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FACILITATING FLEXIBLE LEARNING EXPERIENCES

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Abstract

Digital mediums provide opportunities to create a cohesive environment to support learners' education, by bringing together instructors, learners, and course resources in a way that fosters a sense of community while enabling easy access to course materials. One effective way to achieve this cohesion is to set up the course environment to meaningfully curate and manage resources and interactions, supporting learners' navigation and engagement with the resources, as well as instructors and their peers. We present a digital environment that facilitate such curation by providing a vision that allows instructors to organize and structure their courses comprehensively. We provide an interactive and collaborative learning environment for students with Microsoft Teams to support student communication, collaboration, digital annotation, note-taking, and file sharing. This approach supports personalized knowledge acquisition, learning and study in a structured and moderated environment for learners to attain differentiated educational goals.

Keywords: *Educational quality and standards engagement, cohesive digital learning experiences, automated curated learning, collaborative learning environments, meaningfully curated courses.*

1. Introduction and motivation

The integration of technology into classrooms constitutes a recognized trend in contemporary approaches to higher education, driven by a desire to enhance the learning outcomes and create a learner-focused environment that enables flexibility of learning while meaningfully engaging with the curriculum. Through the deliberate adoption of technology, educators aim to optimize instruction to encourage exploration, differentiation, and ownership of the learning process, focused on high-quality education.

We showcase an agile digital environment using Microsoft Teams in conjunction with OneNote to facilitate instructional communication and collaboration, paired up with digital annotation and note-taking. By using Microsoft Teams, Instructors can integrate like scheduled class meetings with automatically curated recordings, just-in-time office hours, screen sharing that can be used for note annotation, and file sharing to support personalized study and collaborative learning. This ensures that digital resources provide an integrated learning environment that facilitates the strategic use of class time, guided practice, and self-regulated learning. This work is centered around the implementation of an education innovation strategy for meaningful digital learning experiences in physical classrooms, online environments, and hybrid settings. We aim to provide impactful and innovative learning experiences that prioritize intentional learning strategies. We have received positive feedback from graduate students since 2018 on using this method, and we continue to improve these techniques in current courses. Our approach engages students in active learning, exploration, and experimentation to strengthen competencies and confidence as learners.

2. Theoretical grounding

An optimized learning environment is crucial for effective learning, ensuring that learners can process, organize, and connect new information to preexisting knowledge, without feeling overwhelmed by poorly designed learning environment (Bransford et al., 2000). Effective presentation is crucial for a learner's ability to process, store, and encode information, as an overloaded working memory can hinder the transitioning of content to long-term memory (Chang et al., 2012). Technology can support a design that presents learners with the necessary expert and peer feedback, empowering learners to synthesize information from multiple perspectives, asking questions driven by their personal interests, while reducing the strain on the learner to seek new information from multiple content resources. Additionally, this provides learners with critical feedback tailored to their specific challenges, since a well-designed and

dynamic educational environment includes reliable communication & accessible instructional resources to support collaboration (Bower et al., 2014).

Cognitive load theory (CLT) studies the load placed on the brain when a learner is introduced to new information and the limitations of working memory that impact the learning process (Sweller, 2020). All learners have a specific capacity for working memory that impacts the ability to perform complex cognitive tasks (Sepp et al., 2019). If the working memory capacity is overloaded, a student will be unable to process additional information & halting the learning process. As such, CLT emphasizes that both intrinsic and extraneous cognitive load management require proper management of learning materials and classroom design to manage extraneous cognitive overload and foster a learning design promoting learner persistence.

The contribution of our work is to provide a framework and examples of a digital environment that automatically curates content from both learners and instructors, incorporating agile learning tools to provide tailored feedback, thus creating a seamless learning experience with reduced cognitive overload. Our work anchors these concepts to a framework and provides examples of how digital environments can manage cognitive load and optimize knowledge acquisition, retention, and transfer.

3. The dynamic digital environment conducive to flexible student engagements

The strategic setup of this digital environment involves not only deciding what to include in order to facilitate flexible learning experiences but also how to set up the digital environment in order to support the dynamic curation of content both by instructors and learners. We particularly present this setup in the MS Teams environment, driven by the following three instructional goals:

1. Support flexible asynchronous just-in-time discussions, both in groups and one-on-one, by facilitating flexible learning, exploration and differentiation,
2. Support synchronous instruction focused on active learning through conversations, concept mapping, problem-solving, data analysis, and group discussions,
3. Promote co-creation of new content through collaborative projects that need an environment that promotes creativity, collaborative writing, and easy incorporation of immediate feedback.

In this study, we present our pedagogical approach for delivering graduate-level mathematics courses at the Naval Postgraduate School. Our approach involves distinct methods of instruction, which include asynchronous guided learning, classroom instruction, synchronous problem-solving, synchronous data analysis, weekly assessments, as well as creation of new content, such as research projects. As such, we seek a digital environment that supports the functionality identified in the first column of Table 1. The second column identifies how MS Teams supports that functionality for our class (Microsoft, 2024).

Table 1. Summary of desired functionality and solutions for content sharing, collaboration, and communication.

Desired Functionality	MS Teams Features to Meet Functionality
Portal to resources, communication, collaboration	Channels/Tabs/Breakout Rooms
Easy access & integration with existing software	M365 suite
Ability to welcome & orient students, as well as agile access to meetings & resources	Classroom home page with a dynamic display of calendar meetings, assignments, and content
Intuitive posting and curation of content	File sharing & class notebook
Support conversation between students, as well as students and instructor	Curated channels and chats, using the tag notification
Timely feedback mechanism	Focused channel discussions
Assignments and grading capability	Assignments and rubrics
Dynamic access to classroom meetings/recordings	Calendar invites of a dedicated team's channel
Automatically curating classroom recordings	Curated channel for meetings and recordings
Automatic posting of classroom recordings	MS Stream through calendar invites
Ability to run and demo live code	Markdown for live preview and sharing of code
Ability to share editable code in a chat	Code snippets in a message

To exemplify this, Figure 1 showcases an example of this environment, highlighting the MS Teams' default organization channels, and customizable channels designed for topic-focused curation. The home page for MA4027, a graduate-level course at the Naval Postgraduate School, shows students' lightly personalized view with their individual files and deadlines, enabling them to access applicable materials, communicate & collaborate with peers and the instructors effectively. We observed that this dynamic welcome page enables students to identify their immediate priorities quickly, and to easily access relevant digital classroom notes and correlated homework solutions to promote efficiency and effectiveness.

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Moreover, during classes, instructors join the prescheduled semester-long classroom's digital meetings whose recordings get automatically saved in the "Meetings and Recordings" channel, allowing topic repeatability. Students have the option to join the same meeting creating a no-front-classroom setting, as each student can view the content on personal devices during face-to-face classes. This enables learners to exercise agency over their learning by choosing engagement modalities and promoting self-organization, planning, and independence attending online in instances when school attendance would otherwise be compromised.

Figure 1. The configuration of the MA4027 depicts two types of channels and the dynamic welcome page.

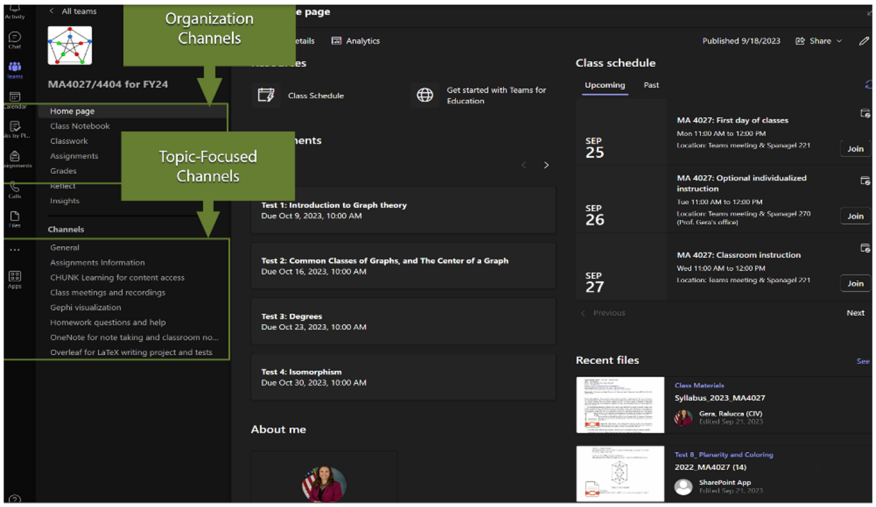
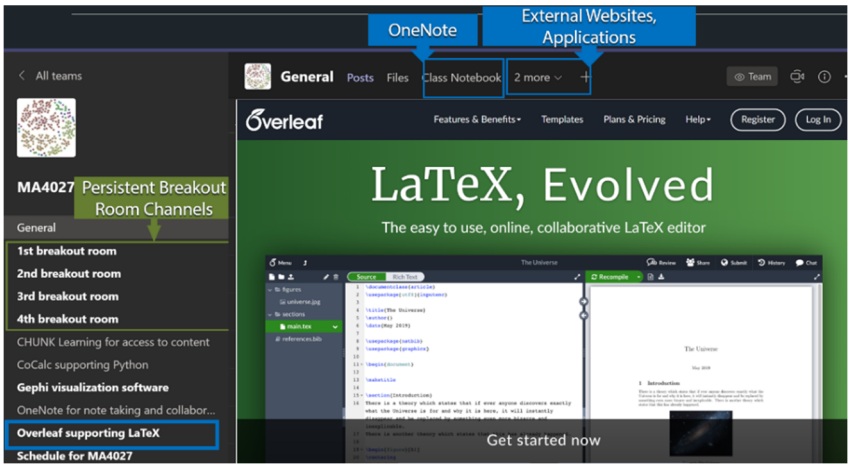


Figure 2 depicts a previous iteration of the MA4027 course, illustrating the channels that support persistent breakout sessions if desired. It also identifies use of topic-focused channels, each used for questions and resources for specific software, so that learners utilize a hassle-free file exchange, perusal of classroom notes, and direct access to external websites (without the need to memorize the respective links, such as the "Overleaf supporting LaTeX" tab). Therefore, learners can exercise greater control over their learning experience and efficiently engage with course materials, fostering a sense of self-assurance and mastery.

Figure 2. The composition of a MA4027 course highlights channels facilitating needed persistent breakout sessions, and a topic-specific channel (depicted in blue) used for classroom notes & direct access to external websites.



To facilitate social learning, topic-focused channels enable the curation of questions and resources, allowing for autonomous peer-to-peer sharing & collaboration on relevant content. This structured learning approach promotes student self-regulation, autonomous learning, and flexible learning engagement. Our analysis of this curated environment indicates that students share resources with their peers and tag instructors when decisions are needed, leading to deeper understanding of subject matter. It is evident to us that curation of information is a critical component of social learning, promoting collective knowledge construction and providing a framework for students to establish their own organizational standards.

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4. The utilization of digital notes and annotation

To encourage safe writing within a digital notebook, it is crucial that a digital notebook have robust organization features and individual permission settings, to differentiate between the instructor's notes accessible by everyone, and the student's individual notes. This ensures that users can easily categorize their notes & ideas, and reference resources in a structured manner, facilitating ease of retrieval to reduce cognitive load, while supporting effective communication with learners and instructors [Soffer, 2020]. Safeguards against unwanted modifications to students' individual work instill confidence in annotating personal insights. Students who demonstrate higher engagement with course materials and utilize technology effectively, including the use of digital notebooks, tend to have higher levels of persistence and better academic achievement than their peers (Morris et al., 2005).

We exemplify this setup in the OneNote environment, consistent with the above-mentioned need for best practices, as well as the pre-identified instructional goals of Section 3. Table 2 summarizes our desired functionality and how OneNote meets that functionality (Microsoft, 2020) and (Microsoft, 2024).

Table 2. Summary of desired functionality and solutions leveraging digital annotation and note-taking tools during instruction, homework, and peer collaborations to streamline the learning experience for students.

Desired Functionality	OneNote Features to Meet Functionality
Digital notetaking accessible across devices	M365 suite
Agile integration of notetaking and annotation	Integrated notebook with the classroom team in MS Teams for digital and handwritten notes
Robust organizational features	Customizable categories, tagging, search, hierarchical notetaking
Clear & customizable permission settings enable safe and collaborative notetaking	Securely share sections or individual pages either 1-1 or groups at various levels of permission.
Facilitate efficiencies during office hours	Student Notebooks & Collaboration Space
Augment and provide updates to classroom notes	Content syncs with instant access
Easy referencing content from multiple sources	Organization of notes using titled sections and pages enables easy referencing of all notes
Private sharing of homework or quizzes for grading	Student Notebooks
Ability to solve & graph math problems	Mathematics solver
Digital Office hours even for face-to-face class	Student Notebooks & Collaboration Space

To exemplify this portion of the digital learning environment and how it supports flexible learning experiences, Figure 3 presents a breakdown of the digital notebook demonstrating streamlined organization of the various elements that reinforce instruction and promote effective learning.

Figure 3. The digital notebook contains four sections, each having specific permissions for editing and viewing content.

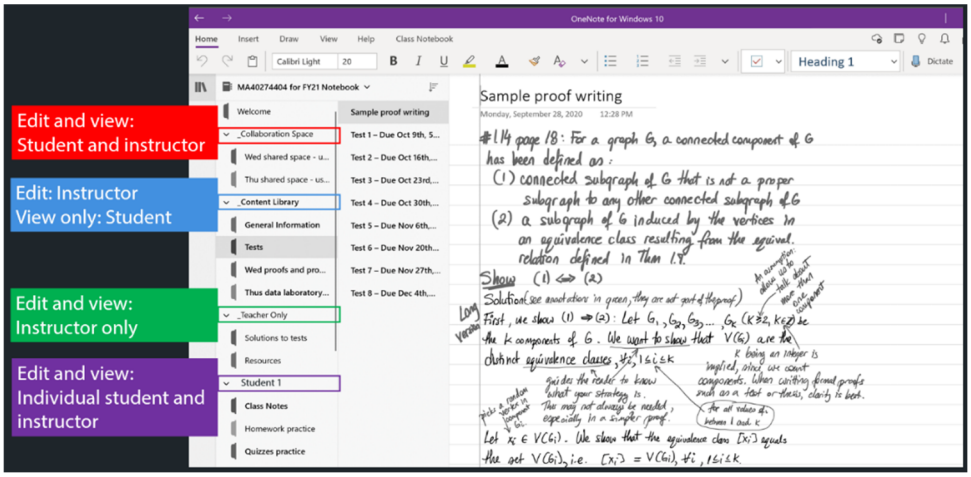
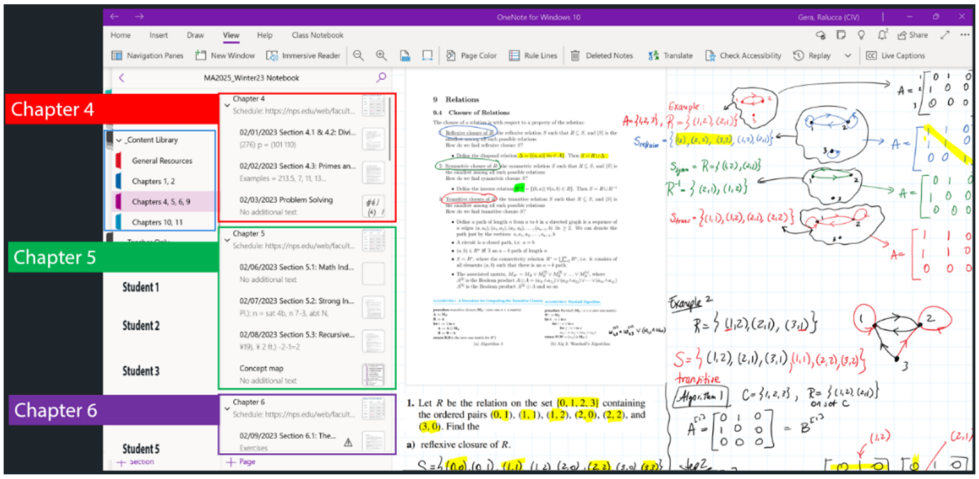


Figure 4 shows an example of organizing content within the "Content Library" using an organized strategy, displaying classroom notes, homework assignments, and practice materials in an orderly fashion.

Particularly, we show three successive chapters in corresponding order integrated with corresponding homework assignments and other relevant practice materials, promoting an organized learning strategy.

Figure 4. An example of organizing content within the "Content Library", displaying classroom notes by chapter.



5. Conclusions

The integration of technology into traditional classroom settings has become increasingly prominent in recent years since technology has the potential to optimize the organization of multiple resources while supporting a variety of instructional methods to support effective and efficient learning. In this research paper, we present methods that aim to support flexible and meaningful learning by offering diverse and accessible opportunities for students to interact with the faculty, peers, and content. Meeting students where they are, rather than expecting their adaptation to distinct faculty engagement styles, creates a learner-centered environment that is central to ensuring student success.

The main goal behind the proposed strategic design of the digital space and digital annotation is to empower students to take ownership of their learning experiences in a student-centric learning environment. We achieve this by focusing on creating choices for learning experiences by thoughtfully curating a course setup that unlocks opportunities for optimized learning. This organization is supported by the utilization of digital notetaking and annotation tools for instruction, homework, and collaboration, promoting organized and efficient spaces for students, and ultimately enhancing academic performance.

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