostic exam loop. The same text and assignments were used. Lectures were based on the same notes. The same handouts were provided to students. Importantly, while the author hoped for a positive outcome, there was no greater motivation to see this technique prove successful than any of the other, less time intensive, approaches tried in the past.

The author's assessment of the exams is that the first three exams given in the course were among the longest and most difficult he have ever given. Indeed, after showing one exam to a colleague who regularly teaches intermediate accounting, the author said, "I will give them the exam today and apologize for it tomorrow." As they were leaving the exam, many students were how they did. The most common answer was some version of, "Not as well as last time, but I did fine." In fact, the average score on the exam was between 85% and 86%. The never received an apology! The median student average grade on the first three exams was 88.4%.

Evidence on this question is provided more directly by comparing the performance of the two classes on the comprehensive final exam. To gain a more directly comparable measure of the performance of students in the diagnostic exam approach course (Summer 2004) with that of students who did not have the benefits of the diagnostic exam teaching and learning cycle, the same final exam was given to the students in the Summer 2004 course that had been given to the Fall 2003 class. For the Summer 2004 class, a higher percentage of the final exam was on material previously tested because of rearrangement of the order of coverage of two chapters. Further, students were not required to take diagnostic exams on the three chapters covered between the last interim exam and the comprehensive final exam. Therefore, any benefit from the diagnostic-exam-based teaching and learning cycle came primarily from the 9 of 12 chapters for which diagnostic exams were required. As the Summer 2004 exams were graded, the grading of the Fall 2003 exams was reviewed and followed as closely as possible to ensure as much consistency in grading as possible and to avoid any effect of personal bias.

The results of the comparison are displayed in Exhibit 7. [Insert Exhibit 7 approximately here.] Note that:

- The Summer 2004 class averaged 8 percentage points higher (77.4% vs. 69.5%) on the final than did the Fall 2003 class.
- Only 7 of the thirty students in the Summer 2004 class (23.3%) scored below 70 on the comprehensive exam with the lowest grade being 63.
- 9 of 27 students (33.3%) from the Fall 2003 class scored below 70 on the same final exam (which was specifically designed for their class schedule). Four of these students (14.8%) scored lower than 63. In addition to the four who scored lower than 63, two Fall 2003 students (7.4%) did not take the final exam—presumably because they had no hope of performing well enough on it to avoid failing the course.

A further noteworthy comparison is that the exam average (for all 4 course exams) of the students who were assigned a B- in the Fall 2003 class was lower than the exam average of every student who was assigned a B- in the Summer 2004 class.

This information and analysis do not support the proposition that the improved performance of the Summer 2004 class resulted from easier exams or more lenient grading.

Did the Diagnostic Exam Approach Students Perform Better in Later Courses?

Another question posed in the introduction to the article is, “Is there any evidence other than the grades assigned in the class that these students were more successful or understood the material better?” Presumably, if students really understood the material better on average than other intermediate accounting students, they would be more successful in subsequent courses that rely upon the material in the Intermediate I course. Performance in the second intermediate accounting course (Intermediate II) for which this course is a direct prerequisite likely provides the best source of evidence to address this question. The rate of successful completion of accounting degrees by students who entered first intermediate (Intermediate I) as accounting majors is another measure of subsequent student success (as well as student satisfaction).

Performance in Intermediate II of students in the Summer 2004 Intermediate I course (diagnostic exam approach students) was evaluated in two ways:

- By comparing the Intermediate II performance of diagnostic exam approach students who took Intermediate II in the second summer term of 2004 with that of all other students in the same Intermediate II classes
- By comparing the Intermediate II grades of the diagnostic exam approach students with the Intermediate II grades of all other students who took Intermediate I during the 2003-2004 academic year.

Exhibit 8 compares the performance of the 17 students from the Summer 2004 Intermediate I class who enrolled in Intermediate II in Summer 2004 with all other students enrolled in Intermediate II in Summer 2004. [Insert Exhibit 8 approximately here.] Intermediate I was offered in Summer I and Intermediate II in Summer II. It should be noted that at least 4 of these 17 students had been unsuccessful in Intermediate I at least once prior to Summer I 2004. Also, two other instructors, not the author, taught Intermediate II in Summer II 2004. As reflected in the data in Exhibit 8,

- The Summer 2004 Intermediate I students performed better on each exam regardless of instructor.
- Only 1 of the 17 Summer 2004 Intermediate I students (5.9%) received a final grade of less than a C- in the Summer 2004 Intermediate II courses, compared to 10 of the other 50 students (20%).
- The average Intermediate II course grade for the Summer 2004 Intermediate I students was markedly higher than the average course grade for all other students in the same Intermediate II classes (approximately half of a letter grade in one class and two-thirds of a letter grade in the other class).

Exhibit 9 compares all Summer 2004 Intermediate I students with all other students who took Intermediate I in the same 2003-2004 academic year. The exhibit provides comparative data for the two groups as follows:

- *Pre-Intermediate I Overall Grade Point Average and Accounting Principles Average*— Both the overall grade point average comparison and the average principles grades comparison indicate that any performance differences in Intermediate I and Intermediate II or in completing their degree programs are not explained by the Summer 2004 students

being of a higher average quality (based on prior performance) than students from the comparative group. Indeed, the exhibit indicates that the pre-intermediate performance of students in the Summer 2004 class was somewhat inferior to the pre-intermediate performance of the other students. The average grade point averages differed only slightly—other students overall grade point average was higher by .08. There was a somewhat more meaningful difference in the average principles grade, which was .28 points higher—slightly over one-fourth of a letter grade—for the students who were not in the Summer 2004 Intermediate I class.

- *Average Course grade in Intermediate I*--The performance of the Summer 2004 class in Intermediate I, as measured by average course grade, surpassed that of all other students by 1.34 letter grades—approximately the same margin by which it surpassed that of the Fall 2003 class used for the initial comparisons presented in Exhibit 1.
- *Intermediate II Retention and Performance*--29 of the 30 (96.7%) Summer 2004 students completed Intermediate II (in some subsequent term) compared to only 153 of 204 (75%) other Intermediate I students of the 2003-04 academic year. The Summer 2004 students average course grade in Intermediate II (2.71) was slightly over a third of a letter grade higher than the average Intermediate II grades (2.36) of the other 2003-04 Intermediate I students. Given the poor Intermediate I average grades of the fourth of the students in the latter group that did not take Intermediate II, the differential in average grades would likely have been more pronounced had all Intermediate I students taken the Intermediate II course.

The best evidence that virtually all of the Summer 2004 Intermediate I students have continued to be successful is that all of the 23 accounting majors in that course have either completed their accounting degrees (18) or are students in good standing who are expected to complete their degrees in the next several months (5). (6 of the other 7 have also completed their degrees, with 2 receiving accounting degrees.) By comparison, 25 of the 119 accounting majors in the other group (21%) are not expected to complete an accounting degree. (Most of these students have completed or are about to complete other business degrees.)

Were Student Satisfaction and Retention Improved?

Another measure of the success of the diagnostic exam based teaching and learning cycle technique is the level of student satisfaction. Student satisfaction can relate not only to the course and the instructor, but also to the accounting major (and hence retention and career choice).

The primary indicator of student satisfaction with the accounting major and student retention is the percentage of students who changed from the accounting major to another major. This comparison was noted at the end of the prior section on how students performed after completing Intermediate I. Recall that accounting major retention was far higher (100%) in the Summer 2004, or diagnostic exam, group (none switched out of accounting) than among all other accounting majors (79%--25 switched, including 12 who scored C or better in Intermediate I and a total of 17 whose intermediate grades provided them with the option of continuing in the major).

Exhibit 10 compares the results from the student evaluations of the Fall 2003 class and the Summer 2004 class. (Insert Exhibit 10 approximately here.) The department tends to emphasize the overall rating of the instructor in particular. Because of its significance, that rating is provided for both (a) the evaluations by all students and (b) the evaluations of only those students who indicated that they expected a B in the course. The latter data addresses the commonly stated concern that higher evaluations might result largely from students expecting higher grades.

The improvements in the ratings from the student evaluations are striking. They are even more impressive when one considers that the same text and assignments were used in both terms, the instructor taught the class in virtually the same manner both terms, etc. The only explanations that I can suggest for the differences are that (1) students were expecting better grades overall or (2) the diagnostic exam system. The “better expected grades” theory is not supported by the analysis of the overall rating of the instructor by the students expecting a B in each term. The differential in the overall rating of the instructor between the two groups is precisely the same for the B-student evaluations as for evaluations by all students. The implementation of the diagnostic exam system appears to be the source of the sizeable increase in student satisfaction reflected in the evaluations.

Exhibit 11 supports the argument that the diagnostic exam system generated the enhanced student satisfaction. The exhibit contains all of the diagnostic exam-related student comments included in course evaluations. (Insert Exhibit 11 approximately here.) (The author likely indicated at some point that feedback on the diagnostic exam teaching and learning cycle would be valued. Otherwise, it is hard to believe that even such a focal, unique feature of a course generated comments from such a high percentage of students.) Clearly, the students appreciated the diagnostic exam system (though recognizing that it demanded much work) and attributed much of their success and understanding to the diagnostic exam system.

Other results are more anecdotal. Intermediate accounting is often considered the course that causes students to determine that they do not want to be accountants after all. Some students in this course told another professor that they were not positive that they wanted to be accountants until they took this course and were now absolutely certain that they did. How many of us have said that we simply cannot get students to do their work, participate in class, and come to us in our offices for help? That was not a problem in this class. Students were well prepared, were constantly in the office seeking one-on-one help, and often determined what was discussed in class because they knew what they did not understand. The student attitude and morale in the class were the best that I have experienced in over 20 years of teaching intermediate accounting or other accounting courses. Numerous students have sent separate notes directly to me, both at the end of the course and subsequently, expressing their feelings about the course and the diagnostic exam technique.

CONCLUSIONS

Several conclusions are suggested by the results of this analysis.

1. The diagnostic exam teaching and learning cycle helped students perform significantly better in the Intermediate I course. The improved performance cannot be attributed to the possibility that the diagnostic exam group students were better students on average than the Intermediate I students in other academic terms. The evidence suggests the opposite.
2. The diagnostic exam system appears to have helped students perform better than other students in their subsequent studies. Clearly, the diagnostic exam group performed notably better in Intermediate II. They also performed better in terms of accounting majors successfully completing accounting degrees. All accounting majors in the diagnostic exam class have or should receive accounting degrees from the university. Over 20% of the accounting majors in the other Intermediate I classes are not expected to complete an accounting degree. The improved performance may result from various beneficial results of having been subjected to the diagnostic exam teaching and learning cycle. For example, it is likely that
 - Many diagnostic exam approach students had a better background upon leaving Intermediate I and were better prepared for Intermediate II and other courses.
 - Some students subjected to the diagnostic exam teaching and learning cycle acquired improved study habits as a result of that experience.
 - Some diagnostic exam approach students learned to judge their level of mastery of a topic more accurately as a result of being subjected to the diagnostic exam teaching and learning cycle. Recall from Exhibit 2 that more traditional teaching and learning methods put the bulk of the responsibility for judging readiness for an exam on the student. Exhibit 3 highlights the fact that the student assessment that adequate mastery of the topic has been achieved initiates the diagnostic exam teaching and learning cycle, but the professor must agree with that assessment of mastery before the student leaves the cycle. The diagnostic exam teaching and learning cycle ultimately places responsibility on the professor to determine if the student understands a topic well enough to set the topic aside until time to review for an exam. Thus, this process provides feedback to the student on whether his or her assessment of readiness is accurate. This feedback may help the students improve their self-assessment skills.
3. Retention of accounting majors was notably higher for students whose Intermediate I experience included the diagnostic exam system. 100% of diagnostic exam approach students listed as accounting majors upon entering Intermediate I are receiving accounting degrees compared to only 79% of other students who listed accounting as their major upon entering Intermediate I. This suggests the possibility that using the diagnostic exam system in principles of accounting courses might further enhance retention of accounting majors. Further, use of the system in principles might result in larger percentages of principles students choosing the accounting major.
4. Student satisfaction skyrocketed as indicated by both student evaluations and retention of accounting majors. The evaluations and related notes clearly indicate that the students valued the diagnostic exam system and thoroughly appreciated the educational experience provided by the course. The author had probably never received an overall rating of instructor (in the Intermediate I class) higher than a 3.3 or 3.4. A rating of 4.59 was beyond any reasonable

expectation he could have had in that course. Further, the author's personal satisfaction and enjoyment of the teaching experience were far beyond any other time he has taught the course over the past 20+ years.

5. Faithfully completing homework is essential, but often it does not fully meet the needs of students trying to master difficult topics. Conventional wisdom says that if students will just do their homework, they will understand the material and do reasonably well on the exams. The one-on-one interaction with students in the diagnostic exam system showed me that this is not correct. Certainly, if students do not do their homework, they likely will not do well on exams. But, doing homework faithfully does not correlate nearly so well with good performance on exams as I have always thought it would.

Students in this class were completing their homework, but they still failed to reach a high enough level of mastery to perform well on the diagnostic exams the first time. Even after doing homework and preparing for a diagnostic exam, many would not perform at the 80% level—some would not come close. They needed one-on-one, targeted teaching that identified and addressed their personal misunderstandings or misconceptions. The diagnostic exams provided a mechanism to both assess their mastery of various important topics and to address their individual needs and deficiencies related to each major topic.

6. Conventional wisdom often suggests that today's students do not do well in accounting because they are not willing to devote the type of effort that prior generations of students were willing to invest. The results from the diagnostic exam approach class suggests the possibility that this is not the case. When students received the guidance and help they needed to succeed, there was no lack of effort or will at all. The experience with the diagnostic exam system causes the author to believe that perhaps students don't mind demanding expectations. They just demand that we provide them with the direction and the means to meet those expectations.

IMPLICATIONS AND POSSIBILITIES

The dramatic positive results of this exploratory study on applying the diagnostic exam teaching and learning cycle have numerous implications. In addition, while the system clearly resulted in positive outcomes for one class under one professor, an obvious question is, can that success be replicated in other terms, by other professors and student groups, and in other institutions; or were these results a fortunate fluke? If the results can be consistently replicated, several questions will need to be raised about the possible uses of this teaching and learning approach in both accounting education and other areas of education. Hopefully, others will investigate these possibilities and experiment with this and other similar systems for improving student learning and success in a variety of fields.

The implications and possibilities of the diagnostic exam teaching and learning cycle approach involve not only the area of accounting education, but also other areas of higher education as well as secondary education. A number of these implications and possibilities that warrant additional accounting education research and research in other areas of education are discussed briefly.

In Accounting Education

- Will the diagnostic exam system enhance student success in and satisfaction with principles of accounting courses? If so, will more students choose to pursue accounting as a major? Principles of accounting courses are considered key points at which many students decide whether to pursue an accounting major and career. The diagnostic exam system correlated with much higher retention of junior accounting majors. Will use of the system in principles cause higher percentages of principles students to pursue an accounting major?
- Will the diagnostic exam system improve learning outcomes in other upper level accounting courses such as second intermediate, advanced accounting, cost accounting, governmental and not-for-profit accounting?
- Relative to more traditional teaching and learning approaches, the diagnostic exam system is labor-intensive and time-consuming. If institutions with large class sizes use this method, provisions will need to be made to assist the professor. Perhaps, qualified student monitors can assist the professor in the grading and one-on-one feedback and teaching required by the diagnostic exam teaching and learning cycle. In institutions with smaller class sizes in which faculty teach more hours, provisions also will need to be made to accommodate the additional time the faculty member will spend, perhaps requiring reduced teaching loads. Are institutions willing to commit the additional resources to (or redirect resources within) the teaching and learning process that would be required to use this type of method effectively on a larger scale?
- Can most, if not all, of the benefits of the diagnostic exam system be gained using surrogates for the professor? For instance, if graduate students (or for principles perhaps undergraduate accounting majors) are used, perhaps in an accounting lab, to do most of the work involved in the diagnostic exam teaching and learning cycle, will similar positive results be achieved? Or, can similar results be achieved using a reduced number and/or rigor of diagnostic exams, thus reducing the time required for retesting, one-on-one teaching, and grading to implement the diagnostic exam system? Can computerized algorithmic homework programs or other computerized resources be used to accomplish the same purposes as the diagnostic exam teaching and learning cycle and achieve similar results?
- If the diagnostic exam teaching and learning cycle is a superior teaching and learning process compared to the more traditional method outlined in Exhibit 2, what are the implications for online courses and online degree programs? Is the same “education” being delivered?
- The diagnostic exam teaching and learning cycle is a cycle of early assessment, intervention to overcome deficiencies, and evaluation of readiness to progress that is individual student centered. Are there other effective methods of providing this type of feedback and assistance that are equally, or perhaps more, successful?

Beyond Accounting Education

- On a broader scale, can the diagnostic exam teaching and learning cycle be used to improve student success, satisfaction, and retention in other disciplines—math, engineering, statistics, chemistry, biology, etc.? If its impact in accounting education is more fully validated, it is logical to assume that similar benefits might be gained in numerous other disciplines.
- Will application in key challenging general education courses enhance student-learning outcomes in those courses and improve student retention?
- Can the diagnostic exam teaching and learning cycle be used in special programs to help increase the success and retention of struggling students—either those identified by early alert systems or those on academic probation?
- If this method does prove to be highly effective in higher education in enhancing learning outcomes and interest in a subject, can it also be used to address critical problems in secondary education? Might it be used as an effective tool for improving American students' success in math, science, and technology and their interest in pursuing careers in those fields? According to a January 5, 2006 Reuters article, Tom Donohue, president of the U.S. Chamber of Commerce said “the United States could not maintain its economic lead while many of its schools performed poorly and global competitors had increasingly well-educated work forces. The bottom line is that this nation cannot rightfully expect to lead the 21st century’s information and technology-driven global economy when we have upwards of 30 percent of our young people not even graduating from high school.” According to the Reuters article, the chamber is already working with other business organizations to double the number of U.S. math, science and engineering college graduates by the year 2015. This goal is more likely to be met if those subjects are taught at both the secondary and college level using a process that both enhances student learning outcomes in, and their satisfaction with, math, science, and technology courses and programs. Will the improved results in accounting be present when the diagnostic exam teaching and learning cycle is used in these other disciplines and at other educational levels?

A FINAL COMMENT

From a personal standpoint, the most profound benefit of the diagnostic exam system is that it “reconnected” me with a love for teaching. I decided many years ago that I wanted to teach primarily because of the experience of “teaching” classmates on a one-on-one basis during my years as a college student. But, college teaching has consisted largely of in-class teaching on a lecture or question-and-answer basis. My limited personal attempts at using the case study method for teaching were enjoyable, but not satisfactory to me from the standpoint of what I felt students learned. The one-on-one (or at least on two or three) teaching that comes with the diagnostic exam system renewed my enthusiasm for teaching and resulted in much closer ties with a far higher percentage of students. Like my students, I rate this course and this experience very highly. Students need “outside-the-classroom” teaching to enhance their success;

professors need it to get the personal satisfaction that a discipline like teaching, that seeks to benefit others, should provide.

**Exhibit 1: First Intermediate Results
With and Without Diagnostic Exams**

	FALL 2003 (Without Diagnostic Exams)	SUMMER 2004 (With Diagnostic Exams)
Original enrollment	33	31
Drops and withdrawals	6	1
Completed the course	27	30
A grades	0	14
B grades*	13	16
C grades*	8	0
D grades*	2	0
F grades*	4	0
Course Average On 4-point scale	2.11	3.51

Exhibit 2: Traditional Teaching-Learning Process vs. Diagnostic Exam-based Teaching-Learning Process

Active Participant(s)	Stages in Traditional Process	Diagnostic Exam Approach Additions to Traditional Process
Professor	Determines <ul style="list-style-type: none"> ▪ Topics to be Covered ▪ Class Time Spent per Topic ▪ Assigned Material Required for Student Mastery of Topic --Readings --Problems, Cases, and Exercises --Group Assignments	<p>Identifies Minimum Topics Students Must Master Before Exam Time</p>
Individual Students	<ul style="list-style-type: none"> ▪ Read assigned material ▪ Prepare or attempts to prepare homework and case assignments ▪ Participate in completion of group assignments 	
Professor and Students as a Whole	<ul style="list-style-type: none"> ▪ Professor lectures in class on topic and leads or oversees discussion of various problems, cases, etc ▪ Students --Ask questions --Respond to questions --Otherwise participate in discussion	
Individual Students	<ul style="list-style-type: none"> ▪ Review material for better understanding ▪ Work (possibly) additional problems or cases ▪ Seek professor’s individual assistance on issues that student recognizes he or she has not mastered ▪ Determines that he or she has mastered a topic 	
Professor and individual students	This interaction occurs in the previous step at the student’s discretion	<p>THE DIAGNOSTIC EXAM CYCLE</p> <ul style="list-style-type: none"> ▪ Professor prepares diagnostic exam and administers to individual student to see if assessment of mastery is correct. ▪ Student takes diagnostic exam when deems self ready. ▪ Professor evaluates diagnostic exam, identifying the individual student’s deficiencies, addresses the deficiencies with one-on-one teaching, and assesses whether the student’s proficiency is satisfactory. ▪ If student’s proficiency is <ul style="list-style-type: none"> --Satisfactory, the student is ready to address another topic (or take the exam). --Unsatisfactory to the professor, the student must do additional study and work, then take another diagnostic exam. (This cycle may be repeated as often as necessary but must be successfully completed for all exam topics prior to exam time or student receives a zero.)
Professor	Prepares and administers an exam once a sufficient group of topics has been covered.	
Student	Takes exam	
Professor	Grades exam and returns to student	
Student	<ul style="list-style-type: none"> ▪ Reviews exam ▪ Determines deficient areas ▪ Revisits topics to improve understanding and proficiency ▪ Seeks professor’s assistance Struggling students likely will not engage in this process until late in the term, if at all.	

Exhibit 3: **The ADEPT Learning Cycle**

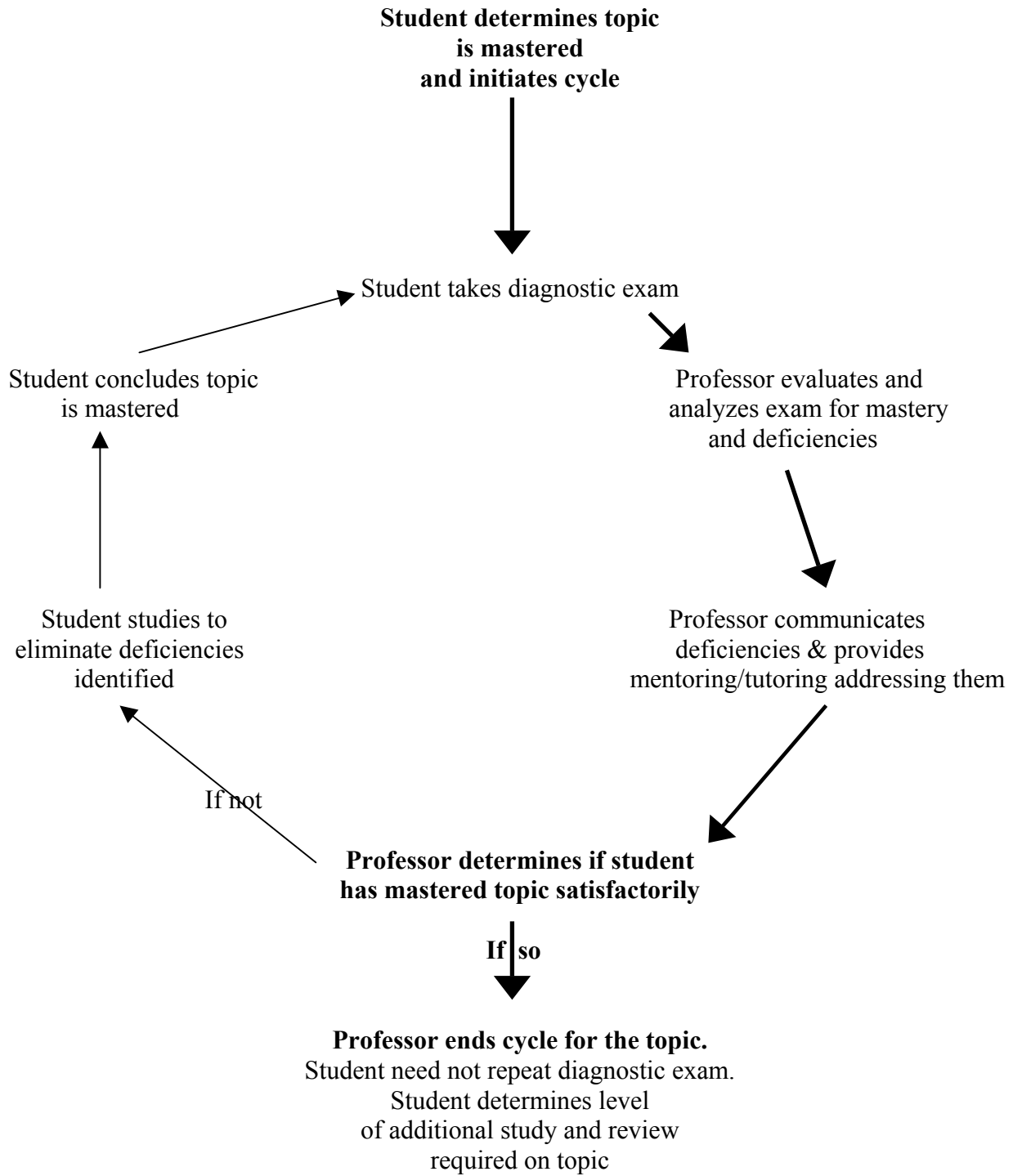


Exhibit 4: Course Syllabus Excerpt

2. Each unit of study involves three required components: reading and homework assignments, diagnostic exams*, and exams. FAILURE TO SUCCESSFULLY COMPLETE AT LEAST 80% OF THE READING AND HOMEWORK ASSIGNMENTS FOR A UNIT AT THE REQUIRED TIMES RESULTS IN RECEIVING ZERO POINTS FOR THAT UNIT and not being able to take diagnostic exams after failing to meet the homework requirements for the unit.

A diagnostic exam will be given on each chapter. Diagnostic exams will cover specific topics and must be successfully completed at the 80% level or above. FAILURE TO DO SO RESULTS IN RECEIVING ZERO POINTS FOR THE GRADING UNIT AND PRECLUDES TAKING THE EXAM FOR THAT UNIT. When possible and necessary, a student may receive more than one attempt at the diagnostic exam(s) on a particular chapter.

Students who successfully complete the homework and diagnostic exam requirements will be given a unit exam. The points received for the unit will be commensurate with performance on the exam. . . .

3. Reading and homework assignments are due on the day assigned in the course schedule. Failure to complete the assignments on the required day means that you have not met the homework requirement for that day. Remember that you must successfully meet the homework requirement for 80% of the days covered by a grading unit or you receive zero points for that grading unit.

For each day's reading and homework assignment, you must turn in a SELF-REPORT on what you completed and on what you did not complete. Include the sources of any assistance that you received. It is fine for students to assist each other, but each student must complete and understand the problem solutions independently. Do not abuse, or allow others to abuse, the privilege of seeking help from fellow students. You must be in a position to certify your homework as your own work—not something that was copied from others or dictated to you by others.

Homework solutions are available from various sources. It is an Honor Code violation for you to use any of these that are not provided directly to you by your instructor . . .

Homework from a subset of students will be reviewed each day and compared to the students' self-reports. False reporting is an honor code violation.

4. Diagnostic exams are intended to ensure that you have prepared in a manner and at a level that will help ensure your successful completion of the unit examination. The intent is to provide every possible opportunity for you to prepare at this level and to be able to demonstrate that you have done so. We will attempt to make diagnostic exams available to you early enough that you will have more than one chance to successfully complete them. Performance at the 80% level is required as these will cover particular major topics within each chapter. The intent is that at least 70% of each exam will cover topics that are covered on the various diagnostic exams.

*Diagnostic exam was not the term used in the syllabus, but is used here to be consistent with the terminology used in the article and to avoid confusion.

Exhibit 5: Diagnostic Exam Topics

Chapter Title	Diagnostic Exam Topics
The Accounting Information System	<ul style="list-style-type: none"> • Journalizing Basic Transactions • Adjusting Entries • Closing Entries • Cost of Goods Sold Computation
Income Statement and Related Information	Preparation of Multi-Step Income Statement
Balance Sheet and Statement of Cash Flows	Preparation of Classified Balance Sheet
Accounting and the Time Value of Money	Time Value of Money Word Problems (Included pension problem, bond pricing problem, deferred annuity problem, rate determination problem)
Cash and Receivables	<ul style="list-style-type: none"> ▪ Bank Reconciliation ▪ Accounting for Bad Debts ▪ Accounting for Note Receivable with Unrealistic Rate ▪ Transfer of Receivables
Valuation of Inventories: A Cost Basis Approach	<ul style="list-style-type: none"> • Computing Inventory and Cost of Goods Sold Using Various Cost Flow Assumptions • Dollar Value LIFO
Inventories: Additional Valuation Issues	<ul style="list-style-type: none"> • Lower-of-Cost-or-Market • Retail Method Inventory and Cost of Goods Sold Using Various Cost Flow Assumptions • Dollar Value LIFO Retail
Acquisition and Disposition of Property, Plant, and Equipment	<ul style="list-style-type: none"> • Interest Capitalization • Exchanges of Nonmonetary Assets
Depreciation, Impairments, and Depletion	<ul style="list-style-type: none"> • Basic Depreciation Methods (including partial-year computations) • Impairments of Fixed Assets
Revenue Recognition	<p><i>Diagnostic exams were provided for this chapter but not required because of proximity to final exam time</i></p> <ul style="list-style-type: none"> • Installment Method and Cost Recovery Method (including journal entries) • Percentage of Completion and Completed Contract Methods (including journal entries)
Financial Accounting and Accounting Standards	No Diagnostic Exams
Conceptual Framework Underlying Financial Accounting	No Diagnostic Exams

Exhibit 6: Pre-Intermediate I Academic Performance

	FALL 2003	SUMMER 2004
Average GPA of students at beginning of term	3.27	3.09
Average Principles Grades	3.61	3.07
Number of Students who had a C in a Principles Course	1	6

Exhibit 7: Common Intermediate I Final Exam Scores

Range of Scores	Fall 2003		Summer 2004	
	Number	Percent	Number	Percent
70 or above	16	59.3%	23	76.7%
63 to 69.9	5	18.5%	7	23.3%
40 to 62.9	2	7.4%	0	0%
Below 40	2	7.4%	0	0%
Did not complete exam	2	7.4%	0	0%
High Grade	85.5		93	
Low Grade	17		63	
Average Grade	69.5%		77.4%	

Exhibit 8: Intermediate II Performance in Summer II 2004

	Class Members from Summer 2004 Intermediate I	Other Class Members	Difference
Exam 1 Average			
Class A	78.13	73.65	4.48
Class B	77.10	74.60	2.50
Exam 2 Average			
Class A	80.38	72.65	7.73
Class B	78.37	75.09	3.27
Exam 3 Average			
Class A	74.38	68.25	6.13
Class B	70.10	69.80	0.30
Class GPA*			
Class A	2.83	2.17	0.66
Class B	2.73	2.34	0.49
Course grades below C-			
Class A	0 (0%)	4 (21.1%)	
Class B	1 (11.1%)	6 (19.4%)	
Total	1 (5.9%)	10 (20.0%)	
Number of Students			
Class A	8	19	
Class B	9	31	

*Based on a 4 point scale with + adding .3 and a – deducting .3 from the grade point per hour.

**Exhibit 9: Intermediate II Performance—
All 2003-04 Intermediate I Students**

	Intermediate I Students from	
	All Other 2003-2004 Students	Summer 2004
Pre-Intermediate Average Grade Point Average	3.17	3.09
Average Principles Grades	3.35	3.07
Average Intermediate I Grades	2.17	3.51
Average Intermediate II Grades	2.35	2.71
Portion of Group That Did Not Complete Intermediate II	51 students 23.61%	1 student 3.33%
Average Intermediate I Grades for Students Who Failed to Complete Intermediate II	1.64	3.00

Exhibit 10: Summer 2004 Student Evaluations

	Fall 2003	Summer 2004
Course-related questions		
Usefulness of text, etc.	3.82	4.44
Educational value of assignments	3.41	4.41
Contribution to your knowledge in subject	3.91	4.63
Overall rating of the course	3.45	4.48
Instructor-related questions		
Knowledge of subject	4.5	4.78
Methods of evaluating student performance	2.43	4.52
Success in communicating/explaining subject	3.00	4.26
Preparation for classes	3.13	4.3
Willingness to help students outside of class	3.41	4.85
Clarity of assignments	3.04	4.44
Administration of class	3.22	4.44
Overall rating of instructor	3.17	4.59
Overall rating of instructor by students expecting a B in the course	3.11	4.53
Grade expected	2.48	3.37
Number of evaluations	23	27

Exhibit 11: Student Comments on Diagnostic Exams* from Summer 2004 Evaluations

1. Diagnostic exams were very helpful. (B)
2. Diagnostic exams = Success in course. (A)
3. . . . class is tough, and the diagnostic exams can be time consuming, but when it comes exam time they really help. . . . I just wish all the homework that was mandatory counted for something. (B)
4. --Keep up the diagnostic exams! I would have failed without them.
--Make the homework worth points (like 5-10% of grade) to help balance out weight of tests . . .
(B)
5. Diagnostic exams are a terrific idea. I know the material thoroughly. . . . (B)
6. . . . is a great helpful teacher that makes sure the students understand what he is talking about. (B)
7. Diagnostic examing was a great success! It definitely pays off around exam time.
(A)
8. This course requires a lot of my time and effort. . . . (B)
9. The idea of diagnostic exams is very good and helpful, although it was hard trying to get them all completed in the little time frame. (B)
10. Pre-tests have helped a lot. It gives you a really good idea of how much more preparation you need to get ready for the test. . . .(A)
11. I learned A LOT! . . . Diagnostic exams were a pain but very helpful. (A)
12. Good class. Diagnostic exams were worthwhile. (A)
13. Makes you learn the material. (A)
14. . . .(A)
15. . . .came up with the idea of diagnostic exams and that was extremely helpful in my success in the class. . . . (A)
16. Pre-tests are useful. (A)
17. While the diagnostic exams were very time consuming, they were definitely helpful. (A)
18. The diagnostic exams definitely help prepare for the tests, but it's a little time pressing for the summer because a lot of students are taking other classes and work as well. I think that during the regular semester they will be great. ©
19. I liked the diagnostic exams thing but the week between the last day of material and the test was too much. (A)
20. Diagnostic exams help a lot! (A)
21. I felt there was too much information incorporated into short amount of time we had. . . .But the diagnostic exams were VERY helpful. ©
22. The diagnostic exam requirement was very time consuming but really helped to gain true understanding of the course material. (A)
23. The diagnostic exams were very helpful. They helped me gain a better understanding of the material. . . . (A)

*Diagnostic exam was not the term used in the course, but is used here to be consistent with the terminology used in the article and to avoid confusion.