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Exploring the Context of Converged Learning: a case study in a polytechnic university

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Abstract

New Jersey Institute of Technology (NJIT), a four-year polytechnic R01 research university in the United States utilized a participatory strategic planning process to implement an innovative approach to the modes of delivery for instruction that exist between face-to-face and online instruction. NJIT defines the spectrum of integration of online and on-ground instruction as Converged Education. This spectrum allows students to either participate face to face, join remotely through real-time video conferencing technology synchronously, or watch classroom instruction asynchronously.

The article opens with a general background of NJIT's approach to the new idea of converged instructional delivery. It provides a brief history, context, and explanation of its interdisciplinary participatory strategic planning process. Then the paper describes the process of pilot testing that was conducted to determine how best to adopt the new modes of instruction across all disciplines. Next, the process for defining and clarifying the terms and conceptions of the various modes to be adopted is presented. After this, the paper discusses the impact of the shift of Web 1.0 to web 6.0 and how the different departments and sectors of NJIT worked on strategic planning together. Finally, the resulting implementation of the new policy and its reflection in course offerings is shown and discussed.

Keywords: *Digital Learning, Converged, Hyflex, Course Development, Instructional Design, Strategic Planning.*

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1. Introduction

The iGeneration does not consider their world as the separate spheres of 'face-to-face (FTF),' 'online,' or 'blended,' but rather as a single, seamlessly interconnected world (Rosen, 2010). Michael Moore has also stated the importance of changing the way education is delivered, based on the direction technology is heading:

> "The experience of learning would be greatly improved in both quality and cost if we would substitute face-to-face interaction with other communication methods when they can do the job as well and divert resources to pay for improved face-to-face teaching in a far more widely distributed geography when it was really needed to accomplish defined learning outcomes" (Moore, 2016).

According to the New Jersey Institute of Technology's "Convergence: A Vision and Framework for Leadership in Digital Learning: The physical classroom and the virtual classroom will converge, resulting in the anywhere classroom, where all students, regardless of physical location, participate in learning activities together" (NJIT, 2013), furthermore "Serving the iGeneration requires breaking down barriers between the physical campus and the virtual campus to create a fully digital learning environment without a distinction between FTF and online learning" (Deek, 2013, p. 20). This spectrum of conceiving course delivery has been termed 'convergence' by Dr. Fadi P. Deek, Provost, and Senior Executive Vice President. Institutions of higher learning are in the process of rethinking how they can deliver their curricula through the use of digital technology to reach more students, reduce costs, and improve effectiveness. Consistent with long-established practices, efforts have focused on classroom technologies such as adaptive learning and Massive Open Online Courses (MOOCs) that retain the distinction between online and FTF. NJIT's "Vision 2020 Strategic Plan" (NJIT, 2015) seeks to transcend this by setting the goal of establishing modes of delivery that end this distinction by the year 2020.

NJIT, a four-year polytechnic research university in the United States utilized a participatory strategic planning process to implement an innovative approach to the modes of delivery for instruction that exist between face-to-face and online instruction. NJIT defines these new modes of integration of online and on-ground instruction as Converged Education that allows students to either participate face to face, join remotely through real-time video conferencing technology

(synchronously), or watch classroom instruction asynchronously. In addition, these different modes were designed to allow students to choose their mode of consumption throughout the semester rather than at the time of registration as typically done.

The article opens with a general background of NJIT's approach to the new idea of converged instructional delivery. Then the process for defining and clarifying the terms and conceptions of the various modes to be adopted is presented. Finally, the resulting implementation of the new policy and its reflection in course offerings is shown and discussed.

1.1. Objectives

The objective of this exploratory study was to examine the participatory strategic planning process to implement an innovative approach to the modes of instruction termed Converged Education. The study sought to review data gathered from committee meetings, pilot tests, and institutional research sources to offer an understanding of the new policy and its impact. The research worked to understand the collaborative process undertaken with a committee of 20 Faculty, Administrators, Students, and Staff members of the university, followed by an exploratory phase with forty pilot classes and the formal adoption of the four new modes of instructional delivery by the university.

1.2. Summary of key findings

The results identify that participatory planning positively impacts the design of new modalities. The resulting implementation of the new policy and its reflection in course offerings is shown and discussed. The study shows the process resulted in a successful policy with four new modes of instruction. During the fall semester of 2020, 820 classes implemented the Convergence model demonstrating the success of the planning process. Another relevant finding is related to the fact that the creation and implementation of educational technologies (especially when informed by pedagogy and classroom practice) are strongly correlated to the development of

technological innovations. The resulting plan was more successful thanks to the additional time and collaboration amongst the faculty and technology support departments.

2. Interdisciplinary Participatory Strategic Planning.

Converged learning was first discussed at NJIT during strategic planning committee meetings. As NJIT entered its participatory process the concept of the converged learning mode of instruction was discussed with the community at large:

> "The 2020 Vision emerged through an open, participatory process. In early December 2013, members of the NJIT community were invited, in the spirit of shared governance, to participate in strategic planning. More than 200 faculty, administrators, students, alumni, and board members joined five committees and numerous sub-committees to design the objectives and strategies. Out of these committees emerged specific reports for five areas: students, learning, scholarly research, community, and investment" (NJIT, 2020b).

Before going further, it is necessary to define Interdisciplinary participatory strategic planning (IPSP) and discuss some of the challenges the committee faced. Strategic planning has many ways of being approach and implemented. NJIT selected participatory planning in which they sought input from all stakeholders:

> "Participatory planning is a process usually designed to address a specific issue, opportunity or problem with the intent of resolving or exploiting it successfully through the collaborative efforts of the crucial stakeholders. This means getting very specific about what is done, to what extent, by whom, for what purpose" (UN Centre for Human Settlements (Habitat) et al., 2001).

Due to the diversity of the participants, the NJIT strategic planning process was inherently interdisciplinary. By soliciting input from so many different disciplinary

subject matter experts at the university, the converged learning committee was required to integrate many diverse perspectives:

> "Bringing together multistakeholder groups requires active planning and coordination and can be time and resource-intensive. Conflict resolution is crucial, as there are often situations and/or populations that are at odds, and disagreements can result in conflict or derail projects (Frey, 2018, p. 1220).

The authors identify a variety of sources to implement IPSP (Godet, 2006; León et al., 2021; Loberti & Dewsbury, 2018). In this context the converged learning working group was charged with defining 'Converged Learning' and so decided that pilot tests were needed to understand the technological, and pedagogical challenges and nuances presented by this innovation.

> "Interdisciplinarity integrates information, data, methods, tools, concepts, and/or theories from two or more disciplines focused on a complex question, problem, topic, or theme. The scope and goals of research programs range from incorporating borrowed tools and methods and integrating them into the practice of another discipline to generating a new conceptual framework or theoretical explanation and large-scale initiatives" (National Academy of Sciences, 2014, p. 44).

As an interdisciplinary researcher, Dr. Lipuma agreed to lead a multidisciplinary team to initiate a series of 'pilot tests' to better inform the IPSP process. The first was initiated in an upper-level undergraduate curriculum and design FTF course, the second condition tested was at a humanity's senior seminar, design to be offered fully online asynchronous. Parallel to these actions, NJIT started recruiting other faculty to begin implementing converge learning in their courses. During the remaining pilot tests, specific use cases were explored with the senior seminar including regular and honors versions of the class. This leads to the identification of best practices and solutions, which are presented in the paper.

3. Converged Learning

As NJIT's move towards this model was undertaken, the Converged Learning working group met and reviewed Technology-based learning (TBL) and HyFlex learning from Educause (Brown et al., 2020) along with NJIT's convergence white paper (NJIT, 2013) which was used to explain and promote this idea for NJIT's 2020 strategic plan. Converged Learning is a prime example of Technology-based learning (TBL), incorporating several delivery modes such as asynchronous, synchronous, or FTF along with the use of a variety of online tools:

> "With the right mix of delivery modes and methodologies, TBL offers more than a repository of learning resources online or a new way of reaching learners at a distance. When done well, TBL offers a way to complement any learning process and, in some cases, it can bring learning to places where it has not traditionally been accessible" (Koller et al., 2005).

3.1. Historical Context: Move Towards Online Learning.

As of 2014, 2.8 million students took all of their classes online. Research shows that online learning is as effective as an FTF course: "The percent of academic leaders rating the learning outcomes in online education as the same or superior to those in FTF instruction was 71.4% in 2015" (Allen & Seaman, 2016). According to the Condition of Education 2019 (NCES 2019-144) report: "The 'Percentage enrolled in any distance education course' increased from 30.8% (Fall 2016) to 32.9% (Fall 2017) as well as the 'Percentage enrolled exclusively in distance education' increased from 12.8% (Fall 2016) to 13.3% (Fall 2017)" (McFarland et al., 2019, p. 26).

As the gap is closed between FTF learning and converged learning, the gap between the effectiveness of learning outcomes also closes. FTF classes are held on campus at given times and are still more popular. FTF does have its limitations. "There are only two options to reach more learners: (1) increase class size, or (2) have faculty

repeat the course at different times or locations. FTF courses also hold students back from choosing their mode and pace of learning" (Koller et al., 2005). Hence, the emergence of converged learning which solves both of these limitations.

Since the HyFlex model allows students to customize and control their learning, this model "encourages students to be more engaged and to take greater initiative in their learning, possibly helping cultivate metacognitive skills" (Educause, 2020). HyFlex courses will require more effort on the instructor's part in developing and customizing the course to be easily accessible for students. Enrollment in these courses may be low due to it being "appropriate for those who are highly motivated to engage in the coursework." Furthermore, "another benefit of TBL programs is that they allow learners to advance through required— or desired—course content at their own pace" (Koller et al., 2005), which proves to be even more true with converged learning as students have more options of how and when they would like to attend class. Research and data are limited for the subject of converged learning, but the data provided by the pilot courses at NJIT offer insights into the concept of technology-based learning. These courses brought about data that displays the success of converged learning and an insight into its emergence.

3.2. NJIT's move to Converged learning

As NJIT's move towards this model was undertaken, the Converged Learning working group met and reviewed Technology-based learning (TBL) and HyFlex learning from EDUCAUSE (Brown et al., 2020) along with NJIT's convergence white paper "Convergence: A Vision and Framework for Leadership in Digital Learning" (NJIT, 2013) which was used to explain and promote this idea for NJIT's 2020 strategic plan. Converged Learning is a prime example of Technology-based learning (TBL), incorporating several delivery modes such as asynchronous, synchronous, or FTF along with the use of a variety of online tools: It became clear that no single mode of instruction would fit between the existing conceptions of FTF and online instruction. Instead a variety of different modes of instruction that

leveraged technology and pedagogical strengths to offer flexibility would be more appropriate. Some allowed for flexibility in location while others offered the flexibility of time and access. One key factor that characterized the innovation sought by convergence was the idea that faculty and students could be freed from the choice of mode at registration often months prior to the first class and determined by an administration unfamiliar with how best to deliver the content effectively.

3.3. Courses for pilot and support

Starting in the fall of 2014, a pilot was run to test different technologies and supports. In the spring of 2016 (4th semester), a much larger integrated group of undergraduates was studied to identify scaling issues in a senior seminar class with 105 regular and honors students. Additional tests and scaling were conducted in subsequent semesters as the policy on the modes of instruction was developed and approved by the university faculty, administration, and board of trustees. In the 2019 academic year, NJIT offered courses in all six modes of instruction, at scale, for the first time, they will be described below.

A team of NJIT technology support personnel, instructional designers, and computer support technicians were involved to help support faculty and student needs as new procedures were developed and tested. NJIT staff oversaw student workers who acted as co-pilots and technicians for early implementation tests. The co-pilot/technician handled troubleshooting in the classroom, acting as level 1 support for any student issues that arose. The time devoted to the course by additional personnel was reduced each semester. This was due to more courses being offered in the converged model and the reduced need for support. The transition also had an impact on the roles and responsibilities of the copilot. During the converge pilot the ‘co-pilot/technician’ was assigned to assist the professor to manage the technology interface. As equipment and training increased, the amount and types of support were reduced and shifted to less personnel-intensive activities.

3.4. Delivery modes at NJIT

First, it was necessary to clearly define the two existing modes of instruction at NJIT: **Face To Face** "All course meetings are held at a given time and place with the instructor and learner in the same space". **Distance Education** "Education that uses one or more technologies to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction" (NCES & IPEDS, 2019).

Based upon this, the NJIT groups working on digital learning identified a continuum that went from fully in-class, to fully online independent studies (no synchronous contact time). Converged classes were along this continuum such that students had the option for a fully FTF classroom experience, a fully online asynchronous experience, or an option that allows students to be synchronous, but remote. The key nature of the converged classroom is that students have the option of how and where to consume course content. This poses many pedagogical and logistical issues for faculty as they plan and design the course. Most faculty would not typically allow for this wide range of options to occur at all times in all classes. However, it was deemed necessary to explore how different elements might work together, as well as what was needed to make convergence happen. Finally, NJIT's administration officially published its "6 Modes of Instructional Delivery at NJIT", including four 'blended' modes:

> "**Synchronous Online:** delivery of instruction takes place at the day and time noted, independent of location. All course activity is completed online through the learning management system. There are no face-to-face sessions, but remote attendance is expected.
>
> **Converged Learning:** Delivery of instruction is independent of place, merging the physical and virtual classrooms. There is an attendance expectation and students can choose to attend class face-to-face or using real-time synchronous video conferencing technology. Some instructors may

require occasional proctored exams (sometimes referred to as a synchronous distributed course).

Hybrid: Delivery of instruction in which some traditional face-to-face contact hours are replaced with required synchronous or asynchronous online instruction (frequently through the learning management system). The amount of online activity is set by the instructor and varies by course. No Hybrid course should be more than 50% online.

HyFlex: Delivery of instruction is independent of time and place, allowing for students to choose to attend class in any of three modes: Face-to-face, Synchronous Online, and Synchronous Online.
Based upon these definitions, the comparison table 1 below shows the way the different modes utilize the various attributes to provide students and faculty with more options" (NJIT, 2019).

	Time		Location		Choice of modes		
Dimensions of Delivery Modes	Synchronous	Asynchronous	On-ground	Online	Registrar	Faculty	Student
Converged	X		X	X			X
Face-to-Face	X		X		X		
Hybrid	X	X	X	X		X	
HyFlex	X	X	X	X			X
Online		X		X	X		
Synchronous Online	X			X	X		

Table 1. - Delivery mode comparison.

NJIT pioneered the development of distance education and developed pedagogical approaches for digital learning. Currently, some undergraduate courses and complete masters-level programs are delivered online. Many courses delivered on campus are also offered in a hybrid fashion, combining the elements of FTF and online instruction. According to NJIT's Vision 2020 Strategic Plan, "Digital learning will be an integral part of every student's experience, with instructors

engaging students through ‘converged’ pedagogies where the boundaries between online and FTF instruction fade. Students will be given more opportunities to learn at their own pace and to explore their own path to achieve their learning goals” (NJIT, 2015). Additional research will be needed to determine the effectiveness of each mode and its implementation on the different types of courses.

3.5. Results

The Strategic planning aided in understanding and troubleshooting the technological demands of this new model of teaching, as well as how it interfaces with NJIT’s current technological infrastructure. NJIT requires students to come to class with a minimum level of computing technology that is supported with software licenses, and that allows the students to download copies of a wide range of programs. In addition, NJIT completed a program that expanded bandwidth and redesigned learning spaces to allow for increased connectivity and power needs.

The number of professors attempting converged classes has increased each semester and represented a wide range of subjects and disciplines at both the undergraduate and graduate levels; all consulted the ongoing findings of the pilots. The technology used for convergence was more than adequate but many times workarounds had to be found for many first-time issues. Once identified, these workarounds were documented and added to a set of best practices, or more permanent solutions were found. Technicians became better at both managing classes and handling student questions and troubleshooting issues as well as directing students to appropriate support materials and personnel. The details of these specific actions are not shared since each will vary with institutional variables in infrastructure, technology, support software and services, level of sophistication with the technology of both students and faculty as well as other factors related to size, student body, and geographic locations. However, logging all issues, with solutions and building a database of support and training materials was key to successful development. Also,

bringing the early adopters together with the larger faculty community to discuss teaching in this mode was very helpful.

Thanks to the strategic planning process, NJIT was more prepared for the shift to online delivery resulting from Covid-19. This significant shift to converged modes is shown for Fall 2020 course offerings in the table 2 below.

Term	F2F	Distance Learning	Convergence	Total
AY 2014	2793	242	0	3035
AY 2015	2927	281	2	3210
AY 2016	2926	299	1	3226
AY 2017	3020	324	20	3364
AY 2018	3061	330	3	3394
AY 2019	3128	357	0	3485
2020 Fall	1663	203	820	2686

Table 2. - Course offering mode 2014 to 2020.

Some structural elements that were tested that proved to be effective related to how the course was run. The room allowed for students to work in groups well and share out. The converged model also worked very well for groups of remotely located students and experts brought together at a common time. This configuration was termed nodes so that groups could work independently on tasks, discussions, or projects in their own spaces wherever they might be. Then during a reporting phase, each group could share a computer screen with other groups and the master room where the teacher was to discuss results. This successfully emulated roundtable discussions that promoted effective collaboration. One drawback of this was that the single faculty member could not visit each group locally and had to rely on the computer interface. Visits from guest speakers and external experts were facilitated by allowing them to avoid travel and host meetings at their local institution. Guest

reported the benefit of being able to watch the classroom interactions while students were learning and working in groups.

Course design is an area that provided results. First, students must have a clear understanding of the requirements and penalties for course attendance and scheduling. There is a clear unspoken understanding of what students think a course should be either in the FTF or online mode. Allowing freedom is seen as a benefit but at the same time, students need to have a clear structure and an outline for expectations of their role and responsibility by the professor. One danger is that students with poor time management might skip class assuming they will go back to watch the video but then never do so. Similarly, some students watch live but remotely without really giving any attention to class but feeling that they had attended. The difference is that it is more difficult to reach out and make contact with distracted or absent students in the converged setting since they may be participating asynchronously.

A clear plan for what materials is to be delivered and what, if any class interaction is expected is key. Many students did not want to communicate via the online chat while others had muted audio making it difficult for them to participate in class discussions. Converged learning worked best for one-way lectures and had the most difficulty when mixed groups of online and on-ground students tried to work collaboratively and had to share drawn or written work. If some students felt most comfortable working on paper, the sharing of that became very difficult. One group even resorted to holding documents up to a laptop being used as a collaboration station. This complex pedagogical challenge led to the recommendation of a range of modes for adoption as the final policy.

Convergence, when planned properly was able to emulate all aspects of a normal FTF class while offering students both flexibility and a record of what happened in the class. As with any technology, there was a time for student adoption of the technology and this seemed to be longer than with other courses but this may have

been an artifact of attention paid to these types of issues. Having the technical support staff was key and allowing class time to deal with and onboard students was an effective way to overcome issues and help students feel more comfortable. Since portions of the class were moved to online materials, this was not as major an issue for time and task completion. In the end, having better instruments to gain feedback and formative assessments of the students' progress are key and need to be developed. In converged classes, it is sometimes difficult to determine if the student is having problems with the course content due to the content itself, the technology interface, or the student's engagement with the technology-mediated experience table 4 list some important questions to be considered:

Key questions.
What is our technological infrastructure to support converged learning?
Do we have sufficient devices to support converged learning?
Will the faculty and technical staff require training?
Do the course offerings and instructional staff fit the desired mode?
Are instructors willing and able to teach in the selected mode?
What is the level of student engagement?

Table 3.- Considering Convergence.

A dedicated, independent side channel was extremely useful. In several different cases, students were unable to access one or more aspects of the class but could text and/or email the technician to ask for assistance or at least inform the faculty member of the issue. Similarly, this side-channel proved useful for private messaging between outside experts and the lead faculty, though could lead to information overload if a single faculty member has to manage all channels simultaneously while teaching and managing the class. Assigning a co-pilot or technician as the coordinator and moderator proved helpful as faculty new to using teleconferencing balanced teaching with this new form of classroom management.

4. Discussion

The global pandemic of COVID-19 has introduced a disruptive innovation for universities. Thanks to the pilot and implementation of 'converge learning', NJIT was better prepared for the crisis. Nevertheless, as new technologies are emerging and the Web is moving far beyond Web 2.0, it is important to consider the possible impact that these disruptive technologies will have on the classrooms and pedagogy. Education has changed as the web evolved to be more interactive and integrated, as Web 1.0 (information) evolved into Web 2.0 (interaction, its use in educational settings grew. Now as the new generations expand, each must be seen as a potentially disruptive innovation, Web 3.0 (affiliation), and Web 4.0 (integration) is already impacting the way students learn and interact with knowledge and one another. Web 5.0 (decentralized smart communicator) "called advantageous web in which human personality and machines can communicate in beneficial interaction" (Önday, 2019, p. 3) promises the potential for vast automation of searching and learning tasks:

> "For the development and implementation of effective pedagogy in Web 5.0 environments, teachers need to become active and critical Web 5.0 users and develop their own skills and strategies for selecting and managing Web 5.0 materials and emotions. Teachers need to select or develop high-quality Web 5.0 resources and use the resources through well-prepared strategic management activities" (Benito-Osorio et al., 2013).

Beyond this is Web 6.0 (translational) which will allow full integration of the previous webs.

The pace of innovation and expansion of the web is not to be ignored or accommodated. Each new generation of learners will expect the norms of their everyday life to be reflected in these secondary and post-secondary classrooms. As the pace of innovation and disruption grows so must the response by the educational system and the educators within it. We realize that NJIT is a

polytechnic institution and so broader liberal arts institutions may face different challenges. Our investigation did not explore the issues of student preferences, academic integrity, and delivery of assessment, which will be, examined in future research.

4.1 The importance of IPSP

The importance of an IPSP approach in bringing together stakeholders from the community to discuss the needs and wants is invaluable. The authors considered that strategic planning is an ongoing process that will always bring a clearer vision of the future the organization wishes to obtain by "building in a strong foundation" (NJIT, 2020a). In this new strategic plan, information and communication technology will serve as a key foundation in achieving an innovative educational system.

Lastly, to achieve a change of culture it is important to be aware of the climate and needs of the community as Kurt Lewin expressed: "Change in culture requires the change of leadership forms in every walk of life. At the start, particularly important is leadership in those social areas which are fundamental from the point of view of power" (Burnes, 2004).

5. Conclusion

From NJIT's experience, thus far, it is clear that convergence is a way to evolve the digital learning offerings for undergraduate and graduate students. In addition, as technology advances and devices and connectivity become more ubiquitous, this means of offering courses will become more attractive and necessary. One of the most important outcomes is the realization that convergence is on an ever-expanding continuum of technology-based learning and must be customized to the key factors of teaching style, limitations of technology, educator and student level

of technology sophistication, and most importantly educational content demands for delivery, assessment, and dissemination of content. Finally, one clear outcome of this initial pilot was the identification of a need for new evaluation tools that fit this new converged model of delivery along with new support and training structures for both faculty and students. As these new modes of delivery become more common and offered to students earlier in their academic career, the more effective they will become. As with the introduction, adoption, and integration of any new technology to education, its persistence and use are tied to its effectiveness, availability, and usefulness. In the opinions of the authors, the combination offered by convergence when tailored to content, students, and educators correctly, has great potential to improve outcomes and positively influence student learning, engagement, and successful completion of the course. Furthermore, leadership styles such as knowledge management and the participatory planning model are relevant to achieve better levels of design and implementation of emerging educational modalities.

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