Combating Poor Passing Rates in Developmental Mathematics through the Synergy of ASAP and the Effective Implementation of WebAssign

A Student Tailored Pedagogical Approach

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Dale Dawes
National Issue

In recent years there has been an emergence of both federal and state focus on institutions’ ability to increase graduation rates. In response institutions have turned their attention on searching for effective ways to increase student persistence toward graduation.

Among the emerging trends;

- Improving support services,
- Developing learning communities,
- Implementing early intervention processes
- Revamping curriculum
- Using innovations in pedagogy.
A Call to Action

A call to action places an increased challenge for community colleges where a large percentage of its student population place into Developmental course work.

According to Hoyt and Sorensen (2001), institutions report that 30–90% of all incoming freshmen need mathematical remediation.

According to McGowen (2006), as of the fall 2000 semester 12% of the mathematics classes at four-year colleges and 57% at two-year colleges were remedial courses. Enrollment in developmental mathematics courses has increased by 73% since 1980 (Brewer, 2009).

The National pass rates for developmental mathematics courses are abysmal. The DWF rate is between 40–50% and in some populations has been reported as high as 90% (Benford & Gess–Newsome, 2006; Herriott, 2006).
Why is this pertinent and of great concern for College administration, presidents and institutions nationally?

Developmental courses are the gatekeepers to higher education, and repeated failure of these courses (e.g. elementary algebra) can often result in stagnant students who give-up on their education or burn through their financial aid without academic advancement.
Possible Solution

The effective implementation of online educational technology in tandem with the support of a comprehensive structured program, designed to improve retention and graduation rates and build student academic momentum to progress quickly through developmental coursework.

The result was a 90.5% pass rate in Developmental Mathematics when online educational technology is effectively implemented and students are provided the key support services.
Institutional Profile

The City University of New York (CUNY) enrolls 96,500 students in its community colleges; approximately 37.8% of those students are Hispanic.

The Borough of Manhattan Community College (BMCC) enrolls approximately 24,500 students; approximately 36.7% of those students are Hispanic.

As an institution where Hispanics make up more than a third of its population there are thousands of Hispanic students enrolled in developmental courses in CUNY.
The Need

- Merseth (2011) noted that 60% of students taking a mathematics placement exam need at least one remedial course. The developmental mathematics path may have 3–5 courses. With more than 1100 institutions, community colleges account for over 44% of higher education students (Merseth, 2011, p. 2).
Online educational technology—with the potential to reach students throughout the country—is a growing trend among college administrators.

Currently the implementation of online homework and testing management systems (OHTMS)—commercial products (e.g. WebAssign, MapleTA, MyMathLab), freely available systems (e.g. WeBWork, DRILL) and adaptive learning systems (e.g. ALEKS, HAWKES, Virginia Tech’s Mathematics Emporium)—are part of the strategy of addressing this crisis.
Online Homework and Testing Management System

- OHTMS require students to login into a website to access their assignments and enter their answers.

- Systems typically have different question types (e.g. numerical, multiple choice, fill in the blank, multiple select) and accept numerical answers as well as algebraic expressions.

- Algorithmically generated questions can individualize assignments by giving each student different numbers.

- Students have access to feedback (i.e. answer key, solution key) and learning tools (e.g. electronic textbook, video lectures, step by step tutorials)
Solve the inequality and graph the solution on the real number line.

\[ x^2 \leq 64 \]

- \([8, \infty)\)
- \((-\infty, 8]\)
- \((-8, 8)\)
- \([-8, 8]\)
- \((-\infty, -8] \cup [8, \infty)\)

Use the tools to enter your answer.
What is the formula for calculating density?

- $\rho = m \times V$  
- $\rho = \frac{V}{m}$  
- $\rho = m^V$  
- $\rho = \frac{m}{V}$  

For both of the samples at your lab station, measure the volume and mass. Then, calculate the density. Specify units for all values.

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<tr>
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<td>53 kg</td>
<td>40 ml</td>
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<tr>
<td>B</td>
<td>206 g</td>
<td>3.2 ml</td>
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</table>
Online survey of 1230 U.S. mathematics and statistics departments to
  i) assess the experiences of departments using homework software; and
  ii) understand the concerns of departments that were considering such software.

467 of 1230 responded

260 departments had used such software

98 departments identified themselves as ‘disinterested’
Current users were more positive about the benefits of homework software than prospective users and much less concerned about drawbacks than prospective users: the primary benefit being better student learning; the primary drawback being students not showing their work.
Show My Work

To solve the equation \( 2 = 14b \), select each side of the equation by 14.7

Show My Work (Required)

Demonstrate the steps you went through to find the answer.

Step One: Create a fraction with \( a \) over \( b \): [Blank]

Submit Answer  Save Answer
Highlighted Key Findings

- Initial faculty resistance to using homework software occurred in most departments. Students and non-tenure-track faculty were more receptive to the software than tenured/tenure-track faculty.
What AMS’ Survey did not do.

“This survey did not solicit information about studies measuring the effectiveness of homework software. For example, questions about the benefits and drawbacks of homework software are answered solely in terms of faculty’s beliefs (for prospective users).

This survey did not consider the student experiences.

(The full report of the Task Force appeared in the AMS Notices 56, pp. 754–60.)
Inconsistent results “web–based versus paper–based homework”

- Several authors—Lenz (2010), Bonham (2003), Hauk (2005) and Deminci—concur with the generalization that there is no statistically significant difference.

- LaRose (2010) found “that students working on homework on–line appear to do no worse in the course than those with pencil–and–paper homework, and may do better.”

- Moosavi (2009) said, “regardless of whether achievement is measured ... the results presented here indicate that students perform better in traditional classes than in CAI (computer aided instruction) classes regardless of the CAI curriculum used”.

These studies lacked Detailed OHTMS Implementation Strategy.
The instructor uses his interpretation of the real-time analytics of an online homework and testing management systems (OHTMS) to serve as indicators for altering his teaching approach (e.g. lecture, class discussion, group work, 1:1 tutoring); the approach is tailored to the needs of each class and each student.

Instructor uses an OHTMS as a tool to create an atmosphere where students are constantly engaged, study groups form naturally and students are able to receive one-on-one assistance as necessary.

The transparency of an OHTMS allows the instructor transform a classroom into an innovative teaching environment where he/she can reach the previously unreachable students.

This implementation strategy is called the Dawes OHTMS -Altering Pedagogy Technique.
WebAssign

An online homework and testing management system

- Developed by
  - Aaron Titus (North Carolina State University)
  - Larry Martin (North Park University)

- Availability
  - Commercially available since January 1998
Test Drive
(14 Day Grace Period)

- Streamlines the grading process
- Register on the 1st Day of Class
- Electronic textbook available immediately
- Cost
- Students see the value immediately
  - Learning Tools
  - Instant Feedback
Reduce the following rational expression to lowest terms, if possible.

\[
\frac{c + 10}{c^2 - 100}
\]

\[
\frac{1}{c - 10}
\]

Specify the restrictions on the variable. (Select all that apply.)

- [ ] \(c = 0\)
- [X] \(c = -10\)
- [X] \(c = 10\)
- [ ] \(c = -10\)
- [ ] \(c = 100\)

Need Help?  [Read It]  [Watch It]  [Practice It]  [Master It]  [Chat About It]
“How many times has the fear of being embarrassed prevented a student from asking the teacher to explain a concept for the second, let alone the third or fourth time? These issues are real. They impact learning” (Shelton, 2013, p. 4).
Student Thoughts on Learning Tools

- “EXTREMELY!!! At times you have only part of a problem incorrect and the alternative versions help you to see the process from the correct perspective.

- “yes, if i cannot go to class or i forgot what professor taught, i would use those tools to learn or remind myself”
Implementation

Homework

- Learning Tools

- Improved communication between instructor & students
  - Extensions (Automatic & Manual)

- Review HW for the 1st 15 -20 minutes
  - Same type of problems with similar levels of difficulty
  - Encourage communication with peers
  - Address problematic questions on an individual & group level
Transparency

Instructor can analyze student performance on multiple levels

- **Individual**
  - Response Logs
  - Scores

- **Assignment**
  - Grades Response Summary

- **Category**
  - Descriptive Statistics
### Scores

**Chp 1 In Class 1 (1162255) -- View | Edit | Schedule**

**Show Analysis**

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<tr>
<th>Grade Essays/Files</th>
<th>Grant Extensions/Submissions</th>
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**Current Students | Dropped | All**

| Current Students (22) | ND | NS | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|-----------------------|----|----|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
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**20**

**21**

**22**
Solve the following equation by applying the squaring property of equality. Be sure to check all solutions.

\[ \sqrt{3x + 4} - 3 = 1 \]

\[ x = \] [4]

- Correct: 76.9% [10]
- Incorrect: 23.1% [3]

Number responding: 13

\[ x = \] [NONE]

- None: 72.7% [8]
- Correct: 27.3% [3]

Number responding: 11
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<td>75</td>
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Implementation

Transforming the Classroom

➢ Reaches the previously unreachable
  • WebAssign transparency allows instructors to see which students are progressing or struggling in real time.

➢ One-on-one attention if necessary

➢ Students are constantly engaged
  • Sense of accomplishment
Implementation

Lecture & Class Work

- Introduce new topic
  - Explain 1-2 examples of each type of question to the class.

- Integrate WebAssign into the Lecture
  - Provide students with 3-6 examples in the form of an in class assignment due by the end of the class.
  - Adequately prepares students for HW
Consistently Engaged

- Everyone does the class work
- Advanced students move at their own pace
  - Start future assignments
  - Read the text before the lecture
  - Increase quality of class participation
  - Tutor their peers
Prerequisites & Benchmarks

Special Conditions
- Group Assignment
- Conditional Release beta

Student must achieve 80% on Chp 1 In Class 1 to access this assignment.
Waive for selected students.

Drop conditional release restriction after

Jun 3 2010 9:00 AM EDT
You have the option to receive an automatic extension.

### Settings

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<th>Maximum Requests:</th>
<th>1 more extension</th>
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<tr>
<td>Penalty:</td>
<td>10% off all questions correctly answered after extension request. Any points already earned will be maintained.</td>
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### Time

| Additional Time Allowed: | 7 days after you click accept |

---

**Answered Requests**

Automatic extension granted: Saturday, September 14, 2013 10:42 AM EDT

**New Due Date:** Thursday, September 19, 2013 12:00 PM EDT
## Grades

**MAT 051 Fall 2012 Dawes, section 121**

Average for Student 15

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**Overall Grade**

Average: 84.44

Items marked with this type of border are visible to faculty only.

Grades were last updated on Jan 15, 2014
Next automatic gradebook update: Jan 15, 2014
Selected Quotes

“yes. the ones that i found useful to me were the grades system and the extension system. being able to check your grades at any time is extremely helpful and can sometimes be a good wake up call”.

“Great features. Grades – keeps me motivated and aware of my current progress. Excellent. Extensions – relieves stress Announcements – great way to get live info from prof. The others I used only occasionally. I loved how you can practice problems in the homework and how it reference the book. Amazing”
yes
Useful
Grades
helped
extensions
COMMENTS

Please note that the instructor will not see the comments until after the grades are submitted.

Instructor's Name: Dale Paws Course Name: Math

Course Number: [Redacted] Section #: [Redacted] Semester/Year: [Redacted]

Based on the questions that you have just answered, please provide more details. Your feedback will help the instructor improve this course.

COMMENTS: Learning the course over the computer made it easier for me to keep track of my assignments and my grades. The solution key for the midterm made it easy for me to understand my struggles to work through it.

Continue on back
Results

Fall 2012 Passing Rates of Students Tested:

- CUNY: 52.5% (5,537/10,583)
- CUNY 2-Year Colleges: 52.1% (5447/10449)
- CUNY 4-Year Colleges: 67.1% (90/134)
- CUNY BMCC: 43.4% (1156/2662)
- BMCC Dawes OHTMS (WebAssign)–Pedagogy Altering Technique: 69.7% (53/76)
Dawes OHTMS–Altering Pedagogy Results

Fall 2012 Passing Rates of Students Tested:

- CUNY: **52.5%** (5,537/10,583)
- CUNY BMCC: **43.4%** (1156/2662)
- Dawes WebAssign–Altering Pedagogy Technique (BMCC): **69.7%** (53/76)
- **Traditional Sections:** Dawes WebAssign–Altering Pedagogy Technique (BMCC): **60%** (24/40)
- **Hybrid Section:** Dawes WebAssign–Altering Pedagogy Technique (BMCC): **71.4 %** (10/14)
- **ASAP Section** Dawes WebAssign–Altering Pedagogy Technique (BMCC): **90.5%** (19/21)
Implications: Professional Development for Educators

U.S. Department of Education
Assistant Deputy Secretary for Innovation and Improvement
James H. Shelton III

Testified to
U.S. House of Representatives
Committee on Education and Workforce

Shelton (2013) wrote, “Longstanding skepticism of technology in education, combined with inadequate training and support, has also thwarted the widespread adoption and use of education technology” (Shelton, 2013, p. 9).
How do students feel about incorporating WebAssign into their Mathematics course?

- “Easy to use with correct instruction. I have used this program across two educators– proper instruction is definitely necessary”.

- “very convenient and reliable. instant feedback and grades were extremely useful. i rather complete math problems with a paper and pen but the features that came with EWA such as feedback and checking your current grades far outweigh that.”
How do students feel about incorporating WebAssign into their Mathematics course?

- “It was great and very helpful. I will look for classes in the future where it's being used”.

- “I liked the way webassign was, it was very modern. Not like the basic paper and pen work, webassign helped you actually go over the problem until you get it”.

- “Of course. webassign is like having the presence of your professor wherever/whenever logged in”
Chappell’s (2011) Bill Gates interview:

So 10 years after starting the Bill and Melinda Gates Foundation—and deciding to put billions into improving education in America—he knows that access to technology is no longer the issue. How we use that technology in the classroom, and whom we hire to teach are. (p. 83)
Implications: Implementation Strategies & Policies

Technology in Teaching and Learning Mathematics
A Position of the National Council of Teachers of Mathematics

It is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of technology to develop students’ understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use technology strategically, they can provide greater access to mathematics for all students.
Comments

Please note that the instructor will not see the comments until after the grades are submitted.

Instructor’s Name: David Dawes  Course Name: MAT
Course Number:  Section #:  Semester/Year: Fall/

Based on the questions that you have just answered, please provide more details. Your feedback will help the instructor improve this course.

Comments: WebAssign really made my life easier, and I wish all professors would adopt the same method. You explained the course materials very well and was tremendous in helping me adjust to math level college. You're a great professor! :)

Continue on back
The support of a comprehensive structural program, ASAP working in tandem with an innovative technique, Dawes OHTMS–Altering pedagogy technique, impressive results are achieved.

When ASAP is coupled with the Dawes OHTMS–Altering Pedagogy technique the class achieved a 90.5% passing rate as compared to the CUNY BMCC pass rate of 43.4%.
ASAP is a comprehensive structured program founded in 2007 with the support of the New York City Center for Economic Opportunity (CEO).

ASAP is designed to improve retention and graduation rates through a range of holistic financial and academic support services.

Goal: Achieve a 50% graduation within 3–years.

The program exist on six of the seven CUNY Community College campuses located throughout the city of New York.
Key Program Elements

- Financial support (e.g. tuition assistance, free use of textbooks and monthly mass transit passes)
- First-year Student Development Classes
- Block Courses
- Faculty Engagement
- Full-time Enrollment
- Career & Employment Services
- Academic Advisement
- Tutoring Services

The key elements aim to remove barriers and provide student supports that will develop and foster a sense of community and build student academic momentum to progress quickly through developmental education, to college level coursework, through to degree attainment.
Specific elements that have a high impact on developmental course progression include:

**Block Courses**
- Block scheduling consists of reserving course sections for students in the same cohort.
- Developmental Mathematics and English courses make up a large percent of ASAP block courses.

**Faculty Engagement**
- Block scheduling allows ASAP Advisors to engage faculty, establish a relationship, and create a line of communication that consist of frequent reports on student progress and attendance. Progress reports allow for early detection of struggling students and provide the opportunity to provide early interventions.
ASAP Supports Contd.

Intrusive Advisement

- ASAP utilizes an intrusive advisement approach to delve beyond the surface, uncovering barriers, addressing personal, domestic, financial and academic issues that often serve as a stumbling block to degree completion.

- Robert Glennen defines Intrusive Advising as “taking developmental advising theory one step further through proactive measures that incorporate interventions”. It is discovering the root of the problem causing a student difficulty and providing appropriate interventions (Earl, 1988).
ASAP Advisement Structure

- ASAP advisement builds a structure that includes bi-monthly advisement appointments between students and their assigned Advisor.

- Advisors engage and coach students on various student success skills
  - Institutional navigation
  - Coping Skills
  - Decision Making Skills
  - Networking with peers and faculty to name a few.

- Advisors monitor grades, attendance and inquire about a students' college experiences and nurtures a relationship that lends itself to discussion on domestic, financial and personal challenges. All of which pose a threat to a students’ ability to attend class, perform and progress.
ASAP is committed to remediate students within the first year of study. Students are required to address remedial needs immediately and continue to enroll until successful completion.

Tutoring is mandated for every student enrolled in a developmental course.
ASAP Retention and Graduation Results

ASAP’s rigorous program evaluation reveal significant differences;

Graduation (CUNY analysis of all cohorts combined)
- Average ASAP three-year graduation rate was 56% versus 23% three-year graduation rate of a comparison group
- Average ASAP two-year graduation rate was 44% versus 15% two-year graduation rate of a comparison group

Retention (CUNY analysis of all cohorts combined)
- Average one-year retention 80% versus 65% retention rate of a comparison group

Developmental Progression (CUNY analysis of all cohorts combined)
- After one-year 84% of ASAP students that needed remediation are fully proficient (satisfied their developmental requirement) as opposed 56% of the comparison group.
ASAP Model Replication and Expansion

- ASAP model has successfully proven to improve retention and graduate students. In turn ASAP has garnered national attention and enormous interest in replication. ASAP is frequently cited in major publications such as the NY Times and Chronicle of Higher Education and at national forums on higher education as a successful evidence-based program.

- Complete College America Time is the Enemy report cited ASAP as one of two programs that significantly provide a structural pathway and improve time to degree.

- The Center for an Urban Future’s November 2011 Mobility Makers report listed ASAP as one of CUNYS “bold reforms” addressing the issue of community college graduation rates.

- ASAP is currently in its second year of a three year expansion that will serve up to 4,000 students across six CUNY community colleges at full scale. ASAP’s three-year expansion is revealing that the ASAP model is both scalable and replicable.
Synergy of Dawes OHTMS–Altering Pedagogy Results and ASAP

- ASAP’s evaluation reveal an average ASAP pass rate of 57%. However, when ASAP is coupled with the WebAssign–Altering Pedagogy technique the class achieved a 90.5% passing rate.

- This large increase, more than doubles the overall passing rate of students in CUNY BMCC (43.4%), and suggests that the combination of ASAP and the Dawes OHTMS–altering pedagogy technique, is a promising vehicle for addressing the national problem of abysmal passing rates in developmental mathematics.

- Administrators and faculty members can use these interactive tools to determine best practices when adopting and implementing online educational technology to increase student retention, development pass rates and degree attainment.
Q & A
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Prof. Dawes is the best math professor I have taken at [redacted] (I’ve taken 3 others). His style of teaching is exceptional, and his use of WebAssign has helped me pass 051 (took it with 2/3 of the other profs. and never passed) I currently take his 056 class, and will be taking his 206 class in the summer. I highly recommend him to all students.

This was my first Math course in America and Prof. Dawes made the material clear and understandable to me. The WebAssign system was accessible and also easy to understand and work with. Overall this class was an enjoyable and beneficial experience.
An analysis conducted by the Center for Benefit –Cost Studies in Education (CBCSE) at Teachers College, Columbia University led by Dr. Henry Levin, a leading national expert in educational cost–benefit analysis revealed;

- An investment in ASAP has large financial returns for both taxpayers and the ASAP student and it shows a reduction cost in public services such as public assistance health and criminal justice system based on higher educational attainment

The average cost per ASAP graduate is $6,500 lower than comparison group graduates.

The benefit gained by ASAP students, the institution and taxpayers outweigh the per–student cost associated with the services provided to ASAP students.