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SHORT COMMUNICATION

The Metaverse—An Alternative Education Space

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Abstract

The Metaverse is a 3D virtual environment already populated by our students. In the form of avatars, their unique personas happily collaborate in spaces such as Roblox and Minecraft. After two years of being fully online, remote learning became associated with fatigue from business-model video conferencing tools such as Zoom, Microsoft Teams, and Google Meet. It is time to consider the adoption of customizable Metaverse platforms where educators and their students can safely teach and learn again in the same space. This paper examines contagion theory to frame the breakdown of our classroom environment during the Covid-19 Pandemic and the transition back to a mosaic of hybrid contexts. This paper delineates the merits of the Metaverse as an alternative education space that fosters Universal Design for learning. Additionally, this paper reviews platforms that support multiple entry points for engagement, representation, action, and expression.

Keywords: metaverse, skeuomorphism, Universal Design for Learning, motivation, volition

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1. Introduction

During the worldwide abrupt pivot to online teaching and learning in March of 2020, students, parents, teachers, and administrators reluctantly jumped into a "safety net" of online teaching and learning mandated by a society in lockdown. The viral *contagion* at hand, Covid-19, caused global morbidity and mortality [1, 2] to those in proximity with infected individuals. The Latin root of the word contagion hails from *contagio* meaning "from touch." Touching and breathing *in the same physical space* as others became deadly, necessitating a worldwide quarantine. The education community scrambled to enact video-based platforms such as Zoom, Microsoft Teams, and Google Meet to retrofit the classroom into a business-meeting paradigm for students and teachers sequestered at home. The default to solely online content delivery sought to substitute, but could never replace, the collaborative teaching and learning embraced by educators with their students.

According to the Pew Research Organization [3], the United States public is divided regarding closure of K—12 schools for face-to-face learning. When the return to live-distanced learning occurred at various timeframes across the United States, administrators, teachers, and school staff resorted to a dizzying puzzle of measures including face masks, desk shields, and staggered in-person schedules to meet physical distance, health, and safety recommendations [4].

In their timely book regarding the Psychiatry of Pandemics, Duan *et al.* (2019) shed light on much of what society observed during the Covid-19 pandemic. Duan and colleagues (2019) explain that *contagion theory* is a collective behavior that delineates how a crowd can have an impact on the emotions and behavior of an individual [5] . Originally developed by Gustave Le Bon in 1885, *contagion theory* asserts that individual behavior is "demoted" to the level of the one group member who is most outspoken (p. 45) [6]. Duan and colleagues (2019) assert that this mass behavior is both unconscious on the part of the individual and uncontrollable. Largely fueled by social media, false information regarding Covid-19 including mask, vaccination, testing, and social distance mandates, undermine public health and pose dangers to individuals making health decisions [7]. The global nature and spread of new variants compelled one international student residing in Asia to share the following with the author of this paper:

> The new wave of the Omicron outbreak does turn (the community) upside down and currently there is no light at the tunnel as the number of infections keeps rising every day. Rumors of a city-wide lockdown are spreading virally on social media, affecting every citizen's mental health. (Anonymous Educator, Asia, February 22, 2022)

School districts in the United States also experienced the contagion of behaviors by members who attempt to cope with the Covid – 19 virus and its variants. The "home rules" in both lower and upper socioeconomic status (SES) contexts might include students and families sequestered at home who do not want to share the private space of their living quarters during online classes in lockdown. Students might choose to turn off their video camera to play games or watch movies on their devices. The purpose of documenting the following shared experience of three teachers in separate contexts is to illustrate the breakdown of the collaborative teaching and learning environment that ensues when an educator is not *in the same space* as their students.

A male middle-school science teacher in an urban, low SES demographic in the Northeast United States shared what he calls the *diffusion of responsibility* that he establishes successfully in face-to-face environments that breaks down during solely online classes. He asserts that he and his students share a rapport and commitment by being in the *same "space"* to achieve the day's learning goals. This *diffusion of responsibility* crumbles when all his students are locked down in their respective homes during his Google Meet online classes. Some students refuse to put on their video cameras. Once a dominant group member refuses to use their video camera, then a domino effect ensues when most students decline to use their video camera (Anonymous Science Teacher, Northeast U.S. Urban Context, February 22, 2022).

A female high school math teacher in an urban, upper SES demographic in the Northeast United States echoed this sentiment. After her school district experienced frequent Zoom bombing, defined as the disruptive behavior by a predominantly uninvited attendee, the district pivoted again to a second platform for online content delivery. Google Meet shelters its community within the password-protected Google Classroom. She shared that most students refuse to turn on their video cameras on both Zoom and Google Meet, forming a disconnect between the teacher and her students whose "home rules" rather than "classroom rules" are in force. Not being *in the same physical space* limits her ability to refocus students' attention on learning goals (Anonymous Math Teacher, Northeast U.S. Urban Context, February 21, 2022).

A female middle school STEM teacher in an urban, middle class SES demographic in the Southeast United States shared that she requires students to turn on their video camera during online classes. If a student claims technical difficulties, she places them into the Zoom waiting room. She resolves the "technical" issue by enlisting the help of a parent or guardian. The teacher explained that this procedure is to maintain her rapport with over 100 students to be fair to those who attend with their camera on. She indicated that, out of all her students, only one genuinely required an additional WiFi hotspot provided by the district to the family to improve connectivity. Further sequestering a student into a waiting room fragments an already fragile classroom ecosystem.

If students are "off-task" during online classes mandated by the lockdown, then what are they doing? One possible answer is a space where most students already reside, the Metaverse, a collection of virtual worlds. To call virtual worlds such as Roblox and Minecraft "just games" is to downplay engaging environments that serve as a lifeline to connect with friends and engage in creativity and learning. Roblox is a free virtual platform dominated by children, ages 5 through 12, who spawn virtual characters to attend English classes, with interactive spelling tests, in a castle-like space such as Royale High [8]. Minecraft is a virtual world where students can engage in building a "sandbox," open-ended world through geometry and creativity [9]. A student in the male science teacher's class mentioned above (Anonymous Science Teacher, Northeast U.S. Urban Context, February 22, 2022) made a connection between the rocks studied during class and the rocks the student used in Minecraft to build structures [10] in the Metaverse.

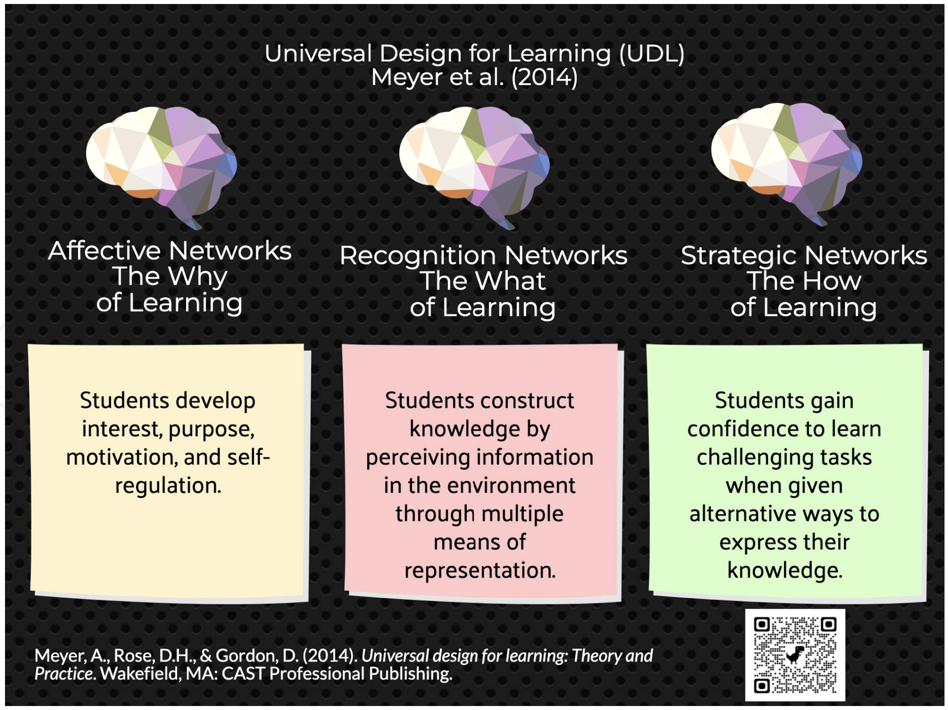


Figure 1. Universal design for learning paradigms.

The examples of Roblox and Minecraft are not meant to suggest that the education community should replace content with existing virtual spaces. There are virtual world platforms to consider as places to conduct classes such that educators can be *in the same space again* with their students in a hybrid approach to teaching and learning. Strictly virtual worlds will never replace face-to-face learning. However, the Metaverse merits examination as a space where teachers and students can co-exist in a hybrid approach to teaching and learning.

The remainder of this paper defines and examines the Metaverse as a virtual environment that the education community can harness as a component of teaching and learning. Universal Design for Learning (UDL) serves as the framework of this paper to draw connections between teaching and learning with the Metaverse. The following UDL paradigms (see figure 1) align with the networks of the human brain that support learning:

- The "why" of learning aligns with the affective networks to engage, challenge, and motivate.
- The "what" of learning aligns with the recognition networks by perceiving information in the environment through multiple senses.
- The "how" of learning aligns with the strategic networks to plan and perform tasks to exhibit understanding.

2. The metaverse

Neal Stephenson coined the term Metaverse in his 1992 novel Snow Crash, where his main character, Hiro Protagonist, spends a great deal of time to escape his living quarters in a U-Stor-It unit in Los Angeles during the 21st century. Stephenson [11] describes the Metaverse as follows:

> So Hiro's not actually here at all. He's in a computer-generated universe that his computer is drawing onto his goggles and pumping into his earphones. In the lingo, this imaginary place is known as the Metaverse. Hiro spends a lot of time in the Metaverse.

Within the Metaverse, individuals reinvent themselves and can enhance their appearance, clothing, or even species such as a gorilla or an imaginary dragon. The avatars represent real people residing in any location on the internet. Stephenson [11] explains the avatars that Hiro sees in the Metaverse as:

> This is all a part of the moving illustration drawn by his computer according to specifications coming down the fiber-optic cable. The people are pieces of software called avatars. They are the audiovisual bodies that people use to communicate with each other in the Metaverse.

Platforms such as Roblox and Minecraft are computer-generated metaverse spaces. Individuals can choose existing "player" templates [12, 13] or design a custom 3D character "skin" on websites such as Minecraft Skins [14]. Roblox offers free options to select body attributes, including skin tone, costumes, clothing, accessories, and animations [15]. According to the Roblox terms of use agreement [16], individuals 18 or older can acquire *Robux* to enhance their avatar with attributes offered for purchase. This author created an account and avatar depicted in figure 2.

This article will utilize Bitmoji [17] as an example of a tool to create customizable avatars (see figure 3) to discuss Metaverse platforms that educators can implement with their students residing *in the same space* to support teaching and learning.

As indicated in the introduction of this article, the worldwide education community defaulted to online meeting platforms such as Zoom, Google Meet, and Microsoft Teams to facilitate online classes with their students in lockdown. While the internet hosts the online meetings, these platforms are not the Metaverse. Immersive views (see figure 4) selected by the host of the online meeting account still situates the attendees in one spot, limiting their freedom of movement. Attendees can upload a profile picture to display when they choose to turn off their

Figure 2. An example of a Roblox avatar.

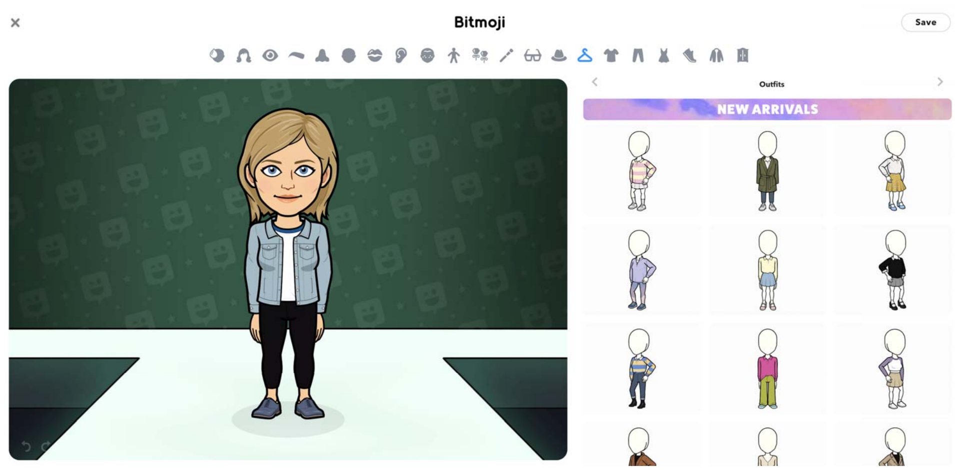


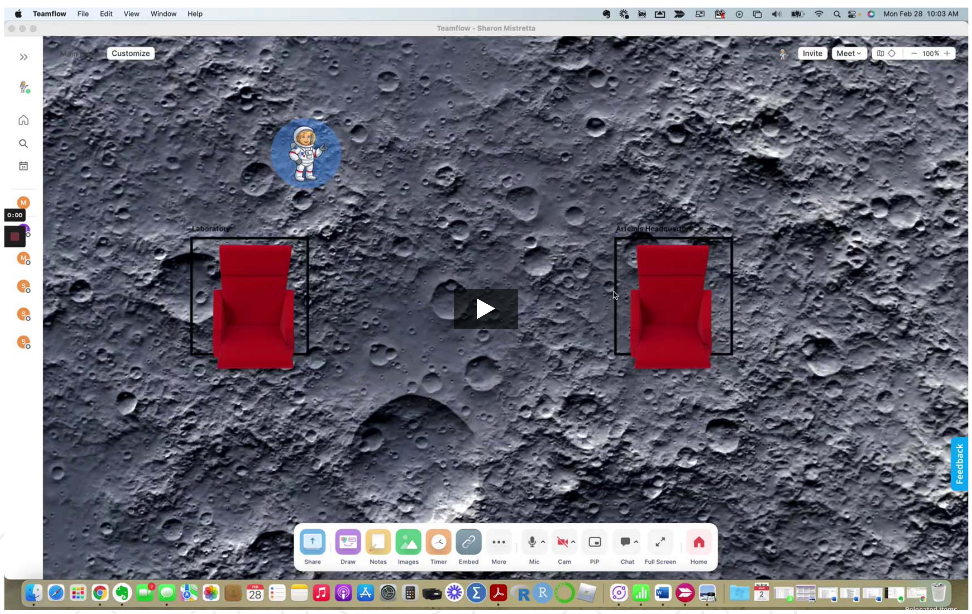
Figure 3. An example of a Bitmoji avatar.

video, however, it is frequently a parent's image when the student uses a home account, or a school logo when the attendee uses an institution-issued device.

3. Skeuomorphism

Skeuomorphism is a user experience (UX) design concept that incorporates objects and environments that resemble the real world. Mobile and computer device users frequently see examples of skeuomorphism when they drag a file to a folder icon to organize documents or click the image of a retro floppy disk to save files [18]. There are skeuomorphic, online platforms that lend themselves to the creation of a customized Metaverse where educators can sustain the illusion of being in the same physical space as their students.

Figure 4. Zoom immersive view.



Video 1. A video tour of the teacher-customized Teamflow Moon Metaverse.
The video is available on
https://cdn.intechopen.com/journals/supplemental/87/ACRT.05_Video_1.mp4.

This paper will use Teamflow [19], a skeuomorphic online platform that provides furniture, layouts, backgrounds, audio zones, collaboration tools, and options to upload images of real-world objects to customize the Metaverse. The Metaverse created by this author (see video 1) provides students with the opportunity to join her in an imagined colony on the Moon where they will collaborate on experiments

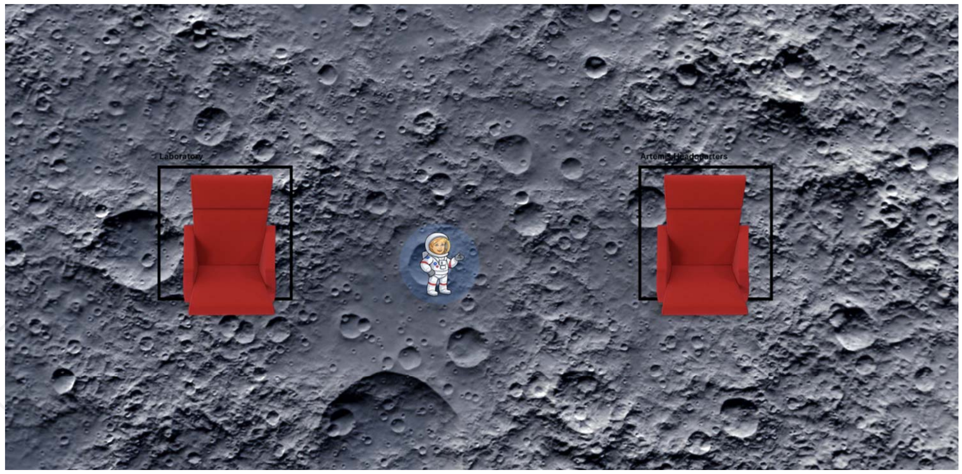


Figure 5. Teacher-customized Teamflow Metaverse environment depicting two portals to additional rooms.

to sustain life and manufacture items. For this unit, the students use Bitmoji to create a customized avatar to upload to their Teamflow member profile. The avatar appears in a circle medallion that reveals when the student *turns off* their video camera. While in this Metaverse, students can mute or unmute their audio as needed. Most importantly, the student can move their medallion around the space to either collaborate with classmates on an assignment within an audio space designated for that purpose or to use a "portal" to another "room". For purposes of this example, this Metaverse begins with the arrival of students on the Moon imagined through an uploaded background of craters. The teacher greets students and then invites them to sit in one of two chairs to "teleport" to one of two rooms (see figure 5). One room is the Artemis Headquarters (see figure 6), a Metaverse space that can accommodate up to 100 students. The microphone UX object placed at the podium allows the teacher to broadcast their voice to everyone at the Headquarters. Teamflow includes tools that the educator can use to create multiple whiteboards, share their screen, or "app smash (embed)" a link into the Metaverse that creates a window of content such as a YouTube video. The second room where students could teleport when they arrive at the Moon Metaverse is the laboratory (see figure 7). Furnished with a user-uploaded lab station and tables, the students can collaborate on an assigned task. The teacher can send a message to members in any space, including a Tinkercad 3D Design Room, a Visual Arts Room, a Formative Feedback Room, and a Gallery Walk to showcase projects (see video 1).

With the Moon Metaverse established as an example of shared space among educators and their students represented by medallions that contain their avatars and audio capabilities, this paper will examine the aspects of Universal Design for Learning supported by Metaverse spaces.

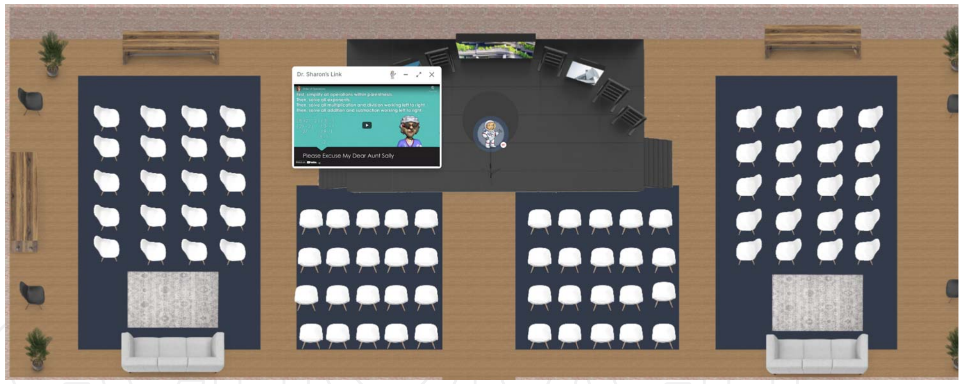


Figure 6. Teacher-customized Teamflow Metaverse Artemis Headquarters with 100-student capacity.

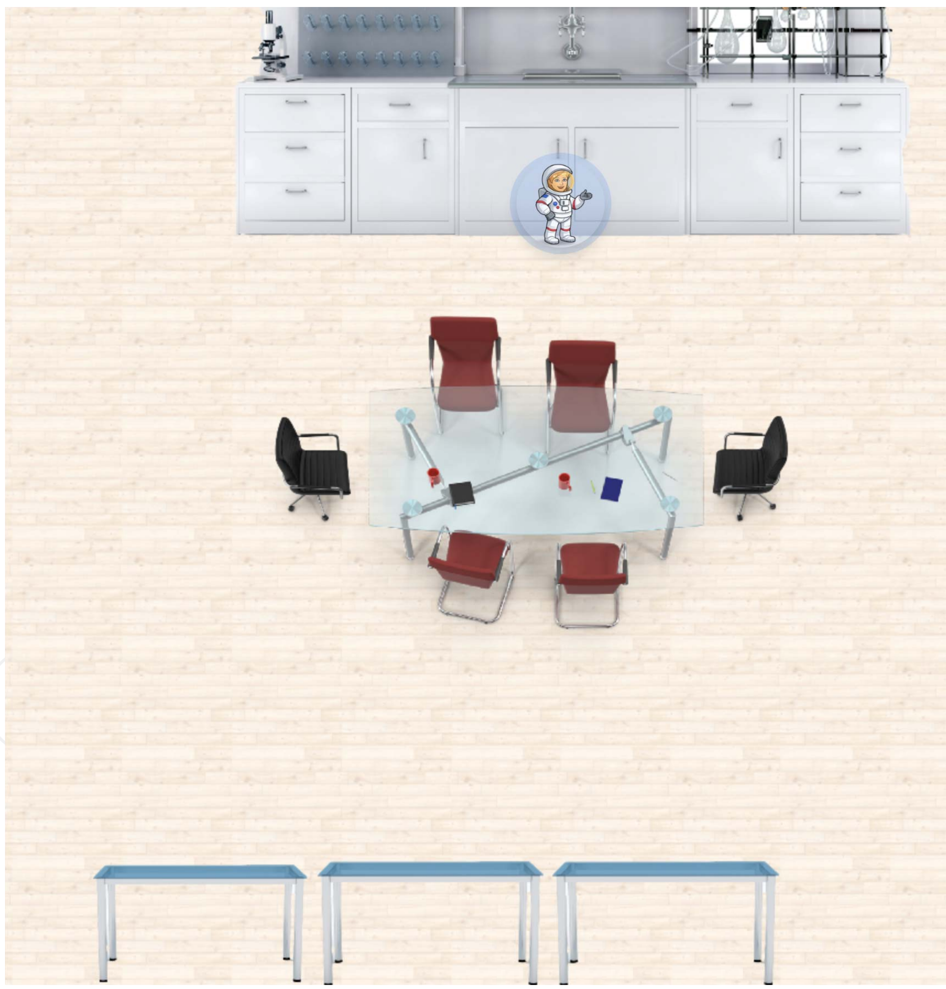


Figure 7. Teacher-customized Teamflow Metaverse Laboratory for student collaboration.

4. Universal Design for Learning

In 1984, the Center for Applied Special Technology (CAST), located in Wakefield MA, developed Universal Design for Learning (UDL) in response to their work with hospitalized children in a multidisciplinary clinic that assessed how these students with learning issues could be better served [20].

CAST [20] sought to:

- empower students by scaffolding areas of weakness
- focus on amplifying students' abilities by giving them the technology tools in an asset versus deficit approach
- provide assessment choices to a child to create something visual through technology. For example, a student referred to CAST with a diagnosis of dyslexia versus amplifying her *abilities* to express herself in other formats, such exhibiting their learning through artwork.
- level the playing field for the students
- help teachers better serve students

The directors of CAST, Anne Meyer, David Rose, and David Gordon realized that *all the students*, regardless of ability, could benefit from equal access to course materials and resources. The CAST directors concluded that it was the curriculum, and not the learners, that posed the problem. Curriculum in schools can be a series of unnecessary barriers to learning through traditional, single-entry-point printed text and fill-in-the-bubble multiple choice assessment approaches. The UDL approach dispels the myth of the average student and provides multiple entry points for engagement, representation, action, and expression [21].

5. The Why of Learning

Students' emotional response to become engaged in learning, sustain motivation, and foster their volition reside in the affective, "Why of Learning "networks of the brain [21]. Motivation is a student's desire to accept responsibility for a task and sustain effort [22]. Volition moves beyond motivation to overcome perceived obstacles, barriers, and hindrances in the learning process [22]. Research also links volition to transformative learning that is discovery and curiosity-based [23], and linked to inspiration evoked by something in a student's environment [24].

The Moon Colony Metaspace offered as an example to support teaching and learning (see video 1) provides an intriguing environment that aligns with students' established citizenship in the Metaverse. One of the tenets of the affective network of learning is to optimize relevance according to Meyer and colleagues [21]. The Moon Colony aligns with platforms relevant to students' activities outside of school

Table 1. The “Why” of learning examples.

Teacher provides the “Why” of Learning	Example in the moon colony metaverse	Depicted in figure
Choice of the level of perceived challenge.	Tinkercad Room: 1. Design tools to use in the Moon Colony. 2. Create and maintain a catalog of proposed and completed tools on [25]. 3. Record audio tutorials on Flipgrid about how to implement [26]	See figure 8
Choice in the tools used for information gathering or production. Choice in the color, design, or graphics of the layout.	Visual Arts Room: 1. Use Piktochart to depict one topic covered in the NASA Artemis Mission Plan [27]. 2. Use Piktochart to depict one topic covered in the China Moon Base Plan [28].	See figure 9
Choice in the sequence or timing for completion of tasks. Involve learners in setting their personal, academic, and behavioral goals.	Formative Feedback Room: 1. Use [29] to book time for teacher-student or teacher-group to provide formative feedback in the Formative Room.	See figure 10

Note: The tools listed in this table can apply to hybrid learning environments to facilitate students’ choices.

where they can collaborate and, most importantly, exercise choice in activities. Educators who build the UDL “why” of learning into their curriculum can partner with students to sustain and inspire students with the goal of fostering expert learners who are purposeful, motivated, and lean into volition (see table 1).

5.1. The What of Learning

The “What” of learning engages the recognition networks of the brain that permit us to recognize voices, faces, letters, words, and complex patterns [21]. In the Moon Colony Metaverse, teachers can “app smash” other applications into each room to incorporate any addressable resource, such as a Google Document, Slides, Form, etc. directly into the “room” for students to access (see video 1). What flexible design formats are under educators’ control to provide multiple entry points for all students? Teachers should design assignment documents and supporting materials, that they can enact in hybrid learning environments, in fonts, and *high contrast font to backgrounds colors* that most readers can see [30]. For instance, sans serif fonts such as Arial or Helvetica, without curls or flourishes at the end of the letters, are the most “readable” by all viewers. A high contrast background to font color is best such that readers can easily decipher words from the background [31].

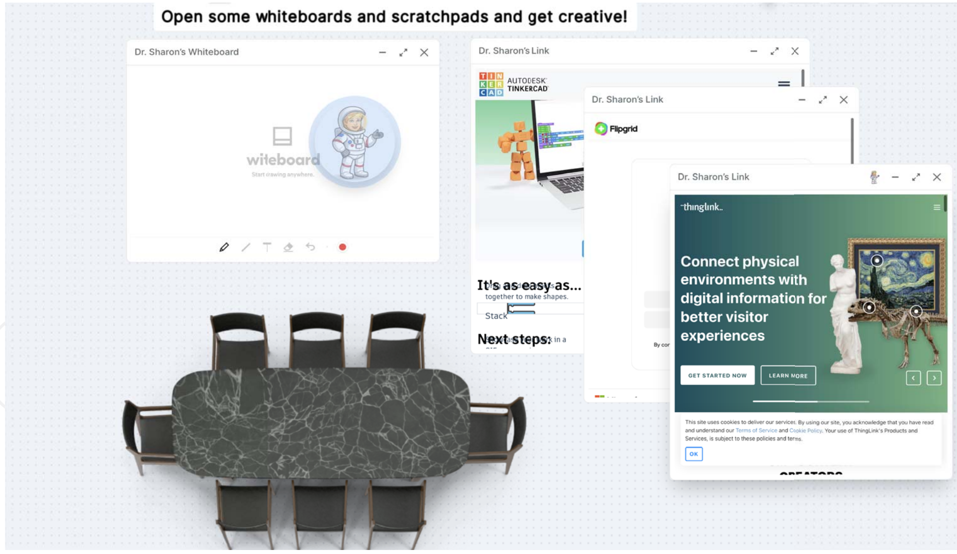


Figure 8. Teacher-customized Teamflow Metaverse Tinkercad 3D Design room for student collaboration.

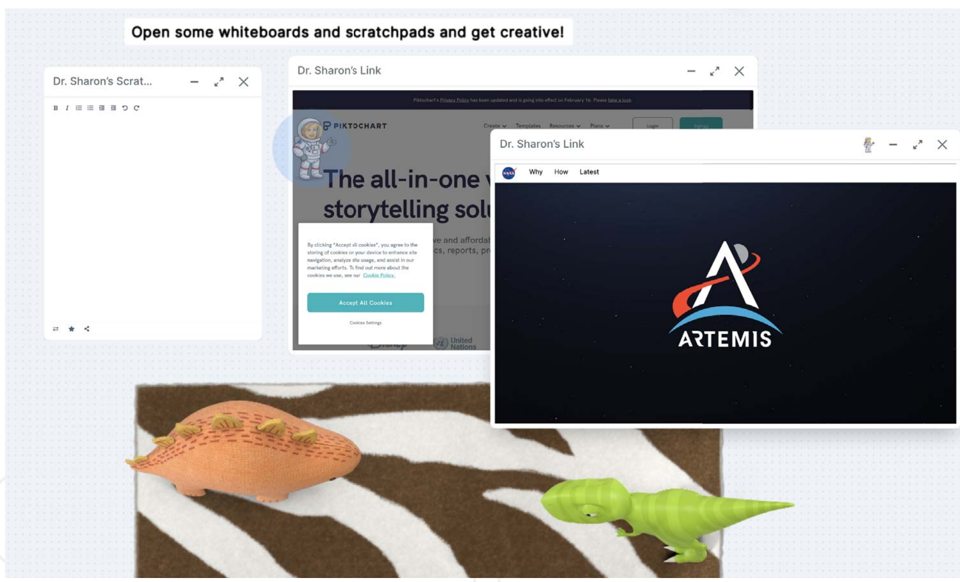


Figure 9. Teacher-customized Teamflow Metaverse Visual Arts room for student collaboration.

Teachers can embed Mote audio notes into documents as images linked to the URL of Mote [32] note. Click on this Mote logo, then click play button that appears in your browser window. Alternatively, read the QR code in figure 11 with the camera of your mobile device to hear the recorded message.

Teachers can provide video instructions regarding assignments on platforms such as Flipgrid to increase their social presence. Flipgrid provides QR codes for each

Figure 10. Teacher-customized Teamflow Metaverse Formative Feedback room for discussion among the teacher and students.

Figure 11. QR code - Read with the camera of your mobile device. Click on the resulting link and press the play button to hear a Mote audio message.

post. Download the QR code and paste it into your assignment as an image. Alternatively, provide a blue link to click the Flipgrid to provide instructions to learners who prefer verbal instructions. By providing text, audio, and video *on each*

Figure 12. Universal Design for Learning - multiple means of representation - text, audio, and video entry points incorporated into all lesson materials.

of the materials provided to students, the teacher can fine-tune the accessibility in the "what" of learning (see figure 12).

5.2. The How of Learning

The "How" of learning provides students with multiple means of action and expression [21]. As exhibited in table 1, student choice is evident to assist students in the persistence of their motivation to take responsibility for tasks and to choose learning paths to work around perceived obstacles or barriers. The "app smashed" Pictochart and Thinglink projects, showcased in the Gallery Walk (see figure 13), provide evidence of the multiple entry points for students to exhibit learning.

5.3. Classroom management

Teaching and learning together in a Metaverse space such as on Teamflow requires an enhanced set of management tools for both educators and students. Educators could adopt the core values expressed by the FIRST Lego Robotics League [33] which they call Gracious Professionalism:

- Discovery: We explore new skills and ideas.
- Innovation: We use creativity and persistence to solve problems.
- Impact: We apply what we learn to improve our world.

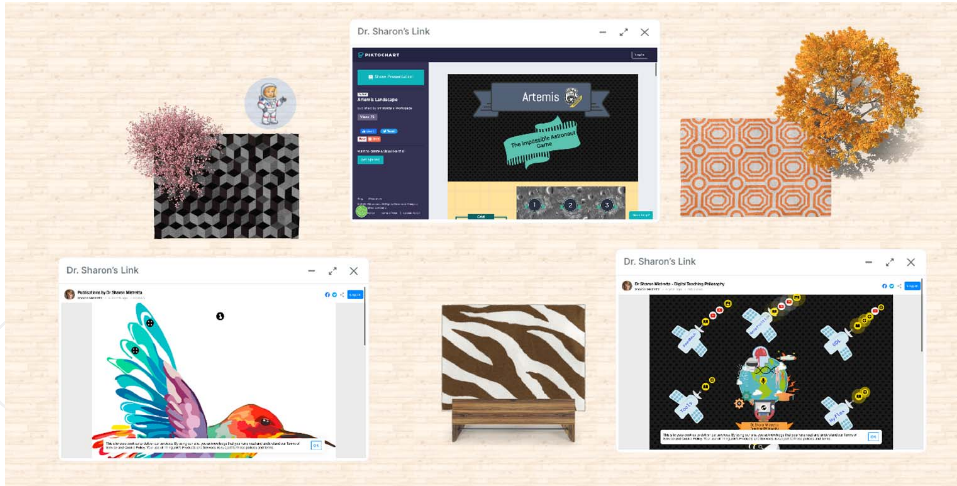


Figure 13. Teacher-customized Teamflow Metaverse Gallery Walk showcasing students' projects.

- Inclusion: We respect each other and embrace our differences.
- Teamwork: We are stronger when we work together.
- Fun: We enjoy and celebrate what we do!

We can travel full circle to the topic of *contagion theory* discussed in the opening paragraphs of this paper. If individual behavior is "demoted" to the level of the one group member who is most outspoken (Duan *et al.* 2019), then educators can set Metaverse rules such that the bar is set high enough to "level-up" behavior aligned with gracious professionalism [5]. In his article regarding the Fourth Industrial Revolution characterized by machine learning, advanced robotics, autonomous transport, artificial intelligence, biotechnology, and genome mapping, Gray [34] asserts that the top 10 skills required for the future workforce include soft skills:

(1) Complex Problem Solving
(2) Critical Thinking
(3) Creativity
(4) People Management
(5) Coordinating with Others
(6) Emotional Intelligence
(7) Judgement and Decision Making
(8) Service Orientation
(9) Negotiation
(10) Cognitive Flexibility

5.4. Literature review

The Metaverse, aligned with Universal Design for Learning, is a shared education space where educators and their students can immerse themselves in a collegial environment such that they will be well prepared for the future. If the Metaverse represents a location where teachers and students can collaborate, then it merits an investigation to discover the pathways to its adoption.

Smart, Cascio, and Paffendorf developed a Metaverse Roadmap in 2007 to foster a cross-industry public foresight project to document pathways to the 3D Web [35]. The educational nonprofit Acceleration Studies Foundation (ASF) maintains a Metaverse Roadmap (MVR) to sustain research and collaborations to answer the question, "What happens when video games meet Web 2.0?" [35, 36].

MVR [37]maintains 19 foresight categories that synthesize inputs to future opportunities in the Metaverse [37]. Within the 19 categories synthesized by MVR (2022) is a detailed history of Metaverse development that includes the inception of term avatar. Morningstar and Farmer [38] developed "Habitat", the first 2D, multi-user dungeon/domain (MUD) chat world for Lucasfilms and based the participants' avatars on the Sanscrit "avatara," meaning an incarnation of a higher being [38]. Morningstar and Farmer [38] described Habitat as a multiplayer, online, virtual environment that could support thousands of users in a single shared cyberspace. Avatars could chat with other users in the virtual environment and were able to pick up and manipulate virtual objects. The user's Commodore 64 home computer communicated with the centralized Habitat system over Quantum Link, a packet-switching data network for the Commodore personal computers and one of the earliest online services [39].

To streamline the roadmap, ASF established four major scenarios of the Metaverse future. The four scenarios, published in 2007, include virtual worlds, mirror worlds, augmented reality, and lifelogging. ASF provided examples to support the four scenarios fifteen years ago in 2007. Kye *et al.* [40] provide more up-to-date examples of the four scenarios. Table 2 reveals the progress from 2007 to the present year in 2022 to illustrate how quickly platforms become obsolete.

The literature published since the Metaverse Roadmap [37] includes editorial reviews, conference proceedings, book papers, periodicals, and reports (see table 3). In a commentary on higher education, Collins [41] speculates that about the future of virtual reality that aligns with [37] mirror world scenario including Google Earth and virtual worlds that serve business and industry. Collins [41] extends the speculation about the Metaverse to classrooms in higher education that is bound by the capabilities of the Internet of 2008 when the virtual World of Warcraft achieves 11.5 million subscribers [42].

Table 2. Comparison of metaverse roadmap scenario examples.

Scenario	Metaverse Roadmap [37] Example platforms	Kye *et al.* [40] Example platforms
Virtual Worlds—characterized by a user's avatar in a multi-user virtual world.	Playdo Habbo Hotel Everquest World of Warcraft Second Life Sony's Home Sims 2 MySpace	Second Life Minecraft Roblox Zepeto
Mirror Worlds—informationally-enhanced reflections of the physical world	Google Earth Amazon Block View Google Maps Street View SketchUp RealViz 3rdTech	Google Earth Google Maps Naver Maps Airbnb
Augmented Reality—enhances the physical world to layer objects in everyday settings.	QR Codes Heads-up display eyeglasses, cell phone displays	Pokemon Go Digital Textbook Realistic Content
Lifelogging—augmentation technologies to support users and document lives.	TrackStick interface to Google Earth iPod interface to Nike sneakers Wearable headcams	Facebook, Instagram, Apple Watch, Samsung Health, Nike Plus

In 2009, Yasar and Adiguezel [43] support the merits of the now-defunct SLOODLE, a virtual reality platform "merger" of Second Life, a 3D metaverse still going strong today, with Moodle, an online learning system. Yasar and Adiguezel [43] support the merits of a 3D online learning system but lament that the merger of a virtual environment and a learning management system do not provide adequate quizzes and communication capabilities.

The collaborations of higher education institutions in the United States and Japan by Barry *et al.* [44] reported on the merits of problem-based learning (PBL) conducted in a Metaverse using Second Life to carry out building activities through the collaborations of avatars in the 3D environment. Barry *et al.* [44] concluded that the Metaverse supported PBL collaborations by eliminating the restrictions of time zones and location.

In 2012, Mattar argues for the merits of 3D virtual worlds to move beyond the physical metaphors of "desktop" and "file folders" to embrace avatar-based virtual environments. Mattar [45] posits that a minimalist approach to provided content motivates students to seek out collaborations and unique, constructed content.

Table 3. Metaverse literature by publication year.

Author(s) and Date	(A)cademic Peer Reviewed Journal (B)ook (C)onference Proceedings (P)eriodical (R)eport	Concepts
Collins (2008) [41]	(P) Educause Review	Predicts virtual workplace of the future in the Metaverse, the need for independent 3D Internet applications, and an imperative for higher education to consider the affordances of the Metaverse to students as lifelong learners.
Yasar & Adiguezel (2010) [43]	(A) Elsevier	Delineates the merits of 3D virtual learning environments using the now defunct [46] SLOODLE platform which is a merger of [47], a 3D virtual environment, and [48], an online learning system. Sloodle required a download from GitHub and platform management.
Barry *et al.* (2010) [44]	(R) Clarkson University (US), Suzuka National College of Technology (Japan), and Nagaoka University of Technology (Japan)	Project-Based Learning using [47], Avatars, and a 3D online community. Japanese and US-Based students communicate and conduct projects in a virtual classroom.
Mattar (2012) [45]	(B) Information Science Reference/IGI Global	Argues for a minimalism of content whereby Web 2.0 tools and 3D virtual worlds can motivate students to search, collect, organize, and produce unique content. Mattar [45] suggests a movement beyond the metaphors of desktop and file folders to embrace avatar-based virtual environments.
Moretti and Schlemmer (2012) [49]	(B) Information Science Reference/IGI Global	Virtual 3D worlds and the Metaverse to support communities of practice (CoP). Second Life [47] as a platform to support CoPs.
Perera *et al.* (2012) [50]	(A) International Journal of Emerging Technologies in Learning	Case Study: Discovers the merits of a 3D Multi-User, Virtual Environment to train for disaster management. This study confirms the merits to engage students but declares the challenges of platform management. Second Life [47] and the open source [51] that requires download, installation, and maintenance.
Gadalla *et al.* (2013) [52]	(A) Journal of Marketing Management	The Metaverse provides opportunities for collaborative environments to enhance social experiences.

Table 3. (Continued)

Author(s) and Date	**(A)cademic Peer Reviewed Journal (B)ook (C)onference Proceedings (P)eriodical (R)eport**	**Concepts**
Garrido-Iñigo and Rodríguez-Moreno (2015) [53]	(A) Interactive Learning Environments	The authors built an OpenSim virtual environment to teach French to university students in Spain. The authors concluded that the use of avatars to facilitate reading and listening comprehension, and written expression resulted in positive assessments of language acquisition by participants.
Kurt *et al.* (2019) [54]	(A) Malaysian Online Journal of Education	Studied teachers' views on Web 2.0 tools, teachers second-most preferred tool was the Metaverse to implement augmented reality applications
Erturk & Reynolds (2020) [55]	(C) International Conference eLearning 2020	Literature review and sample project: peer-reviewed sources with keywords "immersive media," "immersive technologies," immersive media and education," "augmented reality and education," virtual reality and student learning", "mixed reality and education," and "AR, VR, MR, and education." Sample project implemented [56], Concludes that immersive media enhances motivation and engages students.
Han (2020) [57]	(B) Cognitive and Affective Perspectives on Immersive Technology in Education	In a book chapter about learning in an immersive environment such as the metaverse is as concrete as learning in the physical world, necessary to teach students how to decode images from a cultural standpoint.
Kern (2021) [58]	(P) English Teaching Professional	Examines the concept of "presence" and the merits of the feeling of being in a place that aids learning and memory.
Kye *et al.* (2021) [40]	(A) Journal of Educational Evaluation for Health Professions	Reviews the Acceleration Studies Foundation [36] categorizes of the Metaverse into four types: augmented reality, lifelogging, mirror world, and virtual reality. Authors posit that the metaverse is a space for social communication with a high degree of freedom to share and create.

Moretti and Schlemmer [49] support Mattar's [45] argument to support virtual learning through communities of practice in the Metaverse.

Perara *et al.* [50] write about the merits of training individuals for disaster recovery using the 3D Second Life platform. However, the study team laments the difficulties encountered when downloading, implementing, and maintaining the multi-user virtual environment to align with their organizations policies. Gadalla *et al.* [52] also extols the virtues of Second Life as a customizable 3D environment to support and enhance social experiences in retail service.

Garrido-Iñigo and Rodríguez-Moreno [53] describe positive outcomes of a study about French language learners in a virtual environment. The authors conclude that students' avatars assisted them to improve reading and listening comprehension, and written expression. In a survey conducted to query teachers' perceptions of Web tools, Kurt *et al.* [54] reported that the educators revealed a preference for augmented reality and the Metaverse.

In a 2020 International Conference on eLearning, Erturk and Reynolds shared a literature review and sample project implemented using Metaverse Studio [56]. The authors conclude that immersive media enhances motivation and engages students. Han [57] confirms that an immersive environment such as the metaverse is as concrete as learning in the physical world, however, it is necessary to teach students how to decode images from a cultural standpoint.

Kern [58] examines the concept of "presence" and the merits of the feeling of being in a place that aids learning and memory. As delineated in table 2, Kye *et al.* [40] provide present-day examples of the four Metaverse Roadmap scenarios and conclude that the metaverse is a space for social communication with a high degree of freedom to share and create.

6. Conclusion

Authors of the literature regarding the Metaverse, from its inception as a concept in Stevenson's Snow Crash to the Kye *et al.* [40] updates to the Multiverse Roadmap, wrote about this 3D environment predominantly from the comfort of a pre-pandemic world. The authors and their stakeholders could safely toggle between face-to-face, hybrid, and online environments without the worry of a deadly contagion. Metaverse platforms such as Teamflow offer teachers and their students with an opportunity to safely collaborate in an environment that permits unique identities in the form of avatars who can free themselves from business meeting platforms such as Zoom, Teams, and Google Meet to collaborate a customizable environment to support learning objectives and outcomes. Incorporating the Metaverse into as a shared learning adopts a world where students already reside, collaborate, and thrive.

Data availability

Data analyzed within a literature review.

Conflicts of interest

There are no financial or non-financial conflicts of interest/competing interests regarding this chapter. The researcher does not have financial interest or benefit arising from the direct applications of the research.

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