Application for Technology-Based Learning and Support (ATLAS)

Arizona State University
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Table of Contents

Overview ........................................................................................................................ 2
Enrollment growth and technology-based solutions ...................................................... 2
Proposal ......................................................................................................................... 4
Platform features ........................................................................................................... 5
Platform functionality .................................................................................................... 6
Examples of platform applications ................................................................................. 7
Current platforms ........................................................................................................... 9
Platform development ................................................................................................... 9
Other considerations in the success of the platform ...................................................... 9
Conclusion ................................................................................................................... 11
Budget .........................................................................................................................13
Overview

Arizona State University has grown from 35,000 students in 1975 to more than 57,000 students today. To meet the projected 10,000 students that will bring the university student population to 67,000 before 2008, the university must plan for growth on a systematic basis, rather than on a per student basis.

The following approach looks at the university at the design level, and recommends a scalable, technology-based solution to be called ATLAS (Application for Technology-based Learning and Support). ATLAS will be a university-wide information technology (IT) system with significant practical as well as pedagogical advantages. Dynamic, individualized features of the university-wide IT system will help students to succeed, improve freshman retention and increase graduation rates. ATLAS will also allow ASU to support additional students on an already-capitalized base, resulting in a large state university with sustainable operations and an increased number of college graduates for the State of Arizona.

Enrollment Growth and Technology-Based Solutions

The population of the metropolitan Phoenix area has increased between 40 percent and 55 percent every decade since 1970. In the last decade alone, the metropolitan area grew from 2.1 million to over 3 million people – all served by one major research university: ASU. Arizona State University is committed not only to teaching and research, but to social and economic development of the region as well. We want to be judged by who we include, not who we exclude.

Enrollment growth: Arizona State University will continue to experience hyper enrollment growth. However, resources to support students have not grown proportionally, resulting in less than adequate academic and administrative support for students. While traditional means of addressing enrollment growth and student achievement have been implemented, the challenge of exponential enrollment growth has stretched traditional support to its maximum. Increased numbers of English teaching assistants, increased numbers of adjunct mathematics faculty, increased numbers of students in existing classes and classrooms, increased numbers of academic advisors, increased numbers of tutors, and increased numbers of administrators in operational support – all of these assume a direct relationship between new students, and the essential new physical, human and financial resources. This is the case because this is how our institutional operations are designed. They are designed to address short-term needs, as defined by the current set of students, for the current condition of the State.
Historical under-investment in enrollment growth: From FY 2001 to FY 2004, ASU experienced the largest enrollment increase than during any three-year period in the past two decades. For FY 2004, ASU served over 7,600 Full-Time Equivalent (FTE) students with no net increase in the State investment. Even with the modest FY 2005 increase in enrollment growth dollars, after a period of such large enrollment increases, there remains an estimated 5,000 FTE students with no state funding support. This contributes to the widening of the funding gap, on a per student basis, between ASU and the other state universities. With the historical under-investment for enrolled students and anticipated enrollments in the future, a technology based solution is needed to better serve ASU’s students.

Technology-based solutions for learning and support: Technology has changed from a necessary administrative support, accessible by a relatively small number of the university staff, to a “mission critical” element of the modern learning environment, essential to the work of students, faculty, and staff. This shift places new burdens on the University’s technology infrastructure, not simply in its capacity, but in its design, since it must now serve the needs of a broad learning community. Any disruption in the infrastructure, particularly in the learning platform, is a disruption to the learning experience.

To date, the university has relied on home-grown solutions that customize existing software and systems. While this approach has been adequate and affordable, it has not resulted in the ease of use and professional look-and-feel that is an important factor for widespread adoption among a large community with varied levels of technology expertise. Furthermore, these patchwork systems are neither financially nor operationally efficient.

In a recent audit prepared for the Arizona Board of Regents, ASU was noted for the “very progressive online experience (it) provides for students,” with particular praise given to the customized admission requirement information, excellent overview of financial aid and integration of guidance, sophisticated academic course planner, online career-related assessments, access to internships and job listings, single sign-on access, customized transfer student orientation, and online tutorials for technical problems. The same report, however, also called attention to the conflicting access points. While some services have certainly moved to the web, the infrastructure behind the scenes is strained. The Student Information System and the financial administration system at ASU are both examples of systems that can no longer support additional development.
While Arizona State University has been successful despite a home-grown support infrastructure, these systems have already scaled to their maximum capacity. Moreover, striking developments in individualized learning have been made possible through technology-based platforms. These advances will enable ASU to meet its enrollment needs and improve the student experience.

**Proposal**

Enhanced online services and classes are the means by which ASU can overcome the constraints of financial resources, physical space, and human resources. Technology will assure a greater level of support at a lower marginal cost for each student. Increasing the numbers of students who take online courses will help to free up physical space, e.g. a student preferring more individualized instruction may choose to take math online, freeing up classroom space for a student who prefers to learn in a more traditional setting.

The learning or content management system (LMS or CMS) is an essential building block within the academic computing environment. The CMS is the underlying architecture for the course web site, which is created by faculty and staff with the help of the instructional design and production team. Most of ASU’s course development has been uncoordinated with the rest of the institution and has also not taken full advantage of advances made at other institutions that share ASU’s aspirations to migrate key academic content and services to the web. As one of the largest public universities, ASU has much to offer in strategic alliances with other universities and learning vendors.

Enrollment growth can be addressed through ATLAS, a university-wide IT system for student learning and support.
Below are the desired features of the ASU technology-based platform for student learning and support:

### Platform Features

<table>
<thead>
<tr>
<th>Communication Tools</th>
<th>Faculty Services/Administration</th>
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</thead>
<tbody>
<tr>
<td>• Discussion forums</td>
<td>• Authentication</td>
</tr>
<tr>
<td>• File exchange</td>
<td>• Course authorization</td>
</tr>
<tr>
<td>• Email</td>
<td>• Registration integration</td>
</tr>
<tr>
<td>• Online journal/notes</td>
<td>• Schedule</td>
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<tr>
<td>• Chat</td>
<td>• Syllabus</td>
</tr>
<tr>
<td>• Whiteboard</td>
<td>• Announcements</td>
</tr>
<tr>
<td>• Collaborative workspace</td>
<td>• Library and other university resources</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Communication and Collaboration</th>
<th>Course Delivery Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Discussion boards</td>
<td>• Automated testing and scoring</td>
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<td>• Project management tools</td>
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<td>• Document sharing</td>
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<th>Student Involvement Tools</th>
<th>Productivity Tools</th>
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<tr>
<td>• Project teams</td>
<td>• Orientation/help</td>
</tr>
<tr>
<td>• Self-assessment</td>
<td>• Search</td>
</tr>
<tr>
<td>• Student community building</td>
<td>• Bookmark</td>
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<tr>
<td>• Portfolios</td>
<td>• Calendar/program review</td>
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<tr>
<td>• Workshop formats</td>
<td>• Work offline/synchronize</td>
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<th>Faculty Services/Curriculum Design</th>
<th>Content Management</th>
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<tr>
<td>• Instructional design tools</td>
<td>• Flexible content repository for text, video, simulations, internal discussions</td>
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<td>• Instructional design tutorial</td>
<td>• Gateway to library</td>
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<td>• Instructional standards</td>
<td>• SCORM compliant</td>
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<td>• Digital rights management</td>
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<th>Assessment Management</th>
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<td>• Flexible test formats</td>
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<td>• Customized student feedback</td>
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<td>• Statistical analysis</td>
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Platform Functionality

**Student perspective:** The course web site is the backbone of the course, a virtual extension of the classroom, departmental/faculty office, registrar, and gateway to the library. In addition to the course’s administrative nuts and bolts (i.e. its schedule and syllabus), the course web site is interactive, linking students to each other, to resource materials, and to faculty.

- Communications and collaborative tools enable students to exchange files, work on projects together, and comment on each other’s work.
- Content selected by the faculty include text as well as multimedia, simulations, digital learning objects, and case studies. They are interoperable with the ASU library so that the digital materials for each course lead seamlessly to the full intellectual wealth of the traditional library.
- Sophisticated tracking tools enable the student to mark his/her progress in the course, obtain advising and tutoring services, and receive additional problem sets or readings depending on individual needs.
- A writing lab provides bibliographical style sheets for research papers as well as immediate feedback on drafts.
- The course web site tracks relevant lectures, symposia, or other live programs on the ASU campus and Phoenix areas, extending the virtual learning environment to the vibrant life of the campus and community.

**Faculty perspective of additional features:** CMS tools have instructional design tools built into them because many faculty do not have the skills to design good learning modules. Faculty may be experts in content areas, but may not have the time or resources to become well versed in instructional design.

- CMS tools will provide wizards, course templates, and modules that model and link learning activities associated with content and teaching modules.
- Content management tools will aid in enabling faculty to tap the library, digital learning objects, and internet-based multimedia and reference to provide a full range of traditional and interactive course materials.

**Institutional perspective:** Individual student data can be aggregated for assessment and analysis of academic objectives and performance for the department and university. CMS can aggregate the university’s assets for leverage not only within the university, but for strategic alliances and the public as well.
Examples of Platform Applications

Interactive model of student learning

- **Issue and solution:** At Penn State, the traditional course delivery model for Introductory Statistics did not serve student needs and was not cost effective. The university reduced the number of weekly lectures from three to one, giving faculty more time to interact with students and less time to prepare and deliver the lectures. Two of the traditional lectures have been replaced with computer-mediated workshops.

- **Result:** Faculty and teaching assistants utilize these computer-mediated workshops to provide interactive and substantive feedback to students. In addition, the redesigned course offers a variety of online learning materials as well as computerized testing. The redesigned course provides a more interactive model of student learning and reduces costs, particularly in terms of TA support typically required in large, traditional lecture sections.

- **Cost effectiveness:** An overall 30 percent reduction in cost-per-student, from approximately $176 to $123. Annually, this means a projected savings of more than $115,000.

Seamless and collaborative support for students

- **Issue and solution:** In order to deal with a high percentage of first-year drop-outs, Sinclair Community College designed a technology infrastructure that could tie together processes for identifying at-risk students, providing support, and tracking progress. The resulting web-based support system for students and counselors includes a screening process that enables the college to determine the students’ risk of failure and provide a Student Success Plan (SSP) for identified at-risk students. The SSP offers assessments, a case-management counseling approach for both new and current students, and transition plans that range from intensive support services to self-service and web-based systems.

- **Result:** High student satisfaction with the counseling system. Students appreciate the collaborative process, the combination of individualized counseling sessions, and the ability to track their own progress independently.

More physical space, more faculty time

- **Issue and solution:** Brigham Young University is trying to accommodate student enrollment growth simultaneously with square footage restrictions imposed by the administration. The university redesigned the Freshman Composition course to reduce the amount of time students spend in the classroom from three hours to one hour per week, allowing the faculty to spend more time in one-on-one student consultations. A series of interactive multimedia lessons and additional peer-to-peer sessions replace the time students previously spent in the campus classroom.

- **Result:** The redesign leveraged online multimedia modules to teach students key concepts about reading and writing.

- **Cost effectiveness:** The redesigned course shows an overall faculty time savings of 25 percent when compared to the traditional course.
Desirable learning environment

- **Issue and solution:** For the Introductory Psychology course at the University of Southern Maine, the faculty-to-student ratio prohibited a desirable learning environment in which students could receive frequent feedback; faculty were primarily devoted to serving these large introductory course sections and spent less time on developing and revising upper-level course materials. Online resources and a variety of interactive computer activities were implemented.

- **Result:** Improves learning opportunities through more interaction, redeploy key resources, and deal effectively with enrollment. Students receive timely feedback.

- **Cost effectiveness:** Reduced lecture time by 50 percent. While course sections increased in size from 75 to 125, online resources also increased interaction and personalized attention between students and faculty. The department anticipates that savings will accrue, in particular, with the reduction in traditional lecture format classes and the increase in course section size. The previous course model costs approximately $113 per student, and the planned course structure revision is anticipated to cost $58 per student.

Individualized attention

- **Issue and solution:** Linear Algebra at Virginia Tech serves about 2,000 students per year and was traditionally taught in sections of 40 students. The mathematics department sought a way to reduce costs while retaining the individual focus of small sections. The redesigned course operates entirely online, with personal support by a staff of peer tutors and faculty, available weekdays, evenings and Sundays at the Math Emporium, a large 24/7 learning laboratory adjacent to campus. Tests and lectures are available online, in addition to the main interactive learning modules.

- **Result:** A study of learning effectiveness concluded that test and grade results have been essentially the same as just before the redesign, except that retention and completion rates have clearly increased. The freedom to work at convenient times and for as long as needed probably makes the greatest contribution to student satisfaction.

- **Cost effectiveness:** Annual cost savings have been approximately $130,000 (per-student costs in the fall semester from $91 to $21).

Academic achievement

- **Issue and solution:** Harper College has used a blended learning format to deliver chemistry instruction effectively. Key course design strategies include: a discussion board that fosters interaction between students and instructors, thus creating a sense of community, support; and an array of audio and video teaching and learning materials that fit diverse learning styles and create a learning-centered environment.

- **Result:** Grade comparisons show that students in blended chemistry courses receive a much higher percentage of ‘A’s (40 percent vs. 22 percent) than students in face-to-face chemistry courses.
Current Platforms

The backbone of the university’s upgraded academic computing environment will be an expanded version of its current learning management system. ASU currently relies on Blackboard, an off-the-shelf software solution that is difficult to customize to meet the needs of the university and does not support a complex learning environment. Blackboard focuses primarily on the mechanics of the classroom experience, such as its syllabus and class schedules. ASU seeks to expand on this functionality, either by supplementing or replacing Blackboard.

The Open Knowledge Initiative (OKI) is to course management systems what Linux is to operating systems. It is an open source initiative that has evolved from the creative energy of programmers and faculty at several universities. The general idea is to take software modules successfully deployed in two or more locations and enable those modules to function on other campuses individually, in conjunction with other homemade modules or as a comprehensive system. All of this should be possible if standards are developed and then followed. The Centre for Educational Technology Interoperability Standards, which represents all higher education institutions in the UK, is using the OKI specifications to create a nationwide infrastructure for e-learning.

OKI has developed a commercial venture named Sakai that will implement java-based programming standards. These standards, specifically designed for higher education, specify how different educational software products communicate with one another as well as with other enterprise systems. The first version of the software, Sakai Release Candidate 1, was made available to the public this summer. The brand equity and academic credibility behind Sakai is powerful. The development project is funded by four universities – Michigan, Stanford, Indiana, MIT – and supported by a grant from the Mellon Foundation.

Platform Development

The most appropriate development option is to disseminate a detailed Request for Proposal to determine the most appropriate path and partner(s). ASU estimates the one-time project design and implementation costs at $12.5 million per year, with a two-year implementation timeframe and an annual maintenance and operations cost of $3.6 million. ASU requests the first phase of funding in FY 2006.

Other Considerations in the Success of the Platform

Leadership: ASU’s many technology and academic achievement programs have grown without the organizational structure, strategic planning, and coordination that will enable a campus-wide transformation in enhancing academic achievement through technology. At this critical juncture in ASU’s growth, leadership in technology is essential in order to scale the university’s programs with quality and efficiency, and to address underlying considerations such as digital rights management and copyrights, faculty participation, and organizational structure.

Learning environment: Key to this initiative is a reliable and efficient information technology (IT) infrastructure, enhanced online library, and a seamless and transparent computer environment that supports
all members of the academic community. At the center of this environment is a university-wide learning platform that supports individualized instruction and high academic achievement. Its basic features are on the next few pages, and its selection will be based on consideration of existing platforms and the specialized needs of ASU and its knowledge network. This university-wide IT system will establish a scalable digital media management and delivery system that can be customized to individual project needs, and that immediately provides a useable and workable environment for our range of users—from instructors to researchers to the libraries.

**Content Repositories:** Academic institutions can create content repositories at institutional, school or departmental levels to facilitate the sharing and searching of digital content. Librarians can create and manage (indexed and searched) collections of digital content to be used by specific courses or institutions. If several instructors use the same learning content, an institution need only save the content once, thereby reducing storage costs. In addition, students can use these systems as virtual hard drives for storing and sharing academic assignments, resumes and job applications.

**Training:** Professional development for faculty, department chairs, and other senior administrators will assure the adoption of instructional technology through training and special incentives, as well as support for innovative applications and prototypes that fulfill specialized needs for teaching or research.

**Research:** Ongoing research and assessment of educational outcomes will be supported and new research and assessment will be initiated, setting goals in areas such as course completion rates and student performance to measure progress. Data collection and analysis will support additional development in individual programs and research initiatives, but will also provide an objective rubric for measuring institutional progress.

This university-wide IT system will establish a scalable digital media management and delivery system.
Conclusion

The case for ATLAS, a university-wide IT system for student learning and support, is strong. Beyond supporting enrollment growth, this university-wide IT system has the potential to enhance a student’s ability to learn, a student’s ability to achieve, a student’s ability to explore new intellectual space, and a student’s ability to take a course that fits into their work and family schedule.

Traditional assumptions about teaching and learning are no longer adequate. Learning takes place around the clock, and not only in classrooms, laboratories, and libraries. Regardless of our approach or methodology, as educators we must take every advantage of both traditional methods and new approaches that make students an intimate part of the research process and the creative act, bringing an immediacy and intensity to learning that is often lacking. We must incorporate new findings on the processes of learning and apply these to our classrooms. We must take every advantage of the new media tools that are the product of the technological advances of the past decade. These allow students to learn individually and through collaboration with others, and to learn at their own pace, sometimes exceeding the parameters of the course.

Consistent with our focus on the individual is a commitment to enhancing the undergraduate experience with learning in small groups. In keeping with experience and pedagogical research, students sometimes learn as much from one another as they do from their professors. ASU will facilitate mechanisms to structure education in small clusters of students wherever practical. This does not mean that there will be no large classes, but it does mean that these classes will be attended by groups of students who are connected—students who are learning together. In addition, we need to expand the size and intensity of our learning environment for our highest-achieving students.

Key elements to expand include student services such as individualized tutoring, collaborative learning software, writing labs, links to advisors and the registrar; faculty support such as simple production tools and online training; and a gateway to the library, home of ASU’s growing digital resources. The platform will also enable ASU to create high-quality introductory courses that will serve large numbers of students online.

Universities that manage large scale enrollments typically supplement Blackboard (e.g. University of Maryland) or rely on internally created systems (e.g. University of Phoenix). Other universities are actively exploring more sophisticated and flexible learning platforms through academic consortia such as Sakai, led by MIT and the University of Michigan.

ATLAS has the potential to enhance a student’s ability to learn, a student’s ability to achieve, a student’s ability to explore new intellectual space, and a student’s ability to take a course that fits into their work and family schedule.
Without this investment, ASU would rely on capital-intensive, twentieth-century solutions to meet its growing enrollment—and would not be building a flexible, stable information architecture for the future.

Great teachers and students have always been the central equation of higher education. However, universities can now do more than match faculty and students in a classroom or laboratory: they can apply technology to increase the availability of its faculty and other resources and to enhance the achievement of its students. This achievement can be measured in learning outcomes, attrition rates, readiness to pursue meaningful employment, and the perceived value of graduating from a great public institution.

Failure to fund this request will:

- Risk diminished freshman retention, achievement potential, and diminished graduation rates as enrollment grows beyond the university’s learning and academic support systems;
- Inhibit improvements in technology-delivered education;
- Inhibit improvements in the development of a scalable technology-based learning and academic support system;
- Cause ASU’s competitiveness to decline, as for-profit and more entrepreneurial institutions develop sophisticated and scalable resources for higher education; and
- Risk higher investment at a later date, as legacy technology systems and organizational structure perform with less and less efficiency.
**Budget Estimate**  
**Application for Technology-Based Learning and Support (ATLAS)**

### Phase I: Testing and Development  
**$12.5 M**

- **Software**
  - License existing software for platform and university-wide IT system: $2.5 M  
  - Student information system: $2.0 M
- **Equipment**
  - Development: $1.0 M  
  - Platform and university-wide IT system: $1.0 M  
  - Student information system platform: $0.5 M
- **Maintenance**
  - Software: $1.0 M  
  - Equipment: $0.8 M
- **Consultants**
  - Pre-development: $0.5 M  
  - Integration into existing systems: $0.5 M  
  - Content and course creation: $0.7 M  
  - Library development: $1.0 M  
  - Student information system implementation: $0.7 M  
  - Tools for courseware development: $0.3 M

### Phase II: Full Production Load  
**$12.5 M**

- **Software**
  - License existing software for platform and university-wide IT system: $2.0 M  
  - Student information system: $1.0 M
- **Equipment**
  - Development: $0.5 M  
  - Platform and university-wide IT system: $1.0 M  
  - Student information system platform: $2.0 M
- **Maintenance**
  - Software: $1.6 M  
  - Equipment: $1.0 M
- **Consultants**
  - Project management: $0.5 M  
  - Integration into existing systems: $0.5 M  
  - Content and course creation: $0.5 M  
  - Library development: $1.0 M  
  - Student information system implementation: $0.7 M  
  - Tools for courseware development: $0.2 M

### Ongoing Operations and Maintenance  
**$3.6 M**

- **Software**: $1.6 M
- **Hardware**: $1.0 M
- **Implementation**: $1.0 M