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The 2021-22 Multimodal Learning Framework

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About this report

The 2021-22 Multimodal Learning Framework is an Economist Impact report, sponsored by Microsoft Education, that provides faculty educators with insights for how to successfully implement longer-term multimodal learning approaches and address critical progress and learning equity gaps identified in previous reports.

By leveraging compelling insights from faculty and student surveys, expert interviews and desk research, this report provides a playbook of best practices to support educators' use of multimodal learning to achieve a range of outcomes. These outcomes include reaching broader and more diverse student bases; integrating learning with technology-enabled platforms; motivating students to compose ideas in different modes and encouraging deeper connections to learning concepts; offering students the opportunity to participate in a range of cognitive and social learning activities that are responsive to their needs; and setting a platform for faculty educators to shift their emphasis from the delivery of instruction to the engagement of their learners.

We would like to thank the following experts for their time and insights:

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Dr Douglas Harris, Professor and Department Chair of Economics, Tulane University

Michael Horn, author and co-founder at the Clayton Christensen Institute for Disruptive Innovation

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Executive summary

Learners are becoming more diverse in race, linguistic background and age, and the amount of women in higher education has surpassed men.¹ The changing needs and demographics of these students call for education providers to expand their ideas of how, where, under what conditions and with which tools people learn through multimodal teaching and learning. Defined as “learning environments [that] allow instructional elements to be presented in more than one sensory mode (visual, aural, written)”², multimodal learning (MML) builds upon a technology-rich world of digital tools and networks to customise and adjust learning strategies.³ It expands the range of choices available to students, enabling them to co-construct their learning using both familiar modes and newer, more challenging ones, leading to deeper learning experiences.

New hardware, collaboration tools, learning and meeting software and data analytics are creating opportunities for MML in ways that were not previously possible. MML and technology-enabled online instruction are two sides of the same coin—they allow education providers to

expand and diversify their student bases, and ultimately to provide more equitable access to education by responding more effectively to accessibility needs or by offering otherwise unaffordable opportunities. New technologies can also automate the incorporation of MML material, taking the burden off of instructors to integrate MML from scratch. This helps to set the stage for more engaging, rich and creative learning experiences.

Against this backdrop, this Economist Impact (formerly EIU) report provides faculty educators with a “2021-22 Multimodal Learning Framework” informed by expert interviews, academic literature and a survey of educators and students. The framework will show how to successfully implement longer-term MML approaches (evolving from the near-term hybrid “emergency response mode” or “pandemic experiment” to a future operating model). It will also address the critical progress gaps that still need to be bridged according to key takeaways from two previous EIU reports.^{4,5}

¹ NMDU. “5 Changing Demographics in Higher Education: Infographic.” NDMU Online. Notre Dame of Maryland University, July 5, 2018. <https://online.ndm.edu/news/education/changing-demographics-in-higher-education/>

² Sankey, M., D. Birch and M. Gardiner. “Engaging students through multimodal learning environments: The journey continues”, in C.H. Steel, M.J. Keppell, P. Gerbic and S. Housego (eds.), *Curriculum, technology & transformation for an unknown future*. Proceedings Ascilite Sydney (2010).

³ Ryoo, Jungwoo and Kurt Winkelmann. “Innovative Learning Environments in STEM Higher Education: Opportunities, Challenges, and Looking Forward”, *SpringerBriefs in Statistics* (2021).

⁴ Bray, Marianne. “Bridging the Digital Divide to Engage Students in Higher Education”, The Economist Intelligence Unit (2020).

⁵ Bray, Marianne. “Flattening the Multimodal Learning Curve: A Faculty Playbook”, The Economist Intelligence Unit (2020).

Introduction

Current state of multimodal learning

Covid-19 forced the closure of university classrooms globally and accelerated the transformation of higher education. It changed the ways in which students learn and connect with their teachers and peers, thrusting most classes online in 2020 and into new forms of hybrid learning in 2021. Indeed, the majority (85%) of faculty respondents to an EIU survey said that the pandemic had accelerated the future of the virtual education revolution by a decade. Experts

see multimodal learning (MML) as one of a raft of approaches forming the blueprint for innovative learning experiences that seek richer, deeper and more expansive education in the long term.⁶

Although experts have not yet reached a definitive consensus on MML, they agree that it represents a shift away from traditional, writing-based education⁷ and towards a diversification of accessible forms of knowledge sharing and meaning-making.⁸

Experts see multimodal learning (MML) as one of a raft of approaches that form the blueprint for innovative learning experiences that seek richer, deeper and more expansive education in the long term.

For the purposes of this report, Economist Impact defines MML as teaching that includes four different “modes”: visual, auditory, reading/writing and kinaesthetic.⁹ It is important to note that experts’ understanding of MML rejects the “myth of learning styles”, or the idea that some students are inherently “visual” or “auditory” learners. Academic consensus has debunked this theory and the notion that student preferences should dictate modes of learning.¹⁰ Experts such as Rebecca Frost Davis, associate vice president for digital learning at St. Edward’s

⁶ Bouchey, Bettyjo, Jill Castek and John Thygeson. “Multimodal learning”, *Innovative Learning Environments in STEM Higher Education: Opportunities, Challenges, and Looking Forward* (2021): pp. 35-54.

⁷ Bezemer, Jeff and Gunther Kress. “Writing in multimodal texts: A social semiotic account of designs for learning”, *Written Communication*, Vol. 25, No. 2 (2008): pp. 166-195.

⁸ Literat, Ioana, Anna Conover, Elizabeth Herbert-Wasson, Karen Kirsch Page, Joseph Riina-Ferrie, Rachael Stephens, Sawaros Thanapornsanguth and Lalitha Vasudevan. “Toward multimodal inquiry: opportunities, challenges and implications of multimodality for research and scholarship”, *Higher Education Research & Development*, Vol. 3, No. 3 (2018).

⁹ Bouchey et al., 2021.

¹⁰ Philippe et al., 2020.

University in Austin, Texas, now conclude that students need to learn in a variety of different ways, and that the mode used should be driven by content. “The research is pretty clear that although we might have preferences for ‘modes’ of learning, it’s not the best way to do teaching and learning,” adds Michael Horn, author and co-founder at the Clayton Christensen Institute for Disruptive Innovation. “Content often naturally expresses itself through certain modes, and it’s best to let the content lead.”



Contemporary multimodal instruction can be done remotely or face-to-face and engages students through using different platforms, technologies and ways to communicate. Not all MML involves technology. For example, MML can include model making, Socratic seminars and text-based discussion. However, there is a strong connection between MML, technology and remote instruction. Technology enables MML across a myriad of settings and expands the modes available remotely, and can also be deployed in a variety of forms—such as immersive experiences and collaboration tools—to accommodate a variety of student experiences and support engagement and motivation.^{11,12}

Higher education is in the process of evolving into a more effective long-term MML model. Nearly two years after covid-19 first emerged, many faculty members have moved on from emergency response teaching¹³ (also known as emergency remote learning)¹⁴ and are planning for the future of post-pandemic teaching. This report will explore the potential of MML to improve education and elucidate a roadmap for success both in traditional classrooms and beyond, as higher education continues to adapt to the challenges (and opportunities) of our time.

“Content often naturally expresses itself through certain modes, and it’s best to let the content lead.”

Michael Horn, author and co-founder, the Clayton Christensen Institute for Disruptive Innovation

¹¹ “A Multimodal AR/VR Approach for Interactive, Immersive Learning”, zSpace, accessed December 3rd 2021.

¹² Philippe, Stéphanie, Alexis D. Souchet, Petros Lameris, Panagiotis Petridis, Julien Caporal, Gildas Coldeboeuf and Hadrien Duzan. “Multimodal teaching, learning and training in virtual reality: a review and case study”, *Virtual Reality & Intelligent Hardware*, Vol. 2, No. 5 (2020): pp. 421-442.

¹³ Kutaka-Kennedy, Joy. “COVID-19 and the Growth Mindset: Dangerous Opportunities”, in *Educational Recovery for PK-12 Education During and After a Pandemic*, IGI Global (2021): pp. 223-244.

¹⁴ Erlam, Gwen D., Nick Garrett, Norina Gasteiger, Kelvin Lau, Kath Hoare, Shivani Agarwal and Ailsa Haxell. “What Really Matters: Experiences of Emergency Remote Teaching in University Teaching and Learning During the COVID-19 Pandemic”, in *Frontiers in Education*, Frontiers (2021): pp. 397-410.

Examples of different modes

Visual

- Video
- Comics
- Captions
- Subtitles
- Digital presentations
- Flowcharts, diagrams, graphs
- Drawn art, models

**Auditory**

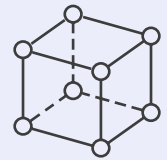
- Podcasts
- Lecturing
- Talking
- Discussions/seminars
- Reading
- Songs
- Speeches, musical projects

**Reading/Writing**

- Lecture notes/handouts
- Digital storytelling/publishing
- Comics
- Captions/subtitles
- Translating
- Textbook reading
- Questionnaire answering
- Note taking
- Worksheets
- List making

**Kinaesthetic**

- Field trips
- Manipulating objects
- Lab experiments
- Walking/moving to think about projects
- Model making
- Making visuals (concept maps, timelines, graphs)
- 3D worlds, mixed reality, augmented reality
- Music and dance
- Real-life examples and scenarios
- Internships



Enabling MML with technology



Multimodal technological tools can support the diverse needs of large student bodies,¹⁵ bringing together visual, auditory, reading/writing and kinaesthetic elements to embed students in interactive learning environments where they feel connected with each other and the educational content.¹⁶ These tools represent a powerful natural evolution in the pandemic-accelerated shift towards long-term remote and hybrid learning, and current peer-reviewed literature offers many examples of effective MML technologies that benefit the higher-education classroom. These include affordable, commonplace MML technologies such as shared surfaces for the projection of digital artefacts that students interact with together; portable devices such as tablets used for playing and manipulating audio and video; and online social groups to share information collaboratively.¹⁷ Game-based learning environments may hold particular potential. Empirical evidence shows that, when using games, students have higher learning gains relative to more traditional learning environments, and suggests that they can be used to enhance domain-specific knowledge and improve skill acquisition.¹⁸

¹⁵ Qusheim, Umar Bin, Athanasios Christopoulos, Solomon Sunday Oyelere, Hiroaki Ogata and Mikko-Jussi Laakso. "Multimodal Technologies in Precision Education: Providing New Opportunities or Adding More Challenges?", *Education Sciences*, Vol. 11, No. 7 (2021): pp. 338-356.

¹⁶ "A Multimodal AR/VR Approach for Interactive, Immersive Learning", zSpace, accessed December 3rd 2021.

¹⁷ Ioannou, Andri, Christina Vasiliou and Panayiotis Zaphiris. "Problem-based learning in multimodal learning environments: Learners' technology adoption experiences", *Journal of Educational Computing Research*, Vol. 54, No. 7 (2016): pp. 1022-1040.

¹⁸ Emerson, Andrew, Elizabeth B. Cloude, Roger Azevedo and James Lester. "Multimodal learning analytics for game-based learning", *British Journal of Educational Technology*, Vol. 51, No. 5 (2020): pp. 1505-1526.

Some proponents of game-based learning argue that this allows students to experience deeper, more immersive learning.¹⁹ Other multimodal technological tools include immersive technologies such as virtual reality and educational applications offering assessment- and feedback-based learning opportunities.²⁰ These tools can enable students to immerse themselves in virtual content based on real-world events—such as a political rally, a refugee crisis, a global management meeting or even a simulated surgery.²¹

Online multimodal tools allow students to collaborate with each other in real time and engage with work in team-based learning environments that encompass both remote and in-person instruction. For example, computer-supported collaborative writing can serve as “a means to deepen students’ engagement with ideas and the literature and for knowledge building by jointly developing a text”.²² It is a cognitive, organisationally demanding process.²³

Proponents of game-based learning argue that this allows students to experience deeper, more immersive learning.



¹⁹ Qushem et al., 2021.

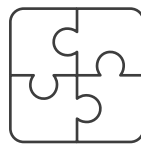
²⁰ Qushem et al., 2021.

²¹ “A Multimodal AR/VR Approach for Interactive, Immersive Learning”, zSpace, accessed December 3rd 2021.

²² Calvo, Rafael A., Stephen T. O'Rourke, Janet Jones, Kalina Yacef and Peter Reimann. “Collaborative writing support tools on the cloud”, *IEEE Transactions on Learning Technologies*, Vol. 4, No. 1 (2011): pp. 88-97.

²³ Calvo et al., 2011.

Benefits of MML



Effective learning: In line with cognitive and neuroscience research showing that MML has many benefits,²⁴ studies indicate that students are more comfortable and find it easier to learn with multiple modes.²⁵ Many students learn more deeply from a combination of representations (text, video, audio, images) than from words alone, known as the “multimedia effect”.²⁶



Flexible learning: MML goes hand-in-hand with students seeking flexible and active learning. In the EIU survey, nearly one-third of students said that flexible learning and interactive tools were the most effective ways to boost their engagement – and that they wanted to interact with the material irrespective of whether they were attending classes in-person or online. As early as 2004, studies showed that this kind of multimodality encouraged student versatility.²⁷ Faculty members can use multiple approaches, including face-to-face methods and online technologies, to cater to a wide spectrum of students.²⁸

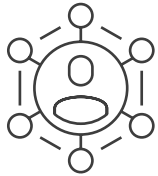
²⁴ Ward, Nathan, E. Paul, P. Watson, G.E. Cooke, C.H. Hillman, Neal J. Cohen, Arthur F. Kramer and Aron K. Barbey. “Enhanced learning through multimodal training: evidence from a comprehensive cognitive, physical fitness, and neuroscience intervention”, *Scientific Reports*, Vol. 7, No. 1 (2017): pp. 1-8.

²⁵ Sankey et al., 2010.

²⁶ Mayer, Richard E. “The promise of multimedia learning: using the same instructional design methods across different media”, *Learning and Instruction*, Vol. 13, No. 2 (2003): pp. 125-139.

²⁷ Hazari, S. “Applying instructional design theories to improve efficacy of technology-assisted presentations”, *Journal of Instruction Delivery Systems*, Vol. 18, No. 2 (2004): pp. 24-33.

²⁸ Picciano, Anthony G. “Blending with purpose: The multimodal model”, *Journal of the Research Center for Educational Technology*, Vol. 5, No. 1 (2009): pp. 4-14.



Increased inclusion: MML enables faculty members to reach more diverse student bodies,^{29,30} because it equips them with more tools to tailor learning to meet a variety of needs. Multimodal technology can facilitate a more personalised and inclusive relationship between students and faculty, as when devices are brought into the classroom and introduced into pedagogy, “teachers and students can do more things together and have more layers of interaction,” says Dr Davis.



Active knowledge producers: A 2019 report showed how students at Stockholm University in Sweden were already using multimodal tools pre-pandemic to become active knowledge producers (rather than passive learners) during self-study.³¹ Students who actively generate their own knowledge (by becoming “co-producers” of knowledge through the projects or research they undertake)^{32,33} are more likely to make meaning of their courses and have a richer learning experience.³⁴ The computer and systems science students in the study were most likely to write digital texts to summarise lectures, followed closely by taking pictures to understand course content. The study highlighted how much students had moved beyond print text in their studies and were using multiple modes to become active designers of meaning and learning.



²⁹ Picciano, 2009.

³⁰ Picciano, 2009.

³¹ Nouri, Jalal. “Students multimodal literacy and design of learning during self-studies in higher education”, *Technology, Knowledge and Learning*, Vol. 24, No. 4 (2019): pp. 683-698.

³² Kalantzis, Mary and Bill Cope. “e-Learning Ecologies: Affordance 2, Active Knowledge Making”, *Works & Days* – Kalantzis and Cope, n.d. <https://newlearningonline.com/e-learning/affordance-2-active-knowledge-making>

³³ Kotzé, Theuns G. and P.J. du Plessis. “Students as ‘co-producers’ of education: a proposed model of student socialisation and participation at tertiary institutions”, *Quality Assurance in Education*, Vol. 11, No. 4 (2003): pp. 186-201.

³⁴ Kotzé and du Plessis, 2003.



UDL and MML work together

Universal Design for Learning (UDL) is a contemporary learning framework used to accommodate the needs of a diverse student body. It can be used as a building block for effective MML³⁵ and vice versa.³⁶ It focuses on three principles: multiple means of representing information, expressing knowledge and engaging in learning.³⁷ The UDL framework works by prioritising the accessibility of learning for students. A 2015 study showed that for students with disabilities, UDL lowered barriers to learning by presenting information in multiple formats and using diverse assessment strategies.³⁸ An earlier study

showed that 92% of faculty members surveyed thought that they could better meet the needs of students with disabilities when using a multimodal curriculum.³⁹

The framework's "universality" means that it caters to the widest possible range of learners. Putting captions on videos, for example, helps people with hearing loss, second-language learners or those studying in noisy environments. A 2011 report showed that after teachers underwent UDL training, students improved their learning because instructors presented concepts in multiple ways and offered materials in a variety of formats.⁴⁰

After teachers underwent UDL training, students improved their learning because instructors presented concepts in multiple ways and offered materials in a variety of formats.

³⁵ Izzo, Margaretha Vreeburg, Alexa Murray and Jeanne Novak. "The Faculty Perspective on Universal Design for Learning", *Journal of Postsecondary Education and Disability*, Vol. 21, No. 2 (2008): pp. 60-72.

³⁶ Bouchey et al., 2021.

³⁷ Rose, David H., Wendy S. Harbour, Catherine Sam Johnston, Samantha G. Daley and Linda Abarbanell, "Universal design for learning in postsecondary education: Reflections on principles and their application", *Journal of Postsecondary Education and Disability*, Vol. 19, No. 2 (2006): pp. 135-151.

³⁸ Black, Robert D., Lois A. Weinberg and Martin G. Brodwin. "Universal design for learning and instruction: Perspectives of students with disabilities in higher education", *Exceptionality Education International*, Vol. 25, No. 2 (2015): pp. 1-26.

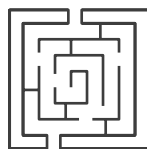
³⁹ Izzo et al., 2008.

⁴⁰ Schelly, Catherine L., Patricia L. Davies and Craig L. Spooner. "Student perceptions of faculty implementation of Universal Design for Learning", *Journal of Postsecondary Education and Disability*, Vol. 24, No. 1 (2011): pp. 17-30.

Challenges in MML adaptation



Despite the obvious benefits of boosting flexibility, agency and interaction for students and enabling educators to cater to a wider set of needs, there are difficulties in adapting to MML. These challenges revolve around how best to design courses using MML tools, as well as considerations around remote courses.



Course design: A key challenge lies in MML course design. Experts such as Mr Horn cite the importance of avoiding layering multimodal experiences all at once just for the purpose of “doing MML”, as this could become overwhelming.⁴¹ “Sometimes there’s the instinct to have words, images, voice-overs, and it overloads the brain, overloads working memory and detracts from the learning experience,” he warns.



Remote learning challenges: Perhaps the largest set of challenges lies in effectively adapting and using MML online. Research shows that remote learning naturally complements MML, as MML pairs well with technology and has grown particularly relevant as increases in tech tools and multimedia software allow faculty members to present, represent and respond to information in different modes.⁴² Yet it also raises significant problems of student engagement.⁴³

⁴¹ Moreno, Roxana and Richard Mayer. “Interactive multimodal learning environments”, *Educational Psychology Review*, Vol. 19, No. 3 (2007): pp. 309-326.

⁴² Bouchey et al., 2021.

⁴³ Bouchey et al., 2021.



Students in the EIU survey cited their biggest concern with remote learning as remaining focused and engaged in online classes and achieving optimal grades. Access was also an issue: 29% of surveyed students lacked access to technology such as laptops and high-speed internet. Institutions are setting students up to fail if they cannot properly access or complete remote education, says Susan Bowles Therriault, Managing Researcher, American Institutes for Research. Many students reported that they found online courses more difficult and time-consuming than face-to-face classes. Some 30% of surveyed students cited adapting to new learning approaches—such as interactive virtual games—as a key driver behind an increase in the amount of time and effort they spent on their coursework. Institutions need to match up desired multimodal experiences with affordable, accessible models that will work successfully for large cohorts of students.

Remote-only MML is difficult because the lack of face-to-face communication can trigger feelings of isolation and miscommunication,⁴⁴

and instructors need to work to engage students, who struggled to remain focused and engaged during the pandemic. Half of the educators surveyed by the EIU reported that students were less engaged since the covid-19 outbreak, while 70% said they were worried about delivering valuable learning experiences. More study is needed to see which remote multimodal tools—such as games and simulations—are effective, rather than just entertaining, and can keep students from tuning out.⁴⁵

Previous EIU reports in this series also identified major practice gaps as faculty members “transitioned” their teaching online.^{46,47} Some of the biggest gaps centred around educators’ attempts merely to recreate their physical teaching approaches online and finding that their traditional classes did not translate directly to a digital environment. Owing to the pandemic’s quick escalation, educators did not have the time or resources to redesign courses to maximise the technologies available; many scrambled to upload text- and lecture-based modules online at short notice.

⁴⁴ Bouchey et al., 2021.

⁴⁵ Moreno and Mayer, 2007.

⁴⁶ Bray, “Bridging the Digital Divide”, 2020.

⁴⁷ Bray, “Flattening the Multimodal Learning Curve”, 2020.



Equity and access: Emergency models and educational shifts implemented during covid-19 exacerbated existing issues⁴⁸ in marginalised communities, such as lack of access to expensive technologies and lack of extra time to adapt to new learning methods. These issues need to be examined when moving towards a longer-term model.^{49,50} Many assumptions made during the pandemic—such as those around students being able to access the internet at home—simply are not true and will not hold up in the long term, says Mr Horn. People may live in areas with a lack of access to devices and reliable internet, known as “digital deserts”, or may not have sufficient digital literacy to interact effectively with new technology.⁵¹ A 2020 survey of US undergraduates revealed that challenges with internet connectivity, digital devices and communicating with professors and teaching assistants were all associated with a lower remote learning proficiency, and students experiencing greater financial hardship struggled disproportionately with remote learning.⁵²

When educators focus on equity, students are more able to engage, participate, collaborate and feel part of the community, and they perform better; this focus is a clear impetus.

Although the experts the EIU spoke to all offered different views of equity and accessibility, their ideas centred around putting in place systems, structures and resources that allow students to access and master content and choose career paths, while simultaneously taking heed of

their different needs and backgrounds. “Equity is not every student getting the same level of intervention, but [ensuring] they’re getting the right level [of intervention] for them to make progress regardless of their background characteristics,” says Mr Horn; accessibility was seen by Dr Therriault as the ability to “access [the desired] information, content, opportunity” while acknowledging that information’s specific relationships to “systems, structures and resources” impacts its availability. A 2017 study showed that when educators focus on equity, students are more able to engage, participate, collaborate and feel part of the community, and they perform better; this focus is a clear impetus.⁵³

Remote MML can disenfranchise students outside the school walls, creating a dichotomy as personal circumstances at home vary, says Douglas Harris, professor and department chair of economics at Tulane University in New Orleans, Louisiana. “People who are at home are less likely to have internet access and more likely to have smaller and louder spaces and [...] other people to care for in the house. That makes it more difficult for them to learn,” he says. Students who are academically behind struggle with asynchronous remote activities that require prior knowledge and motivation. “It’s not enough to get people the bandwidth and devices. You also have to teach them how to use [them],” adds Dr Davis.

In addition, integrating different modes of learning can work adversely if there are issues of resource inequity, says Dr Harris. Not all institutions can afford more resources and licences.

⁴⁸ Beaunoyer, Elisabeth, Sophie Dupéré, and Matthieu J. Guittou. “COVID-19 and digital inequalities: Reciprocal impacts and mitigation strategies”, *Computers in Human Behavior*, Vol. 111 (2020): Art. 106424.

⁴⁹ Goldberg, Suzanne B. “Education in a Pandemic: The Disparate Impacts of COVID-19 on America’s Students”, US Department of Education (2021).

⁵⁰ Girard, Inès, Fiona Vanston and Elodie Faïd. “Covid-19 and Technical Difficulties: The Rise of Inequalities in Higher Education”, Right to Education Initiative (2021).

⁵¹ Girard et al., 2021.

⁵² Katz, Vikki S., Amy B. Jordan and Katherine Ognyanova. “Digital inequality, faculty communication, and remote learning experiences during the COVID-19 pandemic: A survey of US undergraduates”, *PLoS One*, Vol. 16, No. 2 (2021): e0246641.

⁵³ Phuong, Andrew Estrada, Judy Nguyen and Dena Marie. “Evaluating an Adaptive Equity-Oriented Pedagogy: A Study of Its Impacts in Higher Education”, *The Journal of Effective Teaching*, Vol. 17, No. 2 (2017): pp. 5-44.

Best practices

Engage in a thoughtful transition focused on local equity

Equity and access considerations are at the heart of a thoughtful transition. Institutions and educators must understand the local demographics of students, and should work with local community groups and organisations to identify their needs. Elizabeth J. Stroble, chancellor of Webster University, a global university headquartered in St. Louis, Missouri, cites the example of an organisation such as the Urban League of Metropolitan St. Louis as an important partner for institutions in the area. Community organisations are well-placed to identify local talent and help institutions understand what programmes and resources individual incoming students might need.

“If an institution is looking to participate in multimodal learning, [it should] have a screener for students to understand what they might need, their challenges and provide accommodations accordingly,” says Dr Therriault.

Lessons learned from experts and literature⁵⁴ show other priority areas that faculty members and institutions should focus on during the coming transition. Research shows that MML works well when it complements hybrid classes,⁵⁵ and both teacher and students learn and are supported in all modes.⁵⁶ This requires the setting out of “clear learning objectives” before exploring ways to communicate these goals, according to Dr Therriault. Thus, future MML models are likely to take the form of mixed synchronous and asynchronous learning, incorporating lessons learned during the pandemic’s “emergency” phase back into the classroom to increase teacher presence. Teachers might ask students to review and prepare materials remotely before class, while meeting in-person less frequently.

Community organisations are well-placed to identify local talent and help institutions understand what programmes and resources individual incoming students might need.

⁵⁴ Picciano, 2009.

⁵⁵ Finegan, Juliana. “5 Keys to Success in Hybrid Learning”, Edutopia, George Lucas Educational Foundation, May 12th 2021. <https://www.edutopia.org/article/5-keys-success-hybrid-learning>

⁵⁶ Goodling, Lauri Bohanan. “The multimodal turn in higher education: On teaching, assessing, valuing multiliteracies”, *Pedagogy*, Vol. 14, No. 3 (2014): pp. 561-568.

When class does meet, the teachers can use activities that form connections across different elements of the curriculum, suggests Dr Harris.

Experts agree that the MML transition should be pursued with an intentional pedagogical approach, rather than by default. Instructors should let outcomes drive their lesson design and which modes they use, spending time on determining what mastery in each outcome

looks like and all the different ways to achieve it. They can then experiment with different modes as students become more experienced.⁵⁷ “As your students start to progress towards becoming expert learners, you can facilitate more interaction and a variety of modalities with unpredictable twists,” says Mr Horn.

CASE STUDY: Community colleges as a blueprint

Community and other non-traditional colleges in the United States serve as examples for effective longer-term MML adaptation, as they strive to be hubs of social equity and economic mobility. These colleges have a history of creating personalised open-access approaches to serve a range of student needs in local settings and are experienced in catering to students experiencing precarity. Students at these colleges are some of the most diverse and vulnerable in higher education—made up of returning adults, first-generation students, returning veterans and students of colour—and they form a sizeable proportion (46%) of all undergraduates in the country, according to a 2018 report.⁵⁸

Underscoring this precarity, just under half (44%) of low-income students in America attend community colleges when they are first out of high school, and two-thirds are working. A majority (59%) are enrolled on a part-time basis, juggling a complex mix of work, studies, families, finance and even homelessness.⁵⁹ Covid-19 has exacerbated such gaps.⁶⁰

To address these constraints, teachers such as Anne McGrail, a professor at Lane Community College in Eugene, Oregon, combined a move online with adapting micro-tasked MML tools including fieldwork, writing policy papers and posting to online forums into short, flexible modules, ensuring that students’ prior learning and experience were taken into consideration as they engaged with contemporary technological tools.⁶¹ Research shows that community colleges are more capable of offering remote learning as a viable substitute than branded private universities, whose students are more likely to reject such options.⁶² In 2020 Southwest Tennessee Community College in Memphis, Tennessee bought 3,500 laptops for its students to keep them online.⁶³

⁵⁷ Moreno and Mayer, 2007.

⁵⁸ McGrail, Anne B. “The ‘Whole Game’: Digital Humanities at Community Colleges”, in Matthew K. Gold and Lauren F. Klein (eds), *Debates in the Digital Humanities*, University of Minnesota Press, Minneapolis (2016): pp. 16-31.

⁵⁹ McGrail, 2016.

⁶⁰ Saul, Stephanie. “The Pandemic Hit the Working Class Hard. The Colleges That Serve Them Are Hurting, Too”, *The New York Times* (2021), April 2nd 2021, rev. June 2nd 2021.

⁶¹ McGrail, 2016.

⁶² Felson, Jacob and Amy Adamczyk. “Examining the decision to offer in-person college instruction during the COVID-19 era: A multilevel analysis of the factors that affected intentions to open”, *medRxiv* (2020).

⁶³ “Southwest Tennessee Community College Bridges the Digital Divide”, *cityCURRENT* (2020).

Train faculty members and work as a team to get up to speed

The academic world has long relied on text-based education, and MML makes teaching more complex. Faculty members—especially legacy faculty—will need to be trained to become multimodal-literate alongside their digital-native students as newer, effective practices are adopted.⁶⁴ Dr Therriault suggests starting small, with a department or a school within a university, depending on the institution’s resources.

Experts agree that, at institutions where teaching is not prioritised, faculty members are likely to resist change because it distracts from their research. To have success with MML, teaching needs to be at the core of faculty responsibilities and course evaluations. “Institutions that have been successful have decided that teaching is a centrepiece of their work,” says Dr Therriault.

CASE STUDY: Adaptable instruction, adaptable assessment

Traditional methods of assessment may need to change along with instruction. Western Governors University, an online college based in Utah, provides a good example of how teams can work together in a competency-based learning model. The university measures the skills and progress of its students, rather than the time they spend in a traditional cohort-based class. Students progress through courses once they have mastered the material, instead of waiting until the semester ends. If students learn faster, have more time or have prior work or school experience, they can accelerate through their course. This move towards competency or mastery-based learning combined with MML is part of a wider trend in higher education, allowing students to move away from credit hours and direct their own learning. When combined with micro-credits and stackable degrees, students have flexibility not only in the multimodal tools they use, but in their settings and location of in-person study.

In order to make this effective, Western has content experts who work with learning designers to create the courses. This type of collaboration all the university to focus on how to improve its teaching, says Mr Horn. Course mentors shepherd students through their course according to a set of objectives, providing personalised one-on-one support. An entire separate faculty’s sole job is to be experts in the science of assessment, allowing them to offer a more individual or tailored form of evaluation. This separate, evaluative faculty “is trained in the science of assessment [and] they are unbiased about the students... this allows them to create a really robust system to verify mastery,” says Mr Horn. One example: a student studying a masters of nurse leadership programme who is assessed on her context-based work at training new leaders in the local hospital.

⁶⁴ Cope, Bill and Mary Kalantzis. ““Multiliteracies”: New literacies, new learning”, *Pedagogies: An International Journal*, Vol. 4, No. 3 (2009): pp. 164-195.

Define a clear institutional path forward

Management should focus on faculty and student development to define a clear path forward, as leaders cannot rely on covid crisis management, says Dr Davis. Faculty members are not trained to identify the best mode for a particular purpose or teaching style and, as a result, institutions are obligated to help them to think about this effectively, says Dr Harris. Institutions should also think about setting up ethical frameworks for the use of immersive technology in a multimodal world, and getting external validations of learning credentials.⁶⁵

Success in this adaptation might look like a more tailored form of education with clear objectives paired with more objective assessment, according to Mr Horn, and institutions will need to look at how to improve instruction through a feedback loop from students. “Student voice and student choice about the ways in which they like to learn have been raised and elevated during pandemic times and that truly will not go away,” says Dr Stroble.



⁶⁵ Bouchey et al., 2021



Invest in remote learning

Some 75% of instructors surveyed by the EIU expected most future courses to become a mix of in-person and online offerings, reflecting a new operating model of remote and hybrid learning alongside on-campus programmes, a view echoed by experts. “Changes to the multimodal learning experience of students in five to ten years from now will be intimately entwined in hybridised delivery,” says David Conrad Kellermann, senior lecturer, School of Mechanical and Manufacturing Engineering, University of New South Wales. Faculty members agreed that, to deliver successful digital learning, institutions would need to use emerging technologies and develop more agile and flexible strategies. As part of a long-term strategy, institutions will need to work out the best technology to support MML, including equipping active learning spaces for creating and discovering—especially as coursework could become full-scale, immersive and 24/7, with opportunities for dialogue and deep learning.⁶⁶ “It is the challenge for the modern university to automate the provisioning of much more structured and complete digital classrooms. Places for people to create in, not for content to

be consumed,” says Dr Kellermann. “The next ten years will be more about inventing the digital campus: a place where research, enterprise, collaboration and friendship take place.”

In order to construct an effective remote MML education, experts suggest that guidelines and structures are put in place as part of a systemic approach implemented consistently across classes. “I haven’t seen this done consistently well anywhere; expectations are so different from class to class,” says Dr Therriault.

Multimodal remote learning requires prior knowledge and motivation to engage with asynchronous remote activities, says Dr Harris. A large majority (90.5%) of faculty members in the EIU survey said that investing in staff training is essential to deliver effective virtual learning experiences. This is particularly important as faculty members may find it hard to switch between modes in a live class.⁶⁷ Equipping them with digital training and the tools necessary to understand how to use remote environments is a top priority.

⁶⁶ Bouchey et al., 2021

⁶⁷ Bouchey et al., 2021

Embrace the potential of data, analytics and emerging technologies

Multimodal data and analytics are powerful tools that can be leveraged to understand student experiences and personalise learning at scale. These tools collect data on learners' characteristics, behaviour, interactions and performance, allowing instructors to integrate tailored tasks responsive to students' needs and competencies (Qushem et al., 2021). Data and analytics have been used, for example, to:

- analyse students' acceptance of a mobile augmented reality (AR) system in science education (Arvanitis et al., 2011);
- examine dialogue, task actions, facial movements and gestures of students in digital tutoring environments and predict their engagement, frustration and learning gains (Grafsgaard et al., 2014);
- capture data on eye tracking and clickstream produced during student interaction with games to understand skill acquisition (Giannakos et al., 2019); and
- enable multimodal sensors to better understand and improve student learning in complex environments (Worsley, 2014).

However, ethical issues regarding the use of MML data remain largely unaddressed and cast a long shadow over ongoing research: issues such as privacy, participant consent, the use of human data (such as eye tracking) and data management should be addressed in future literature, and risk management strategies for institutions are essential.^{68,69}

Immersive experiences, digital platforms and collaborative tools can be used to create more adaptive educational experiences that are responsive to the diverse learning needs of students. They can also offer experiential opportunities that are hard to find "in real life";⁷⁰ developing work-based skills and contributing to future professional success. One study of university students found significant increases in self-regulated learning and self-efficacy among those who used an e-book reading system that provided individualised and on-demand multimedia materials.⁷¹ Another study on immersive technologies found that university students with almost no experience of using "virtual worlds" had deep and meaningful learning interactions with the technology, if offered orientation processes.⁷² Emerging technology can even help instructors to respond to issues of student engagement and motivation in real time: one promising study developed a multimodal system to detect students' engagement and provide feedback to teachers, who could then implement personalised interventions.⁷³

⁶⁸ Alwahaby, Haifa, Mutlu Cukurova, Zacharoula Papamitsiou and Michail Giannakos. "The evidence of impact and ethical considerations of multimodal learning analytics: a systematic literature review" (2021).

⁶⁹ Martinez-Maldonado, Roberto, Judy Kay, Simon Buckingham Shum and Kalina Yacef. "Collocated collaboration analytics: Principles and dilemmas for mining multimodal interaction data", *Human-Computer Interaction*, Vol. 34, No. 1 (2019): pp. 1-50.

⁷⁰ Bouchey et al., 2021.

⁷¹ Chen, Cheng-Huan and Chien-Yuan Su. "Using the BookRoll e-book system to promote self-regulated learning, self-efficacy and academic achievement for university students", *Journal of Educational Technology & Society*, Vol. 22, No. 4 (2019): pp. 33-46.

⁷² Christopoulos, Athanasios, Marc Conrad and Mitul Shukla. "Increasing student engagement through virtual interactions: How?", *Virtual Reality*, Vol. 22, No. 4 (2018): pp. 353-369.

⁷³ Aslan, Sinem, Nese Alyuz, Cagri Tanriover, Sinem E. Mete, Eda Okur, Sidney K. D'Mello and Asli Arslan Esme. "Investigating the impact of a real-time, multimodal student engagement analytics technology in authentic classrooms", in *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (2019): pp. 1-12.

Use the flexibility of remote MML to provide more options for students

Well-implemented multimodal remote learning can give students access to opportunities they would otherwise lack—for example, a virtual lab that the school cannot fund physically, or using video for acquiring or representing knowledge.⁷⁴ Furthermore, MML offers new opportunities for learners navigating impairments or disabilities, says Dr Kellermann. Basic challenges like those faced by a dyslexic student, for example, requiring a diagnosis, letter, application, and then provision of a reader for a paper-based exam, will be replaced by seamless and destigmatised experiences, such as being able to launch an immersive digital

reading tool for any digital content throughout an assessment (with no diagnosis or labelling required), he says. These equity and access opportunities should be identified and pursued as future learning strategies are developed.

This kind of accessibility can encompass those who cannot take classes during the day, or who cannot be on campus: for example, workers, carers and parents of young children. “Higher education has had invisible walls to everyone but the fit, healthy, unencumbered youth, and these walls will soon be gone,” says Dr Kellermann.



Well-implemented multimodal remote learning can give students access to opportunities they would otherwise lack.

⁷⁴ Nouri, 2019.

⁷⁵ Anne B. McGrail, “The ‘Whole Game’: Digital Humanities at Community Colleges”, 2016.

Conclusion



MML, when paired with remote or hybrid learning and immersive, analytical and interactive tools, has the potential to offer students from many backgrounds an education that engages all their senses and allows them to choose how, when and where to study and learn. MML also allows educators to address gaps exacerbated by the pandemic, such as equity, access and engagement, as well as to meet a growing range of educational needs from students.

In order to pivot successfully towards a long-term operational framework focusing on flexible and innovative learning experiences, higher education needs to focus its MML strategy on outcomes, team building, and adaptability in both instruction and assessment, and on using analytical and emerging tools to personalise learning at scale. Finally, institutions need to prepare for how the digitisation of multiple elements of delivery will affect the experience of all students, whether remote or on campus. “The pervasive augmentation of digital to physical modalities will not just impact learning content, but also students’ experience and the [creation] of the digital twin of the campus itself,” says Dr Kellermann.

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