Big History in Action: Explorations in Multimodal Communication Strategies for Different Audiences in Taiwan

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Ever since I began teaching Big History in 2018 in Taiwan, the most frequently asked question is: 'How is Big History relevant to me?' For high-schoolers, we connect cross-disciplinary knowledge and learning strategies so they can process knowledge with diverse media. For lifelong learners, we combine problem-solving competency and complex big-history case studies so that they can apply competencies in multiple contexts. For our Executive MBA program, we help business leaders focus on organizational complexity and facilitate a discussion of structural change.

Educator David Perkins proposes that education should fill the gap between knowledge and the lives that students are likely to lead, rather than just building a vast reservoir of information. Health educators Christen Rachul and Lara Varpio suggest that a multimodal communication strategy can shape professional education by using multiple modes. In this article, we identify how a specific learning theme for different groups and elaborate how multimodal communication can address a variety of big-history topics and contexts.

Big History with Technology: Connecting High School Experience and Emotions

Learning is all about how humans process and store information. In order to enhance cognitive processing and active learning, educator Stephen Kosslyn proposes a set of principles that can be organized under two general maxims: 1) Think it Through and 2) Make and Use Association. We found that Virtual Reality and Augmented Reality (VR/AR) technology is effective in helping students integrate information and abstract concepts, which in turn enhances their understanding and memory. An analogy can be seen in how visually-impaired people learn to read braille.

When sighted-learners read, they activate a part of the brain known as the 'visual word form area' (VWFA). Research suggests that when blind learners read braille about things for which they have had no visual experience, they activate the same area. The VWFA is a multisensory integration region that recognizes shape-descriptions and connects to the brain's language area. This allows learners to achieve high-level perceptual representation. In sum, the brain acquires information through reading, regardless of the sensory input (visual or tactile).

In the world of scientific phenomena, symbols and equations, we are like blind people. With our limited sensory abilities, we cannot 'see' a magnetic field, a gravity wave, or the formation of a star. So we try to recognize the symbols and construct a representation of the world in our mind. IT educator and engineer Yiyu Cai suggests that VR/AR technologies not only provide a new way to perceive scientific concepts but also engage students to learn in an immersive environment.

In this case, students try to use prior knowledge to recognize items from the virtual world. In addition, they often feel excited to use technologies like VR/AR, so their emotions are activated, which enhances their memory. For instance, if we have students create the virtual reality of a living cell's environment, they will use their own experienced self-explanation to represent what they have learned from textbooks, then apply it in a different context.

I used Google Expedition to provide VR/AR content in my big-history class. Image 1 is from our class on human evolution, where I explain by using augmented reality how neurons transmit information in our brains. From the 2019 class survey, all of the 120 students gave positive feedback for the experience, and two-thirds (80) added qualitative descriptions (not required in the survey) about how it changed their concept of learning.

Problem-Solving Competency: Big-History for Lifelong Learners

Big History is a powerful thought-tool that provides multiple viewpoints across a variety of time frames and scales. Lifelong learners look for inspiration and insights to improve their decision-making and enhance their life quality. Big History can provide a framework for understanding and solving the challenges of our time, especially through its ability to zoom into details and zoom out to a big picture. This being said, lifelong learners can find the big-history narrative remote from daily living, so we combine competency-based training with big-history case studies to provide diverse contexts.

Competency-based education is the sum of information, abilities and attitudes a person should possess for engaging in daily life and tackling future challenges. Core competency should provide bridges between different domains of action

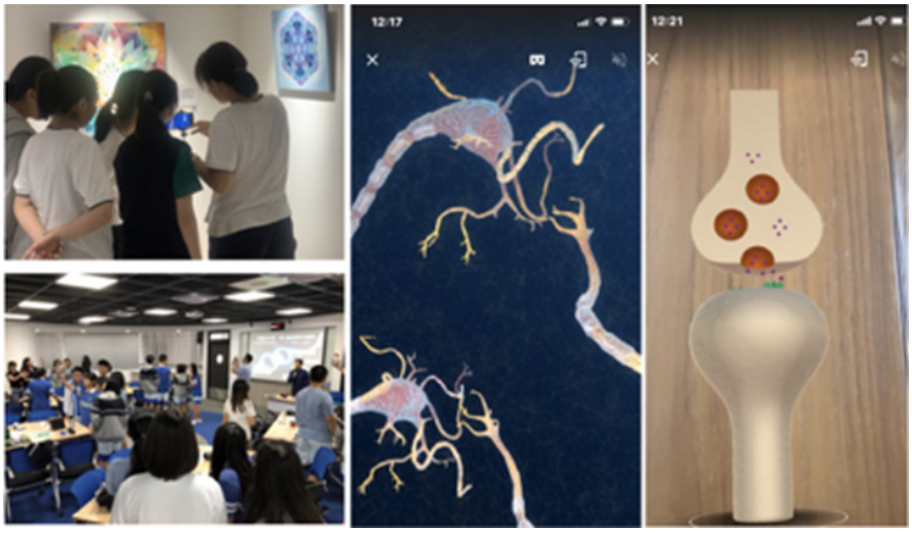

Image 1: Use of augmented reality (AR) technology in our big-history class to demonstrates how neurons transmit information in our brains. Ming Dao High School, Taiwan, 2019. Photographs by Gavin Lee.

and bring together integration between them. One of the best aspects of competency-based education is that it gives students choice in how they learn and how they demonstrate their learning. In order to accomplish this, we use rubrics to help students track their progress.[1]

Politician and education-reformer Robert Kerrey describes the pedagogy of Minerva University as a successful example of competency-based education, which is dedicated to 'provide students with a set of intellectual tools that is applicable across a wide range of situation.' Minerva's tools to reach this vision are 'habits of mind and foundational concepts (HCs).'[2] Each HC has its own five-point mastery rubric and is illustrated with content from multiple domains.[3] Inspired by these HCs, we identify thirteen problem-solving competencies (Table 1 provides three of these, as examples).

In our big-history class for lifelong learners, students do pre-class work relating to one or two competencies. They then have to apply those competencies in solving big-history problems. For example, they might work on a hypothetical reform in 19th century China after the First Opium War. Participants role-play the Grand Minister of State, the Minister of War, and the Emperor. They define the problems that China faced, establish the goal of reform, then identify the constraints to making the reform happen and the major obstacles that need to be removed – all from different perspectives.[4]

The most frequent feedback we receive from students in this class is that previous history classes criticized why historical figures were so short-sighted, even repeating their own mistakes. It was not until they imagined themselves in that era and in that official position that they realized it was not so easy to make the right decisions, for example, there were too many constraints that make them reconsider the priority and reallocate resources. To their surprise, even those students who are not history fans still find analogies to problems that occur in modern life and learn practical wisdom from these case discussions.

Competency	Proficiency Level
Define the Problem	Characterize the core problem by specifying obstacles between the present situation and the goal, while also identifying the problem's scale (to avoid distraction).
Constraints	Specify boundaries and needs for solutions, while being able to weigh pros / cons between constraint satisfaction and transformation strategies.
Gaps in Analysis	Identify if there are adequate solutions or gaps to be filled between the present situation and the goal in order to determine if a new solution is required.

Table 1: Competencies and proficiencies for habits of mind and foundational concepts (HCs).

Rethinking Management: Experiencing Self-Organized Complexity for Business Leaders

As for business leaders, they are looking for inspiration to improve their management skills. Currently, I teach two Executive MBA programs in Taiwan. The students are all fascinated by the idea of new, emerging complexities in their organizations. In order to provide more experiences and reflections, we work on a redesign of the classical video game, *Pong* (1972), with an in-depth discussion of complex system theory.

IT graphics scientist and Pixar-cofounder Loren Carpenter famously reinterpreted *Pong* at a crowd-experiment in the 1990s.[5] We modified this virtual ping-pong game into a mobile version. The rules are simple. Participants use their smartphones to control the paddle. They press green to make the paddle go up or red to make it go down. Each move of the paddle is the average of all players' intentions. Everyone is aware of each other's thinking, but they can only respond to an overview of themselves as they co-form a new complexity. In fact, the participants do what birds, ants and bees do, they flocked self-consciously without speaking a word.

Self-organization can be defined as the process by which complex systems, consisting of many parts, tend to achieve some sort of stable, pulsing state in the absence of external influence. Within a self-organizing structure, teams own the 'how' to do the work, along with deciding 'who' does the work within the team.[6]

This educational gaming component makes a huge impact on most students and causes them to reflect on how they can create an environment with Goldilocks conditions to facilitate such self-organization in their own organizations. The discussion is associated with the big-history concept of how emerging properties push the world through different thresholds with new complexity.

Conclusion: Towards a Whole Gamification Experience for Big-History Education

Big History provides good frameworks for thinking across fields, disciplines and scales, but the scientific knowledge involved is still inaccessible to many teachers and students. In order to overcome this barrier, we use a multimodal communications strategy to furnish experiences for students from different group backgrounds, so as to enhance their most-needed learning outcomes. Only when students are willing to engage in such classroom interactions can we deepen their learning and get them to apply their new knowledge. This is the mark of excellence in education.

In addition to the application of the VR/AR technology, problem-solving case studies and social gaming discussed in this paper, we are also working on how to revolutionize the learning process of big-history education through a series of other games. Instead of just learning knowledge in the classroom, students will become facilitators of different games, all of which will be designed to help them and their teams understand the mechanics of the game. The final outcome of the semester will likely be hours of continuous gaming marathons. Our goal is to reshape the big-history learning through gamification and to trigger students' interests to discover more in an upward spiral of achievement!

Image 2: The Pong game and follow-up group discussion on applying self-organization in management at National Taiwan University Executive MBA program, 2019. Photographs by Gavin Lee.

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Endnotes

1. Justin Reich and others 2019.
2. Kerry 2017.
3. A list of these habits of mind and foundational concepts is found at the Minerva University's website: <https://www.minerva.edu/graduate-programs/graduate-academic-program/>, accessed 8 February 2022.
4. Big History@Taiwan 2021.
5. Lindner 2018.
6. Self-organization represents the spontaneous emergence of order in natural and physical systems and brings a fundamental relocation of energy and action within a system to achieve a larger goal. This idea is widely adopted in improving modern management theory. For example, policy and systems scholar Louise Comfort provides assessment of the conditions that facilitate or inhibit the emergence of self-organization in rapidly-changing and dynamic conditions, illustrating these conditions with selected examples from an actual case of disaster operations. Comfort 1994: 403–407.