# Technology-driven Hybrid Teaching Methodologies: A Lean Analysis of Student Learning and Job Seeking Courses

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### ABSTRACT

Software Development Times' industry predictions call 2022 the year of Hybrid Work. If workplaces have pivoted to hybrid work, so have college and university students in their learning environment and job-seeking efforts. For students to transition to a hybrid work environment, they must seamlessly and effectively use technology tools to transition between remote and in-person domains. Studies show that students' technological skill level may be insufficient to match the level required to navigate the streamlined methods used in revamped hybrid education/job-seeking systems (video interviewing, location, or productivity tracking). Even when technological systems provide access, they can sacrifice "equity and inclusion" requirements that protect against student vulnerabilities and hinder student success. Performance in this pandemic-restricted world may also impact how student school-to-work transition is achieved. Using a brief year-end student survey using Lean analysis this uncovered "waste" within the Pre-practicum (Problems of Practice) and Practicum courses focused on workplace skills and job-seeking processes. The resulting implementation plans 1) provide a roadmap to reduce waste, 2) increase alignment that supports equity and inclusion, and 3) integrate customer-focused on-demand elements such as career coaching, known to increase student success.

Keywords: lean analysis, hybrid instruction, equity, inclusion

#### 1 Introduction

Workplaces environments are transforming, impacting university and college students' transition plans (Dąbrowska et al., 2022). This is especially true for those just starting their careers, and for the traditionally marginalized student (Garriott, 2020). Microsoft's 2021 work trend index lists hybrid-based changes that have an uneven impact in the workplace, and 5 of the 10 are important here: 1) Flexible work is here to stay and hybrid work is inevitable; 2) the differential between groups based on either thriving or struggling is growing, especially for Gen Z, women, frontline workers, and those new to their careers. 3) high productivity of the current workforce is masking exhaustion causing some to consider leaving their jobs; 4) Shrinking networks may be endangering innovation, as teams are more siloed in a digital world; and 5) Talent is everywhere in a hybrid work world, but the demographic distribution of who seeks what employment is changing - Gen Z and those without a graduate degree as the groups most likely to apply for remote jobs.

Many studies report that the pandemic restrictions interrupted student plans to prepare for workplace transitions and job-seeking. These "career shocks" have impacted student access to traditional experiential learning opportunities, requiring educators to provide "work-in-learning opportunities to preserve student exposure (Adams & Mazza, 2022).

Higher Education is also being influenced by the need to incorporate a hybrid model as a new normal. The attempt to move the needle to achieve student success may have been



temporarily derailed because of pandemic-related - transitions from in-person to online environments. According to (Keyek-Franssen, 2018), the strategy of looking to student advising and predictive analytics, or even incorporating high-impact learning initiatives to achieve student success is limited because these methods do not provide measurable impact. Moreover, such programs were designed for a largely in-person environment and have not been evaluated under more restrictive Covid-based guidelines. She asserts that universities should look to curriculum and course-level activities to further student success. She suggests that "combining HIPs (high-impact practices) at the campus and programmatic level with highimpact teaching practices at the course and classroom level can provide a double dose of student success practices", including 1) learner-centric designs focused on learner outcomes; 2) learning assessments that provide quick, quality feedback,3) experiential learning, and 4) incorporating open resources (OER) to ensure learner equity (p. 2). These practices combine to produce an at-scale learning environment where students' in-course feedback can reshape course methodology to better fit student needs.

However, these changes suggest that hybrid environments will require students to simultaneously be adept in online and in-person environments. Online or virtual often require technological tools, access, and strategies, however in-person methodologies have a different set of demands (Singh et al., 2021). Being able to do both well is a new skill that students need to master. However, students' resources may not match the new requirements impacting equity and inclusion. Needing to be adept at both causes new "waste" to be introduced into learning systems, and therefore, educators need to find better ways to support the student in these situations. Resource redundancies and duplicative efforts create confusion about how to be successful.

# 1.1 Statement of the Problem

Since new course modalities require students to excel in both in-person and online environments, educators need to adjust the curriculum and technological training that supports new learning. These new strategies should support "equity and inclusion" requirements that protect against student vulnerabilities or hinder student success. Moreover, performance in this hybrid, the pandemic-restricted world may also impact how student school-to-work transition is accomplished and achieved.

# 1.2 Issues of Technology Equity and Inclusion in Teaching-Learning Systems

Anecdotal evidence supports that the flexibility needed in hybrid environments does not impact all students equally and that students differing circumstances can frustrate traditional efforts of universities and educators to ensure equity. Moreover, the need to respond to student diversity has prompted the recognition of a gap between traditional online teaching designs, practices, and student needs. New scholarship has begun to address these gaps that exist when navigating face-to-face and virtual environments simultaneously.

Inclusivity in virtual education (IVE), according to (Fermín-González, 2019), is a different way of understanding education, and suggests a new paradigm reflecting new philosophy and values, viewing education as a positive right for all people (citing (Colás Bravo & Lozano Martínez, 2011; Echeita Sarrionandía & Ainscow, 2011)). (Fermín-González, 2019) course design suggested that IVE must consider diversity in how students learn, focusing on

innovations allowing students to be served according to "their uniqueness Also, (Lalla, 2015), focused on language proficiency communication barriers as a major challenge for international students in online education. Additionally, (Catalano, 2015) study of the impact of offered directions for complex thinking about inclusion of "trans" students beyond a one-size-fits-all policy. The author suggests that having a liberatory consciousness for individuals at an institution reasserts how everyone is responsible for "trans student" inclusion at all times. Moreover, (Catalano, 2015) suggests that to be inclusive requires 1) awareness ("noticing and knowing that 'trans' students exist and learning more about their experiences"); 2) analysis ("consider the range of possible activities and the results that each of them is likely to produce;" 3) action (consider the levels of support they received from individual staff or faculty and encouraging them to take action with their support, and 4) accountability (that individuals accept accountability to self and community for the consequences of the action that has been taken or not taken" (p.429).

To address student equity in the online environment, (Russell, 2021) proposes an Equity Design Framework that shows how certain equity-based practices evolve from emerging to developing to transforming in the areas of the definitions of equity and diversity, historical frameworks. technology, communication, self-awareness, course materials, and assessments. She suggests that online content must be offered "in a variety of modalities (text, video, audio) while allowing students to participate through a variety of methods (discussion boards, text chat during synchronous sessions, video logs, etc.) (citing (McBrien et al., 2009)). Educators must intentionally review our course design and content delivery after each class session and at the end of each semester, to ensure we are truly providing an equitable education to all."

(Donovan et al., 2021) suggest that inclusivity means engaging with all students in ways that are relevant to them, "creating a space for examining controversial topics, asking questions, and voicing opinions where learning is supported through various modalities, abilities, and backgrounds (citing (Ambrose et al., 2010)). (Donovan et al., 2021) and colleagues suggest that in-person courses should include applied best practices within the online learning environment, and should contain peer feedback, assessment, inquiry-based learning assignments, collaborative work, and opportunities to share with the broader community.

#### 1.3 Issues of Technology Equity and Inclusion in Job-Seeking Systems

Similarly, employers are beginning to address these needs. For example, (Balhara et al., 2021), provided strategies to their leadership as "actionable and accessible strategies for navigating and mitigating the pitfalls of bias during the residency and fellowship interview season." By recognizing that institutional racism and entrenched implicit and explicit biases represent substantial barriers to achieving workforce inclusion. They suggest that programs must consider how they send signals of inclusivity since these signals can influence applicants' perceptions of their likelihood of being offered a position.

Additionally, (Adams & Mazza, 2022) reported that students accessing virtual employer interviews needed to be trained in new skills to be successful. Different skills may be required for virtual as opposed to traditional face-to-face meetings. The authors suggested that curriculum and experiential learning paradigms needed to be supplemented to help students

understand and navigate the differences each platform demands. However, to make sure that these practices work for a student in the hybrid environments educators must parse out what methods are best practices in the separate environments. To do so requires an understanding of how they overlap and what can be added or eliminated.

# 1.4 Lean Philosophy and Value Stream Mapping

These studies indicate that incorporating inclusivity and equity-based practice is paramount to understanding what to discard, what to retain, and how to design a more effective technology-based hybrid learning experience that addresses equity and inclusion hybrid workplace. Specifically, for this study, how should the hybrid educational and employment demands be modified in the Problems of Practice and Practicum sequence for the Administration of Justice students at the University of the District of Columbia to support student success? Also, how are these changes supportive of learner-centric outcomes, and quickly focused feedback, and how can they be implemented in a way that supports learner engagement?

The concept of Lean manufacturing is a process that was developed by Toyota in the Toyota production system to address issues that impacted the efficiency of delivering their products to customers. The lean methodology is based on the process of continuous improvement. The Lean evaluation includes s process known as Value Stream Mapping (VSM) which is used to identify bottlenecks, waste, and value-added steps within a flow of material and information. The value stream map is the appropriately named tool used to present and analyze the information uncovered by looking deeper into an organization's processes for inefficiencies or other processes that do not add to the organization's goal. Though it still stands as a methodology for manufacturing, it has been used in several education-based studies to identify practice areas that do not support educational goals, especially when new, more efficient process mechanisms emerge. Several authors have used the Lean process to better understand and measure distinct parts of the educational processes so that unnecessary tasks and practices can be modified or eliminated.

# 1.5 Lean Philosophy in Education

(Riezebos & Huisman, 2021) sought to develop a VSM for education, specifically focused on the problem of work stress to see if mapping the process would enable participants to improve work processes that generate work stress. The authors found 3 main generators of workplace stress, dependency on others, task requirements, and autonomy surrounding the task. They used observation methodology with a limited representation of traditional VSM symbology allowing participants to own and secure results.

Similarly, (Anand Kumar et al., 2020) sought to apply lean thinking for the identification and minimization of various "waste" in an educational institute. Hence, when Lean thinking was adopted, waste from the existing processes was identified and solutions to eliminate waste were proposed. The results indicated significant changes measured by the Chi-square test. Also, (Alexander & Fadden, 2017) study using VSM resulted in a VSM-based process that addressed the needs of an online student in the traditional on-campus system. Because the online and in-person systems were never imagined as one system, the authors suggest that focusing on the future state was critical to motivation and the process allowed them to visualize the current state's ineffective "person-dependent silos that impacted students. In another study, (Zanchi et al., 2021) looked at different teaching methods using VSM. They compare three companies' approaches using VSM teaching-learning processes and found that though coaching had similar results to instructor-led training methods, they speculated that it might also be beneficial as a final part of a teaching-learning process.

Lastly, (Sanahuja, 2020) study focused on "lean teaching" and sought to establish what issues are non-value-added (waste) and how to eliminate them. Sanahuja's approach envisioned the role of students as customers where the teachers are "transmitting knowledge to students and guiding them to acquire corresponding skills. This study used Sanahuja's model to categorize student feedback to understand whether "lean teaching" methodology can be used to modify student experiences in the Problems of Practice course, and to facilitate greater alignment for student's Practicum experience.

Using the insight from the literature review, and Sanahuja's lean teaching analysis, this study uses Value Stream Mapping as a first step to reimagine the Problems of Practice and Practicum course sequence to understand the impact of varying technology requirements on equity and inclusion student protections. The study also suggests modifications to the Practicum sequence to support technological equity and inclusion without the identified "waste" while incorporating enhanced feedback methods for students.

#### 2 Methodology

Value Stream Mapping (VSM) is at its core a four-step process. Though the processes are simple, they are designed to establish a baseline and the processes included therein. First, the scope of the project is outlined. Then, the current state is mapped customer feedback. Next, with additional customer feedback, a future state is imagined. The future state is an imagining of a process without the identified waste in the system that increases efficiency and produces customer-valued outcomes with pull, flow, and perfection ((Shou et al., 2017) p.3907). Customers used the elimination of identified waste in the system to provide input on what might increase their perceptions of value. Then an implementation plan is developed, with an added continuous feedback loop designed to integrate customer feedback and refine the process. The study will use this process as modified by (Sanahuja, 2020). In successive class cohorts, the continuous feedback loop will be used to "validate" the process that corresponds to new technological and other environmental changes and cohort demands. This is because though the goals and objectives for the class remain clear, each cohort of students is different, and the validation process gives each class an opportunity to identify different areas of waste or revive former waste as an important part of their learning. The validation process may be unique to education but may also be important to incorporate in a situation where the customer exists as a cohort.

The scope being mapped by VSM is the current teaching and job-seeking process within the Problems of Practice and Practicum sequence, specifically those that address the technology-enabled hybrid requirements that ensure equity and inclusion parameters while reducing the "process/content waste" for the student customer. The traditional VSM current state process focuses on time-related bottlenecks in a system that includes 1) taking time (the speed that it takes to produce a product), 2) lead time (time between each process), 3) cycle time (the time taken at each station or situation), and then 4) waste (time in each area that is not productive). An initial chart of the process that incorporates the Problems of Practice and Practicum class processes suggests that in the Problems of Practice class, students need to also be tracking the Practicum internship/WIL experience before the "implementation" of the internship. The Problems of Practice tract includes direct methods validations demonstration and goal achievement.

Class	Direction	Resources	Methods	Validations	Demonstration	Goal Achievement
Employment: Practicum	Career Identification	Resume of experience and/or education	Handshake, UDC events	Credentials	Interviews	Selection (interview w/o selection is valid
Education: Problems of Practice	Syllabus	Reading Materials; Course Materials	Class Lecture	Assignments/ Assessments	Class Participation Presentations	Grade

Table 1: Tracking Transitions of Problems of Practice and Practicum Processes in tandem

Another aspect of VSM is calculating time or wasted time in each area. If too much time is allotted or used, it can be a source of waste. The transitions between each process are indicated below and the estimated waste is identified. Waste that is eliminated reduces "time" within each area and between each transition. presentation, need assistance with a video presentation, and need flexibility when systems were not working; need resources available individually, not just for the class group; need individual meetings with the professor.

Table 2: Transitions Pr	roblems of Pi	ractice and P	Practicum
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Transitions between each element	Take time – speed to produce -	Lead time – between each process (includes transition skills and technology	Cycle time – time in each situation	Waste(time plus identifier)	New Waste Students can review the syllabus because loaded too late
Class to Direction	Learning platform and syllabus/syllabus loaded before class begins	Most students do not review the syllabus before add/drop deadline. Course acknowledgment	Discussions before the add/drop deadline	The syllabus is too wordy for quick review; revised	
Direction to Resources	Use of a learning platform to find assignments	LMS familiarity And educator review	Calculating time spent on the platform	Finding items on the learning platform	Alternating technology
Resources to Methods	Syllabus sources	No lead time – as needed	As needed but if unclear, more time is needed		
Methods to Validations	Accessing and understanding assignments	On-demand – Preps, and demands that coincide with the method	Learning platform issues Missed assessments	Grade assignments more quickly and adjust the feedback	
Validations to Demonstrations	Performance – assessing and understanding	On-demand Essay grading delays	Prep virtual sessions	Closing assessments early before learning	Discussion versus chat/Automation

Demonstrations	Understanding	More	Ability to	Mone	Feedback loop
of Goal	how	standardized	cure	ongoing	
Achievement	performance	feedback; lack of		feedback	
	equals Grade	immediate		Cumulative	
	Visibility on LMS	feedback		grades more	
				accessible	

The tracking indicates some areas of waste that could be eliminated by new processes. However, additional waste was identified from the student class survey below.

#### 3 Results

Waste identified by students in the class discussion included: turning on video when not speaking; joining only with the computer; inflexible schedule for presentations; total responsibility for electronic access; assigned topics for presentation, access only to class-based resources, group counseling, going to the career center to access resources.

Table 3: Comparison of Types of Waste Identified by Students from Journal Feedback (color of	coding
evaluation)	

Manufacturing	Lean Teaching (Sanuhua, 2020)	Waste Identified by Students: POP	New Waste: Hybrid Based
Defects – efforts caused by rework, scrap, and incorrect information.	Erroneous or low-quality content, activities, or materials.	Total responsibility for electronic presentations	Assignments are not needed for both environments.
	Inappropriate technological resources.		Student tech is not reliable – upload before
	Inadequate methodology and assessment system.		a presentation
Overproduction – production that is more than is needed or before it's needed; or is over- processed	To teach content that is already known. To teach more subjects and content, and to endow students with the same content.	Long syllabus with limited use for students	Excess assignments in both virtual and hybrid environments- time navigating complicated syllabus - streamline
Waiting – Wasted time waiting for the next step of the process	Teachers and students waiting for the start or continuation of the class, to receive feedback or attention.	Inflexible schedule for presentations	Submit presentation whenever completed to address schedule flexibility
	(e.g., due to technological breakdown, slow technological systems, delays of people, heterogeneity of students)		
Transportation – unnecessary movement of products and materials	Excess movement of the content, activities, and materials, physically or virtually	Inflexible in-person or virtual-only options	Inability to access a single platform – variety, high flex
Inventory – excess products and materials not being processed	To have content, activities, technological resources, and materials prepared but not used	Access to only class- based resources; exercises geared directly to internship resources	Extra resources to maintain virtual and in- person requirements –

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Motion – unnecessary movements by people	Teachers doing tasks other than teaching Turning on video when not needed		Another validation method other than video
Extra-processing – more work/higher quality than is required by the customer	Teachers and students not involved in the improvement. of the teaching-learning process. Teachers in underutilized jobs; students' creativity not considered.	Completing assignments not used or needed for class	remove less impactful assignments
Duplication -	To repeat the teaching or assessment of content due to the use of an inappropriate methodology or because of difficulty (poor planning) Excess of practice activities.	Reviewing similar content for students that are late or missing and making all students participate	Video for missing students
Output Measure	Time measurements (citation)	Better assessment measures: Moving through the process at their own pace; coaching resources	Multiple assessment measures

The above waste suggests that inclusion requires additional access/demonstration points, but the measures must align with the stated outcomes. The ability for customers to pull resources when needed is a key principle of lean analysis. Delivering only what is demanded minimizes overproduction. In the Problems of Practice class, - this may mean only requiring students to use their video when speaking, allowing them to join from any device, and the flexibility to adapt the course presentation schedule to fit the student's schedule. However, equity and inclusion demand as many options as practicable to achieve outcomes which means that some processes cannot be classified as waste.

To that end, Table 3 takes the waste and embeds it into the transition chart to compare it to the equity and inclusion lens as a way to make sure that what may be eliminated from the class does not impact equity or inclusion and facilitates it. In fact, this lens allows the instructor to opt for minimization of a waste item over elimination, or to provide it in another "pull" format so that students that might need it can access it within the confines of the class.

Transitions between each element using technology	Equity	Inclusion
Class to Direction	Make sure students can get access to course explanations before the course begins	Provide written, visual, and audio resources
Direction to Resources	Question and answer sessions throughout the semester	Variety, including culturally sensitive formats
Resources to Methods	Directed students to additional resources	Variety of assessments aligned to outcomes
Methods to Validations	Feedback methods	Different validations to measure the same skill
Validations to Demonstrations	Understand what is considered a success	Culturally sensitive success markers
Demonstrations of Goal Achievement and general success	Listen and incorporate student feedback	Provide culturally sensitive means for students to provide feedback.

Table 4: Tracking Problems of Practice and Practicum transitions with Equity and Inclusion Lens

#### **4 Discussion:** The Future State

What these charts show is that the transitions include different types of waste using technology between processes impacts Equity and Inclusion in such a way as to create a buffer between the transitional objectives and include additional touchpoints. The roadmap for the future state is presented below.

The future state imagines that students should be able to seamlessly flow through the process and the process should also flow with clear paths from one station to another and ample communication along the way. Students should be able to pull what they need from the resources in a way that charts their own experience. Students who need more resources can "pull" them or can be guided to pull them. This addresses the issues of equity, but the educator's mindset must be flexible in addressing student needs. Inclusion is addressed by providing different modalities for students to access. Student needs are understood by allowing students to access the same resources differently or providing different access points that fit different learning styles. In this process, perfection is the act of continuing to reconsider waste in systems and continue to eliminate it. The corresponding implementation plan is outlined below.

Class	Direction	Resource s	Methods	Validations	Demonstratio n	Goal Achievemen t
Employment : Practicum Add to POP	Career Identificatio n – add this element to the POP syllabus and take out waste	Resume of experience and/or education: Add Career Center- enabled resume workshop	Handshake, UDC events: Mandatory Handshake training and attendance at an event	Credentials: Add opportunities to get credentials during the POP	Interviews: Add Career center interview training/ Require 3-5 interviews Apply for internships	Selection: Internship, WIL assignment, or credentialing assignment
Education: Problems of Practice	Syllabus Resources Add the above elements and remove old and new waste. Add technology transition training	Reading Materials; Course Materials: Add access to resources that promote internships – Add internship link for students to "pull"	Class Lecture: Bring in Career Center, employers, Develop an instructor/pee r coaching cohort with Career Center assessments.	Assignments/ Assessments : Only presentations and Practicum related tasks	Class Participation Presentations: Updates on status: Peer and Instructor Feedback sessions	Grade: Class determines the grading structure at beginning of the class.

 Table 5: Implementation Plan Chart – Simultaneous goal achievement for both classes during

 Problems of Practice to address equity and inclusion and new waste: New Flow

Lean measurement and addressing new waste, equity, and inclusion.

This implementation chart focuses solely on waste elimination aligned with equity and inclusion protection Here there are suggestions, that when implemented in the 2022-2023 course sequence, should reflect less waste. Students will be surveyed, and surveys compared.

VSM Production Waste Categories	Waste Identified by Students: POP	New Waste: Hybrid Based
Defects	Total responsibility for electronic presentations on the learning platform.	Assignments are not needed for both environments
Overproduction	Long syllabus with limited use for students	
Waiting	Inflexible schedule for presentations	The modality of presentation submission requires different skills
Transportation	Inflexible in-person or virtual-only options	Switching
Inventory	Access to only class-based resources; exercises geared directly to internship resources	Extra resources to maintain virtual and in-person requirements
Motion	Turning on video when not needed	
Extra Processing	Completing assignments not used or needed for class	
Duplication	Reviewing similar content for students that are late or missing and making all students participate	Identical Electronic and Physical items
Output measure	Better assessment measures: Moving through the process at their own pace; coaching resources	Equating. Modulating different outputs

#### Table 6: Waste Chart

## 5 Conclusion – Measurement Adjustment and Individual Coaching Protocols

The modification to the Problems of Practice course tracking flow will add important elements of the needs of the Practicum course and eliminate aspects of the course that are not valued. This allows the redesigned Problems of Practice course to have a "workshop" feel, where students can access the level of resources needed to meet their individual goals. Increasing resource touchpoints addresses student equity while increasing the access modalities helps students with different needs to feel included. Increasing and speeding student feedback is a critical part of learning employment-related successes, especially when students are interviewing for internships and jobs. Since student evaluations of the Problems of Practice course indicated that more individual attention that addresses their specific needs was important to their success, a coaching element will be added to the course.

The Problems of Practice and Practicum sequence will be changed to remove waste and incorporate "lean" tasks using the identified modifications to the course that eliminated student-identified waste to incorporate peer and instructor-led coaching. A continuous feedback loop will be added so that each class cohort can identify the elements of the course that provide value. However, students who need more help can "pull" for resources without

burdening other students. Also, students can gain access through accessible virtual and in-person resources. These changes will be implemented in the Fall 2022 Problems of Practice course to support the 2023 Practicum class.

Using course changes to help students understand the benefits of hybrid learning and how that transitions to hybrid work is critical. A LinkedIn survey found that Black, U.S. Latino workers, and women are more likely than white workers to prefer remote work (McGrath, 2022). And, according to Game Changer Network (GCN, 2021), governments that embrace telework remove, geographic barriers, opening the possibility of hiring workers who don't live locally. For smaller governments "that can't afford 24-hour security, this can be game-changing and open up even more opportunities for tech-savvy students no matter what their background or ethnicity" (p.1), which works to level the playing field.

#### 6 Publisher's Note

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