

CASTLE



CNMS
ACTIVE
SCIENCE
TEACHING &
LEARNING
ENVIRONMENT

The CASTLE at UMBC

Repurposed Space as a Platform for Student Success through Teaching Innovation

College of Natural and Mathematical Sciences

TIMELINE & UTILIZATION RATES

BACKGROUND

In 2008, the University identified four strategic priorities, one of which, student success and retention, was the foundation on which this initiative was built.

The College of Natural and Mathematical Sciences (CNMS), with campus-wide support, developed plans to repurpose space on the first floor of the University Center to create the CNMS Active Science Teaching and Learning Environment or CASTLE.

The CASTLE responds to the need for appropriate space on campus to maximize resources to host new active learning initiatives in science and mathematics and is part of a continuing emphasis on student success and retention.



CASTLE USE – Fall 2010 to Fall 2012				
BIOLOGY	CHEMISTRY	MATH/STAT	PHYSICS	OTHER
BIOL 123	CHEM 300	MATH 106	PHYS 121	HONR 300
BIOL 141 (summer)		MATH 150	PHYS 121H	Math/Stat Clinic
BIOL 142		MATH 151	PHYS 122	Calculus Clinic
BIOL 233		MATH 152	PHYS 122H	GRE Workshop
BIOL 251		MATH 155		TA Training
BIOL 252		MATH 251		TQC Workshop
		STAT 351 Hyb		
		STAT 355		

September 2008 to May 2009	Conceptual development, budget proposal, Approval of the modifications of UC 115D space including HVAC improvements
June 2009 to August 2009	Renovation of UC 115D
September 2009 to August 2010	Submission and review of plans and bids for custom furniture, security, and AV installation; placement of orders; Installation of custom furniture and equipment
Fall 2010 Semester	Inaugural semester (<i>available 54.5 hours per week</i>) 78.9% Utilization – 62.4% Use for credit
January 2011	Active Learning Workshop Series with the Faculty Development Center (FDC) begins
Spring 2011 Semester	84.8% Utilization – 66.5% Use for Credit (<i>54.5 hours/week</i>)
Fall 2011 Semester	77.9% Utilization – 69.7% Use for Credit (<i>availability increased to 61 hours per week</i>)
January 2012	Active Assessment Workshop with FDC begins
Spring 2012 Semester	Initiated requirement for Assessment Report to CNMS Dean on the effectiveness of CASTLE use; 81.9% Utilization – 47.5% Use for Credit (<i>61 hours/week</i>)
Fall 2012 Semester	75.1% Utilization – 71.7% Use for Credit (<i>61 hours/week</i> – Request for CHEM 300 denied due to limited time slots.)

MOTIVATION

The imperative for the CASTLE followed from the success of the first major implementation of active learning in CNMS: the *Discovery Learning* method of instruction in CHEM 101 that started in 2005 and was later extended to CHEM102.

In Fall 2004, the pass rate in CHEM101 (A,B or C) was 69.8%. In AY 09, after the Chemistry Discover Center was implemented, the corresponding rate was 89.7% and 93.9%, for CHEM 101 and CHEM 102, respectively. Following the principles of the CDC, the CASTLE was planned to help all departments in CNMS to employ active learning methods in foundational courses.

Research literature provides considerable quantitative evidence supporting the overall effectiveness of active learning methods in improving key learning outcomes in introductory science classes. Recent research concerns the development of purpose-designed spaces, such as the CASTLE, that effectively support active learning and student engagement.

DESIGN

The space and infrastructure was designed from concepts proposed by a multi-disciplinary group of faculty teaching introductory natural science and mathematics courses. Key requirements were:

- Accommodate over 90 students working in hierarchical groups
- Base seating arrangements, furniture specifications and the AV installation on findings in science education literature and UMBC's experiences with the Chemistry Discovery Center
- Use custom round tables with one computer per group of 3 students with internet, A.V. and networking to, support the triad-learning teams
- Provide an instructor's station with the latest interactive instructional software enhanced by 11 wall-mounted whiteboards and 8 wall-mounted LED monitors
- Facilitate instructor movement with wireless instructional capabilities
- Keep within the project budget and include effective security measures

CASTLE – A FUNDING PATHWAY

Science Applications International Corporation (SAIC) committed \$300,000 in January 2011 to support UMBC's innovative instruction in introductory science and math through the CASTLE.

National Experiment in Undergraduate Education (NEXUS) is a \$400,000 collaborative grant from the Howard Hughes Medical Institute (HHMI) funded January 2011 to August 2014. UMBC is developing inquiry-based learning modules centered on the application of mathematical and statistical modeling in introductory biology courses. Many of the NEXUS modules are being piloted in CASTLE-based discussion sections.

Evaluation, Integration and Institutionalization of Initiatives to Enhance STEM Student Success (iCubed@UMBC) is a \$1.2 M multi-treatment randomized controlled trial funded November 2010 to October 2015 by the National Science Foundation to study the effectiveness of four academic support initiatives on first year freshmen. One of the initiatives involves MATH 150, 151, 152 and 155 active-learning discussion sections held in the CASTLE.

CASTLE CHALLENGES

- Scheduling classes each semester
- Balancing space demands among departments and funded-program requirements
- Defining active learning among different disciplines
- Assessing active learning instruction
- Meeting multi-user equipment and storage needs
- Maximizing use of SchoolVue®, the CASTLE classroom management software
- Providing transition/set up time between different classes
- Updating and adding new software to the Instructor and student computers
- Keeping the CASTLE space neat and orderly
- Ensuring users do not bring food and beverages into the CASTLE
- Allowing appropriate user access while maintaining security

ACKNOWLEDGEMENTS

The CASTLE serves as a platform for teaching innovation at UMBC because of the ongoing support it receives from faculty, instructors, teaching assistants, department schedulers, the Faculty Development Center, the Office of the Registrar, DoIT, Campus Security, and the CNMS Dean's Office. CIRC in the Department of Mathematics and Statistics will become a new partner in Fall 2012 with its help in assessing the CASTLE's effectiveness.

This classroom was constructed with the support of all of UMBC's Deans and Vice Presidents, through the strategic priority planning process initiated by the Provost. The faculty work group who determined the key components of CASTLE consisted of Bonnie Tighe, Yoon Song and Nagaraj Neerchal (Mathematics and Statistics), Eric Anderson and Lili Cui (Physics), Jeff Leips (Biology) and Bill LaCourse (Chemistry and Biochemistry). The process benefited greatly from discussions with Diana Hamilton of the Chemistry Discovery Center and with Bob Beichner director of the multi-institutional SCALE-UP project hosted by North Carolina State University. Kathy Sutphin, CNMS Assistant Dean, worked with vendors to realize the key design elements, and coordinated construction and installation of the entire facility by working with the contractors, Dell/Mediatech. Critical support was provided by many UMBC Facilities, DoIT and Instructional Support staff members whose input guided the purchasing and installation process.

