

# Student Technology in the Classroom: A White Paper

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## Introduction

The purpose of this white paper is to give an overview of technology use for pedagogical purposes and make recommendations for the campus. It is the product of the multi-year collaboration of an interdisciplinary group of faculty who participated in faculty learning communities committed to developing pedagogies that make effective use of new digital technologies. The FLC's goals dovetail with several of those articulated in the campus strategic plan. In particular, the plan calls for development of state-of-the-art learning spaces and support for educators in creating innovative teaching. We offer expertise and insights developed through the FLC in a series of recommendations that we believe will facilitate achievement of key strategic goals in teaching and learning. The following addresses:

- Who we are and the history of FLCs
- How technology on campus fits into the strategic plan regarding teaching and learning
- Technology on campus: Collaborations and guidelines
- Survey of technology-related initiatives, support, and training on campus
- Policy recommendations, including for information dissemination and for standards of technology

## Part 1. Who We Are

This section provides a general overview of our group and its members, along with a brief history of FLCs devoted to technology in the classroom.

Members of the Student Technology in the Classroom FLC (listed alphabetically):

- **Tiffany Gierasch** (member), is a senior lecturer in the Chemistry and Biochemistry department and the Director of the Chemistry Tutorial Center. She teaches primarily large-enrollment (300-500 total students spread over sections of ~200 students each) sophomore courses.
- **Milvia Hernandez** (member), is a lecturer and coordinator for Spanish language teaching in the Modern Languages, Linguistics and Intercultural Communication (MLLI), and teaches small (~30 students per sections) intermediate level language courses (SPAN 201 & 202).
- **Tomoko Hoogenboom** (member, previous member), is a lecturer and Japanese area coordinator in the Department of Modern Languages, Linguistics and Intercultural

Communication, and teaches mainly small (~30 student) upper level language courses as well as cultural courses.

- **Yi “Yvonne” Huang** (member) is an associate professor in Mathematics and Statistics, serves as a committee in the statistical graduate program, and coordinates the biostatistics graduate track. Additional to graduate courses teaching, she regularly teaches a large-audience introduction-level statistics course for biology and life science related majors, STAT350 (125 student per semester, offered every semester).
- **Tracy Irish** (member, previous member) is a clinical instructor and coordinator for the STEM/Science Masters of Arts in Education (MAE) program in the Education department. She oversees the STEM/Science MAE program, which includes recruiting students, hiring and training instructors, develops course work, and proposals associated with the STEM/Science MAE program.
- **Christine Mallinson** (member) is an associate professor in the Language, Literacy and Culture Program, where she teaches small (~10 student) graduate seminars in sociolinguistics and research methods.
- **Carole McCann** (member, previous member) is chair and professor in the Department of Gender and Women’s studies, where she teaches small (~20-25) upper level required courses in feminist theory and methodologies that are combined with smaller (~5) graduate sections.
- **Laura Rose** (member), is a lecturer in the Psychology department, and teaches a range of classes from large (~200 student) introductory courses to relatively small (~25 student) upper level psychology courses.
- **Donald Snyder** (member, previous facilitator) is a senior lecturer in the Media & Communication Studies department, and teaches small to medium (~30-50 student) core, elective, and writing intensive courses.
- **Liz Stanwyck** (facilitator, previous facilitator), is a lecturer in the Mathematics and Statistics Department, and teaches a range of classes from large (~160 student) Freshman lecture hall calculus to relatively small (~30-40) upper level statistics classes.

In 2013, UMBC’s Faculty Development Center introduced Faculty Learning Communities (FLCs) as a space for faculty across the disciplines and colleges to share their ideas and concerns about post-secondary education and learn about strategies and techniques that have been successful for others. FLCs offer a valuable structure for encouraging faculty interaction, collaboration, and support in addressing the issues surrounding student engagement, retention, and success.

The word ‘community’ is central to the faculty learning community experience. The goal is to fashion an environment where members are committed to the group through collaboration, sharing, and peer support. In his introduction to the edited collection *Building Faculty Learning Communities*, Milton D. Cox defines an FLC as a “cross-disciplinary faculty and staff group of six to fifteen members (eight to twelve members is the recommended size) who engage in active, collaborative, yearlong program with a curriculum about enhancing teaching and learning and with frequent seminars and activities that provide learning, development, the scholarship of teaching, and community building” (Cox and Richlin, 2004, section 1b). FLCs are more than committees; in addition to committing to producing a ‘deliverable’, the groups are committed to each other and to the shared learning process, beyond just the group’s output. These

differences must be communicated to the faculty applying to, and in, them, through a variety of methods.

Over the past three years, Faculty Learning Communities have become a valuable resource space for the development and implementation of strategies to improve student success at UMBC. In the Spring of 2013, one of the first of three FLCs introduced to the campus was titled, *21st Century Literacies: Developing and Implementing Digital Assignments*, facilitated by Donald Snyder. This FLC asked faculty to reflect on how emerging technologies might be utilized to challenge our students to enhance, reflect upon, and demonstrate the knowledge they are gaining across the colleges at UMBC. The FLC successfully brought together faculty interested in exploring the value and potential of developing and implementing digital assignments in the classroom. The community explored various benefits and challenges connected to digital assignments, including questions about assessment, and their potential to promote metacognitive development while increasing student engagement. At the conclusion of the FLC, every participant had designed and began implementation of a new digital assignment into one of their courses.

The following year, Donald Snyder partnered with Liz Stanwyck to co-facilitate a FLC entitled, *iTeach: Using Tablet Computers in the Classroom*. This FLC built off the themes and conversations initiated the previous iteration, by focusing on the potential for faculty adopting the use of tablets in the classroom. Participants oriented themselves with various education and digital production apps, sharing how tablets could become valuable assets in their courses (planning, content delivery, and creative production). The primary goal was for participants to strengthen their capacity to use tablets for instructional practice.

The present document is a result of a third FLC, which maintains membership from the previous two FLCs. This FLC, *Incorporating Student Technology into the Classroom*, explores the various ways in which teachers can harness the power of student technology in their classrooms. Participants are exploring ways to incorporate students' devices into lessons and lectures, so that students can actively engage using technology they already have access to. The primary goal is for participants to find ways to turn potential distractions into classroom strengths. While the membership of the FLC shifted some from year to year there were some constant themes that emerged concerning what technology we can expect to be available in classrooms, to instructors, and to students. These discussions were enriched by the FLC members' diverse backgrounds, fields, and instructional settings.

The current white paper is a result of the collaboration and knowledge building gained over the past three FLCs. From these interactions, members have been able to uncover shared obstacles, needs, and potential solutions for increasing the value of technology in pedagogy. We hope the white paper will act both as an audit of where UMBC is currently in terms of offering resources and support for such initiatives, and as a document where we can discuss specific barriers and needs that must be addressed to better implement our ideas into practice.

## **Part 2. Alignment with Strategic Plan and Interdisciplinary Activities**

One of the four goals of the campus strategic is to "Develop innovative curricula and academic programs that support and enhance the success of our undergraduate and graduate students

and prepare them for meaningful careers, lifelong learning, and engaged citizenship..." To achieve this goal, the plan calls for four specific strategies: to provide "exemplary support for educators in creating state-of-the-art ... curricula delivered through innovative and effective approaches to teaching and learning"; development of "campus-wide policies and standards for technology use in instruction"; creation of "state-of-the-art learning spaces" supporting both traditional and new pedagogies; and "to take full account of the perspective of classroom faculty" regarding the quality and usefulness of teaching spaces." The pedagogical innovations and collaborative discussion among three years of FLC participants align with each of these elements. As background to the recommendations that follow, this section provides some examples of pedagogical strategies infused into various departmental curricula across campus.

Indicating the interdisciplinary reach in how technology is integrated into curricula across campus, we provide examples from five departments from the humanities, social sciences, and sciences: Media and Communication Studies; Psychology; Modern Languages, Linguistics and Intercultural Communication; Mathematics and Statistics; and Chemistry and Biochemistry.

As a relatively new department focused on the history of media, the Department of Media and Communication Studies (MCS) has been very proactive in encouraging our students to utilize the technologies of the 21st century to become content producers. One of the major initiatives we implemented to help facilitate student use of technology was the development of MCS 101: Media Literacy. The class contains a lab component, where students experiment with digital media in order to create memes, infographics, podcasts, and movies. This has enabled the department to experiment with digital assignments throughout the curriculum. Examples include the use of digital movies engaging with media theory in MCS 333, audio projects modelled after NPR segments about the history of radio in MCS 222, and the utilization of various social media platforms for information distribution in MCS 355.

In the Department of Psychology, a growing number of faculty hold favorable attitudes toward the use of student technology both in and outside the classroom. The three core requirements within the major, PSYC 100, 211, and 311, are all currently offered as hybrid courses, and require online work that is connected to classroom learning. Online coursework includes independent mastery assignments, discussion boards, videos with quizzes, writing assignment, and other active learning experiences. During face-to-face meetings, faculty also integrate technology in the classroom. Examples include the use of: (1) clickers as a way for students to respond to content questions and express opinions regarding key topics, (2) online trivia websites, such as Kahoot, to increase student engagement, and (3) library database and Google searches to guide students' understanding of information literacy.

Because of the interdisciplinary nature of the department of Modern Languages, Linguistics and Intercultural Communication (in which courses address not only language but also culture, film, literature, and linguistics), its faculty have implemented various technology-enhanced pedagogies to engage diverse groups of students. Some courses are offered as hybrid and others are face-to-face but most include some sort of technology used both in class and outside of class, such as e-textbooks, tools in Blackboard (lecture videos, homework upload, grading center, discussion board, wikis, journals and blogs), and language and cultural learning through videos, among others. Through the use of such technologies MLLI faculty seek to provide effective instruction and learning.

In the Department of Mathematics and Statistics, student access to technology is an integral part of all service courses (e.g., the calculus sequence): online learning systems integrated with Blackboard have been used for many years. These courses use online quizzes as well as electronic homework and tutoring. Many faculty teach with tablets and make notes available to students outside of class, and hybrid versions of several classes run each semester. In Applied Calculus (Math 155) students have access to videos of lectures, complete with notes and audio; during seminars students are in an active learning computer classroom (the CASTLE) and use the computers to solve calculus problems in small groups. In the hybrid version of Statistics for Business and Economics (Stat 351), students bring laptops and tablets to discussion sessions to engage in data analysis in real time.

The largest freshman and sophomore level “lecture” courses in chemistry (CHEM 101, CHEM 102, CHEM 351, CHEM 352) depend heavily on the use of technology by both students and instructors. Many of these courses have been flipped and technology has been used to support this pedagogy. Blackboard is used extensively to deliver material and resources both before and after class; examples include links to appropriate Khan Academy videos, daily Reading Guides, and handouts. In addition, publisher-supported on-line assignments are used to prepare students for class time which is devoted to active learning and problem-solving. The use of online assignments is the only way to realistically assign and grade the frequent pre-class assignments in these large-enrollment courses, none of which have teaching assistant support. Clickers are used during class for real-time feedback on student learning and for low stakes assessment; again the size of these courses requires the use of technology to gather feedback and assess student needs. Some instructors also offer virtual office hours using Blackboard Collaborate in order to be accessible to more students. The Chemistry Discovery Center, described in part 4, is the home of an additional active-learning component for the freshman general chemistry sequence. This is a paperless environment where documents are sent to student groups electronically, documents are completed electronically, and finished documents are returned to the instructor electronically. SchoolVue software is utilized to allow the instructor to monitor 18 student groups from her workstation simultaneously. While it is a significant resource, it is used exclusively by the CHEM 101 and CHEM 102 courses. It is occupied M-Th from 8 am - 6 pm (except 12-1 pm) just to accommodate the students in those two courses, so it is typically not available to other courses in the department.

As the above examples demonstrate, the use of technology is a strategy that can be infused into approaches to active learning, the type of innovative pedagogical strategies for which UMBC is increasingly known (e.g., through top rankings by the US News & World Report in the areas of innovation and undergraduate teaching). These techniques of teaching and learning benefit students in their college careers and in the professional workforce. In a recent *Baltimore Sun* article, UMBC was highlighted as a leader in liberal arts education that breaks down barriers (Weisgal, 2016). Dean Casper is quoted in the article, noting that UMBC has changed some of its institutional teaching practices to reflect what students will confront when they enter the workforce after graduation. The emphasis has been placed more on seminar style courses that promote interaction and collaboration as opposed to lecture-based teaching. “For the rest of their lives, they will not be in large halls listening to someone lecture,” he explains. “We’re more mindful now of how our students learn and how well they learn.”

### **Part 3. Technology on Campus: Collaboration and Guidelines**

Central to emerging notions of digital multiliteracies is that students should become able to make and do things with digital content, not just read and write about them. In the classes taught by our FLC participants, students are learning to compose, edit, and share their digital work, using various digital platforms and software.

While the Faculty Learning Communities have provided a solid foundation for this type of work, they remain limited in their reach. Faculty eager to collaborate across the boundaries of disciplines have few opportunities to meet, plan, and develop teaching strategies and find little in the way of institutional support for technical challenges, software and hardware purchases, and other infrastructure needed for innovative work.

To address the changes in the nature of scholarly research and teaching, the Modern Language Association (MLA) issued a report outlining the professional and institutional challenges facing practitioners of the digital humanities and has issued guidelines for the appropriate assessment of this work (for a discussion, see Loviglio et al., 2012). In this report the MLA suggests that at the very least institutions should “develop written guidelines so that faculty members who create, study, and teach with digital objects; engage in collaborative work; or use technology for pedagogy can be adequately and fairly evaluated and rewarded.” Many of our peer institutions have already begun to develop such guidelines, in the humanities as well as the social sciences and the sciences. We believe that such an effort at UMBC is both important and long overdue. To meet this goal, specific attention must be paid in particular to the area of classroom infrastructure.

For students to gain the technical, analytical and research skills necessary to produce and analyze digital texts, as well as identify the social, ethical, and intellectual challenges and opportunities they present, UMBC will have to invest in new configurations of classroom space, learning outcomes, and pedagogical practice. The vast majority of campus classrooms are ill-equipped to facilitate instruction oriented toward adopting innovative pedagogical strategies utilizing emerging digital technologies. Most classrooms lack basic infrastructure to network student laptops, to project student work, to share work digitally, or even to allow for students to gather together in working groups. In short, many classrooms make the most commonly accepted best practices for digitally enhanced pedagogy nearly impossible to undertake. This applies even to the “smart” classrooms, which lack networked computers, multiple projectors, and open, modular floor plans to enable different classroom configurations based upon the needs of the instructor. While we appreciate the efforts of various colleges in introducing rooms like the CASTLE and Fine Arts 011, these rooms do not completely meet the need of our faculty – the demand for these rooms is extremely high.

Also, our current definitions, standards, and policies regarding undergraduate education do not recognize the importance of media, digital, and visual literacies. Although the University’s mission statement makes reference to “incorporate[ing] technology across the curriculum,” there have been few initiatives to support and to fund this process. Furthermore, General Education requirements nowhere acknowledge these multiliteracies as critical tools for the liberally educated undergraduate, and the current Writing Intensive requirements still make no mention of multimedia communication.

Faculty who want to innovate with technology in order to facilitate student multiliteracies find sparse support. Even Blackboard, which is intended to support the implementation of technology in faculty lessons and student course work is often unreliable and frustrating. While the staff in Faculty Development, DOIT, the New Media Studio and elsewhere on campus are tireless, enthusiastic, and generous with their time and talents, there is not enough technical support, hardware, software, and lab space to assist faculty who are game to try new things but not expert in using technology to make their classes more collaborative, innovative, and production-based.

#### **Part 4. Survey of Technology-Related Initiatives, Support, and Training on Campus**

This section provides a brief overview of campus-wide initiatives and resources related to hardware, software/apps, and technology training.

To begin, the **Faculty Development Center** (FDC) has acted as an infrastructural support system for the development and discussion of pedagogical innovation and experimentation. They host yearly one-day welcome orientations for new full-time faculty and twice-a-year evening orientations for part-time faculty. In collaboration with the Office of the Provost they have offered a one day Teaching and Learning Symposium with presentations and posters about innovative teaching and learning. Of specific note for this white paper, the FDC has also promoted workshops and panels to the value and challenges of integrating technology into the University classroom.

The **New Media Studio** (NMS) helps the campus community in applying emerging media technologies in teaching, learning and creative endeavors and works closely with campus clients to produce custom media solutions for the web, multimedia and video. The NMS conducts ongoing research and evaluation of new media technologies. The NMS serves as a collaborative environment, bringing together faculty from various disciplines to work on technology-intensive, interdisciplinary projects. The NMS has served as a base for collaborative interdisciplinary projects. In Fall 2013 the NMS along with the Division of Information Technology (DoIT) supported the creation of a new equipment loan program based in the AOK Library. This program provides the UMBC community with access to audio and video recording equipment suitable for a variety of academic and personal projects. NMS also sponsors UMBC's institutional membership in the New Media Consortium (NMC), an international community of experts in educational technology. The NMS has been involved in digital story work since 2004, working with faculty in many disciplines to facilitate projects that foster digital literacy and community engagement (see [stories.umbc.edu](http://stories.umbc.edu)), and NMS's digital storytelling faculty workshop has evolved into an annual event facilitated by Studio staff and faculty peers. Based on their workshop experience, faculty in many disciplines have adapted the techniques of digital storytelling in the creation of innovative learning experiences in their classrooms. In some cases this has moved beyond the personal narrative focus of digital storytelling to include documentaries and other forms of visual assignments. The Studio provides graduate teaching assistants on a limited basis to provide technical assistance in production skills in the classroom.

The **AOK Library** at UMBC supports technology-enhanced teaching and learning in several ways. *Library instruction sessions on information literacy and the research process: An average*

of 150 sessions per year are offered, are tailored to a course's research needs and provide hands-on opportunities for students to practice research skills. *Blackboard content*: The Library creates core research content that is automatically populated into Blackboard courses each semester. Additionally, instructors can work with subject librarians to add additional course-specific content. *Assignment design*: Librarians work with faculty to develop class assignments and to choose primary source and original materials for use during class. *Course reserves*: The Library hosts, maintains, and processes electronic and hardcopy course reserves for instructors who require these materials. Additional support comes in the areas of consultations with subject librarians, online research assistance, roving research assistance, and library how-to videos and guides. *Electronic collections and access to materials*: The Library has an extensive collection of ebooks, electronic periodicals and databases. Additionally the Library participates in consortial (USMAI) and campus level demand driven acquisitions (DDA) of ebooks, as well as rapid interlibrary loan (ILL) of items not available at UMBC. *Media equipment and spaces*: The Library provides access to A/V equipment, recording spaces and editing software for the creation of multi-media projects. *Varied and flexible 24/7 work space*: The Retriever Learning Center is a social learning space in a socially connected learning environment - with proximity to co-located library services, tutoring, information resources and information technology. *Drop-in workshops*: Librarians provide hands-on workshops on topics such as Endnote Basic, Zotero, Google Scholar, and finding and using images in scholarly work. *Digitization of materials*: The Special Collections Department digitizes primary source and other Special Collections materials on demand for faculty and class use. *Gallery tours*: The Library provides expert tours of gallery exhibitions. Finally, the Library fosters collaborations with teaching faculty, classes, and students through exhibit experience, course projects using original materials, student internships, and graduate assistantships.

The **Division of Information Technology** provides, as a primary resource, consulting on technology-related issues: They host office hours and brown bag sessions for faculty and staff to learn about technology, and they meet one-on-one with those interested a specific technology implementation need. Along with the FDC, they coordinate bi-annual Hybrid Design Workshops; they also support clickers and train new instructors on their use; they help maintain the FAQ collection (i.e., in-time training via video tutorials); and they facilitate the Computer Replacement Initiative (including iPads) to help keep technology up to date.

Other ongoing initiatives, centers, and projects on campus that further seek to integrate the use of technology to support teaching and learning include:

- In CAHSS, the Dresher Center for the Humanities and the Center for Innovation and Creativity in the Arts
- In CNMS, iCubed@UMBC (Evaluation, Integration, and Institutionalization of Initiative to Enhance STEM Student Success); the Interdisciplinary Quantitative Biology (IQB) Program, the Math Gym, with the support of the Freeman Hrabowski Fund for Innovation, the Biology Teaching Circle, the Science Learning Collaboratory (SLC), CASTLE (CNMS Active Science Teaching and Learning Environment), the Chemistry Discovery Center (CDC), and the Howard Hughes Medical Institute (HHMI) National Experiment in Undergraduate Science Education (NEXUS) project. CNMS also supports the use of adaptive learning software to review algebraic concepts and support just-in-time mathematics preparation.



- In COEIT, the ACTIVE Center (funded by the Hrabowski Innovation Fund and donations from BAE Systems and Northrup Grumman), the NSF-funded CE21 – Maryland project which has conducted several information-gathering surveys of high school computer science teachers in Maryland, the CS Matters in Maryland NSF-funded project bringing together UMBC, UMCP, and three "leader teachers" from Charles and Baltimore Counties, the NSF-funded Transforming the Freshman Experience of Computing Majors project, and the Center for Women in Technology (CWIT).

The above list is not comprehensive but rather is a sampling of technology-related initiatives and projects on campus. A full description of these contributions is too extensive for the purposes of this white paper, but these examples provide a glimpse into some of the work being done across campus to leverage technology in teaching and learning.

## Part 5. Policy Recommendations

This section provides recommendations for support for the integration of technology into the classroom, particularly along the lines of information dissemination and standards of technology. These recommendations further dovetail with the implementation of the Strategic Plan.

We specifically recommend that UMBC seek to address **five** goals relevant to technology and teaching and learning on campus:

1. Recognize the value of **Faculty Learning Communities** as an important vehicle for faculty engagement across campus and further as a mechanism that can be employed to affect and shape campus policy.
2. Add the **Classroom Planning Committee** to the standing list of Faculty Senate committees with faculty representation.
3. Develop a **Central Warehouse** to house all of the relevant campus-wide information valuable for teaching with technology; this structure would facilitate better dissemination of information about technology on campus and knowledge of where that information is.
4. Recognize the need for improvements to **Classroom Infrastructure**: The pedagogical work of utilizing digital technologies demands a classroom infrastructure that supports the varying ways in which faculty might implement best practices for developing students' digital, multiliteracies. To this end, we recommend:
  - Classroom makeovers, including hardware, software, and floor plan design to make it easier for students and faculty to access information, communicate with others, collaborate with each other, and produce multi-media forms of scholarly work. Of particular interest is the inclusion of document scanners in all of our teaching spaces.
  - Development of a Technology Teaching Lab, where collaborative, multi-media work can be produced and shared and where the technical skills of digital inquiry can be taught.
5. Recognize the need for improvements in **Technical Assistance**: Supporting work for pedagogical innovation with technology requires special technical assistance, beyond that which is currently available at UMBC. To facilitate this assistance, we recommend:
  - Pedagogy Technicians, supported by RA-ships in Information Systems, and available to faculty, staff, and students in a "Genius Bar" type setting.

- Funding to broaden student access to visual tools. Beyond computer labs, such access includes circulating production equipment such as video cameras, DSLRs, digital audio recorders, microphones and accessories. iPads or other tablet computers are another possibility.
- Funding to collaborate with the New Media Studio to build and maintain a website with tools that faculty can use to try experimental modes of teaching, share resources, and collaborate on digital projects, publications, and other scholarly work.

Because digital and multiliteracy is increasingly impacting the definition of what it means to be literate in the 21<sup>st</sup> century, technology on campus is a pressing issue. With the implementation of the above recommendations, UMBC will be taking a significant step in officially recognizing and supporting the innovative work surrounding digital pedagogy that is currently taking place across campus. To foster innovative teaching and learning with technology, UMBC must make a dedicated effort to support faculty and encourage the spread of the digitally enhanced pedagogical strategies throughout the University.

## References

Cox, Milton D., and Laurie Richlin (Eds.) 2004. *Building Faculty Learning Communities: New Directions for Teaching and Learning*. San Francisco, CA: Wiley.

Loviglio, Jason, Jessica Berman, Beverly Bickel, Rebecca Boehling, Lee Boot, Helen Burgess, Kate Drabinski, Nicole King, Ed Larkey, Jennifer Maher, Denise Meringolo, Tim Phin, Craig Saper, Bill Shewbridge, and Donald Snyder. 2012, June 12. "A Methodology of Collaboration": Expanding the Digital Humanities at UMBC." White paper.

Weisgal, Margit. 2016. Overcoming Barriers and Bottlenecks in Focus-Based Education. *Baltimore Sun*: February 22.

## For Further Information

"Academic Compass: Learning Environments Survey Learning Spaces Summary Report," October 2014. Prepared the by Simon Welsh, Senior Learning Analytics Officer, Learning Technologies, Division of Student Learning, Charles Sturt University. Retrieved from: [http://www.csu.edu.au/\\_data/assets/pdf\\_file/0005/1156199/PhysicalSpacesReport.pdf](http://www.csu.edu.au/_data/assets/pdf_file/0005/1156199/PhysicalSpacesReport.pdf) This 12 page report, illustrated with several graphs, contains a summary of key findings in relation to physical learning spaces only, including respondent profiles and academics' views on Physical Learning Environments. For the future design of physical learning and teaching spaces, flexibility is the key. We need to provide academic staff with physical spaces that can support a variety of pedagogies – the survey suggests CSU academics want to embrace, and are already embracing, a range of pedagogies that place differing demands on what it means to provide "effective" spaces."

“Design of the Learning Space: Learning and Design Principles” by Chris Johnson and Cyprien Lomas. *EDUCAUSE Review*, vol. 40, no. 4 (July/August 2005): 16–28. *Published online on Saturday, January 1, 2005*. Retrieved from

<http://www.educause.edu/ero/article/design-learning-space-learning-and-design-principles> This

article features a step-by-step procedure to design learning spaces for the “Net Generation” The article specifies that, ““Net Gen” students have preferred modes of interaction, communication, and socialization, and these differences are putting pressure on higher education to change. Current and new students may be less willing to spend a large part of their education in large lecture halls. Instead, they may prefer to augment, or even replace, their lectures with formal and informal small-group discussions with peers. Rather than write a term paper, some may want to create a short digital story to demonstrate mastery and competence. This new generation of digital natives will change the nature of higher education. As Marc Prensky has stated: “Our students have changed radically. Today’s students are no longer the people our educational system was designed to teach.”<sup>9</sup> The planning team needs to ask: “What technology skills and preferences do students currently have?” “What skills will they have in the future?” “What skills will they need?” “How will we meet these needs?”

“Designing Learning Spaces - Student Survey.” Retrieved from:

<http://www.surveymonkey.com/s.asp?u=697812777315> This Online Survey of Students takes about 20 minutes to complete.”The survey is part of an effort to employ highly effective learning behaviors in the design of learning spaces for students. The survey inquires about the behaviors students favor for learning. It asks about 12 specific learning behaviors, most of which are elements in three benchmarks for effective educational practice identified by the National Survey of Student Engagement: active and collaborative learning; student-faculty interaction; and enriching learning experiences. Survey questions ask about the importance to the respondent of each of the learning behaviors, about the adequacy of campus space on your campus for accommodating each behavior that is important to the student, and the specific places where each behavior happens.”

*Envisioning the Future of Education*. Retrieved from <http://www.envisioning.io/education/> “This visualization attempts to organize a series of emerging technologies that are likely to influence education in the upcoming decades. Despite its inherently speculative nature, the driving trends behind the technologies can already be observed, meaning it’s a matter of time before these scenarios start panning out in learning environments around the world.”

“Envisioning the Future of Education Technology.” Founded in 2011 by Michell Zappa *Envisioning* is a radically new type of organization designed for an accelerating future. Retrieved from: <http://www.envisioning.io/education> For the poster image, see:

[http://static1.squarespace.com/static/53bbcfe8e4b0db0fef85fcc6/t/53bd8dece4b0a80116431a5d/1404931564406/envisioning\\_the\\_future\\_of\\_education.png](http://static1.squarespace.com/static/53bbcfe8e4b0db0fef85fcc6/t/53bd8dece4b0a80116431a5d/1404931564406/envisioning_the_future_of_education.png) This is a poster image, a free visualization with emerging scenarios for the future of education. The image diagrams future types of instruction and need for corresponding types of spaces. The blurb on the poster states, “This visualization attempts to organize a series of emerging technologies that are likely to

influence education in the upcoming decades. Despite its inherently speculative nature the driving trends behind technology can already be observed. Meaning, it is a matter of time before these scenarios start panning out in learning environments around the world.”

“Learning Spaces” by Larry MacPhee. *Educase Quarterly* Vol. 32, No. 1. 2009. Now available on the web. Last revised 09.17.2013. Retrieved from:

[http://jan.ucc.nau.edu/lrm22/learning\\_spaces/](http://jan.ucc.nau.edu/lrm22/learning_spaces/) The author is Associate Director of e-Learning at Northern Arizona University. MacPhee observes that, “Learning Spaces are locations, physical or virtual, where learning happens. This report focuses on physical learning space design. How are learning spaces designed and how are they used by our instructors and students?” The report includes a comprehensive review of learning spaces on a campus. The table of contents includes approximately 50 links that discuss a range of formal and informal spaces.

Learning Spaces Collaboratory (2013). *The LSC Guide: Planning for Assessing 21st Century Spaces for 21st Century Learners*. Retrieved from <http://www.pkallsc.org/basic-page/lsc-guide-planning-assessing-21st-century-spaces-21st-century-learners> “This is a guide for planning for assessing spaces for learning, developed under the auspices of the Learning Spaces Collaboratory with support from the National Science Foundation (NSF). It is designed to spark broader and more informed dialogue—on individual campuses and within national communities of stakeholders—about the relationship between the quality of learning and the quality of spaces for learning in the undergraduate setting. It is designed to encourage deeper attention to questions planners should ask in developing new and reshaped spaces that better inform the process of assessing how such spaces impact learning.”

*Learning Spaces Toolkit: A Resource for Designing and Sustaining Technology Rich Informal Learning Spaces*. Retrieved from: <http://learningspacetoolkit.org> “Planning learning spaces becomes more complex every day. Whereas once this process amounted to providing mainly places for quiet, individual concentration, today it means creating more places that accommodate a wide range of activities, technologies, and participants – both in-person and connected virtually. In these spaces, people need to be able to create, retrieve, combine, display, share and information, then do it all over again, all in a space that they can easily reconfigure and is well supported by staff that meet and anticipate their needs.... The Toolkit is freely available as a resource on the web and is developed using a collaborative process that shares thinking early and often from the broader community. The resources developed support the full lifecycle of a project, from defining the goals and needs early on to constructing the space to supporting and assessing it. By using the Toolkit, institutions will be better equipped to orchestrate the planning process so that learners are better supported and space, technology, and services are effective.”

[NMC Horizon Report > 2015 Higher Education Edition](#) is a collaborative effort between the NMC and the EDUCAUSE Learning Initiative (ELI). This 12th edition describes annual findings from

the NMC Horizon Project, an ongoing research project designed to identify and describe emerging technologies likely to have an impact on learning, teaching, and creative inquiry in education. Six key trends, six significant challenges, and six important developments in educational technology are identified across three adoption horizons over the next one to five years, giving campus leaders and practitioners a valuable guide for strategic technology planning. The report aims to provide these leaders with more in-depth insight into how the trends and challenges are accelerating and impeding the adoption of educational technology, along with their implications for policy, leadership and practice. View the work that produced the report at [www.horizon.wiki.nmc.org](http://www.horizon.wiki.nmc.org).

“Rethinking the Classroom: Spaces Designed for Active and Engaged Learning and Teaching.” Solution Essay 2008. The article has no attributed author but is published by the *Herman Miller Company*, a global concern, headquartered in Zeeland, Michigan, specializing in the design and furniture for a variety of work spaces including universities. Retrieved from: <http://www.hermanmiller.com/research/solution-essays/rethinking-the-classroom.html> The article claims that, “Educators, researchers, and students are discovering the benefits and advantages of cooperative, active, and engaged learning. Classroom spaces that support such a shift in teaching and learning have lagged behind. A significant opportunity exists for maximizing learning opportunities and creating meaningful experiences by rethinking the classroom experience.” Though the article is brief there are several links to “case-studies,” “research summaries” and “solution essays” that introduce a broad range of design innovations for learning spaces.