Micro Project – Small Plants, Big Discoveries: AI-Driven Exploration

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The Kyoto Conference on Arts, Media & Culture 2025
Official Conference Proceedings

Abstract

To fulfill the USR goals prioritized by Taiwanese universities, we adopted the global Design for Change (DFC) model by Kiran Bir Sethi to develop the Place Change Maker (PCM) strategy. This strategy integrates place exploration, design thinking and making, and place-based change practices. Using PCM, we carried out social service projects at four rural primary schools – each with over 80 years of history and fewer than 50 students, which are at risk of closure. Through digital fabrication, we developed an upgraded "digital microscope" and led the Micro Project – Small Plants, Big Discovery workshops. In these workshops, students built and customized their own microscopes, using them to explore the microscopic ecology of characteristic campus plants. We provided "M2M ChatGPT" procedures to investigate the connection between microscopic plant features and real-world landscapes. For example, they observed that the nodal structures of bamboo leaves resembled the bamboo plant itself. Using AI-assisted image recognition, they found aerial photos of car factories arranged in a pattern similar to that of bamboo leaves. Similarly, the umbrella-like structure of pennywort leaves under the microscope resembled the Place Charles in Paris when viewed from above. This innovative exploration not only enhanced students' digital literacy but also broadened their global perspective. Our initiative reimagined the value of rural schools and supported the Sustainable Development Goals of "Quality Education" and "Reduced Inequalities," advocating against the closure of schools in remote areas.

Keywords: university social responsibility (USR), place change maker (PCM), digital microscope, M2M ChatGPT, SDGs

Introduction

Since 2018, Taiwan has actively promoted the University Social Responsibility (USR) program to encourage college students to apply their academic knowledge in serving society and addressing real-world challenges. Building upon this national initiative, our team has accumulated five years of experience in USR implementation. Continuously exploring how higher education can be meaningfully linked to social engagement. Inspired by Kiran Bir Sethi's Design for Change (DFC) movement, which advocates the belief "I CAN" and empowers young people to initiate positive change (Kiran, 2009), we developed the "Place Change Maker" (PCM) social service strategy. Derived from the DFC framework, PCM guides college students to engage in hands-on service activities in rural primary schools, embracing the belief: "I CAN MAKE and CHANGE IT."

In this study, we led college students to visit six rural primary schools, each with over 80 years of history and fewer than 50 students. During these visits, students explored and documented the unique plant ecosystems on each campus. To enhance experiential learning, we adopted digital manufacturing technologies to create portable "digital microscopes," which became the core tools in our *Micro Project – Small Plants, Big Discoveries* workshops. In these workshops, college students and young children collaboratively assembled maker microscopes. They examined the microscopic worlds of local plants, embodying a shift in the maker spirit from DIY (Do It Yourself) to DIT (Do It Together).

Furthermore, AI—particularly ChatGPT—played a crucial role in expanding the educational potential of this project. By enhancing students' learning skills and linking microscopic plant observations to broader real-world landscapes, AI helps broaden the horizons of children in remote areas and contributes to narrowing the educational gap between urban and rural regions. Overall, this research aims to (1) develop a PCM strategy that empowers college students as makers capable of transforming places and creating positive impact; (2) establish an AI-driven exploratory learning procedure that connects microscopic plants to the macro world in support of our "Small Plants, Big Discoveries" goal; and (3) reshape perceptions of rural primary schools while advancing the Sustainable Development Goals of Quality Education and Reduced Inequalities. Ultimately, we envision these schools continuing to flourish, preserving emotional bonds with local communities, and becoming enduring symbols within their regional memory.

Related Work

DFC to PCM

Originating from Indian educator Kiran Bir Sethi's 2009 Design for Change (DFC) movement. Established after observing "I can't" attitudes among students at the Riverside School and built around the four Design Thinking phases of "Feel, Imagine, Do, and Share" to cultivate an "I CAN" mindset —which has since expanded to over 60 countries as one of the world's largest child-led change platforms (Kiran, 2009). We adapted DFC into a Place Change Maker (PCM) social-service strategy tailored for college students.

Digital Microscope

In 2015, Kenji Yoshino presented and demonstrated how to create a stand for approximately $10, turning a smartphone into a powerful digital microscope (Yoshino, 2013). Professor

Jiang Hongren of National Taiwan University improved and produced Taiwan's first digital microscope, characterized by its triangular shape (Jiang, 2014). His promotion inspired many teachers and children to adopt this learning tool. This also inspired us to improve the focal length of this type of digital microscope to match the more advanced camera functions of today's smartphones and tablets, and to simplify the materials to a lower cost than Kenji's version, making it more suitable for mass production, which we call the "Maker Microscope." In 2016, we initiated the promotion and implementation of seed teacher workshops (FBI Lab, 2016). In 2024, we expanded this program to primary schools in rural Taiwan, offering the "Microscopic Project – Small Plants, Big Discoveries" workshop. College students will guide primary school students in rural areas to use the Maker Microscope to explore the unique natural environment of their school campuses and create microscopic plant specimens. During the process of studying plants at a microscopic level, primary school students discovered that the microscopic images looked very similar to things they had encountered in their daily lives, such as "bamboo leaves look like bamboo" and "money plant looks like an umbrella." This made us wonder if it was possible to transition from the microscopic to the macroscopic and find world landscapes that resembled the microscopic images.

ChatGPT in Primary School Education

Prior research has shown that primary school students in Selangor, Malaysia, achieved notable gains in grammar, vocabulary, and learning motivation when using ChatGPT to support English writing (Jeyraman et al., 2025), and that students in grades 4–6 at two schools in Uruguay were highly engaged in a social studies course that employed ChatGPT 3.5 to generate teaching materials, diagrams, and exercises tailored to different knowledge levels (Jauhiainen & Garagorry, 2023). Extending these AI-assisted learning approaches, we invited college students to collaborate with primary school students in using GPT to explore connections between microscopic plant observations and real-world landscape maps.

Implement and Practice

Design PCM for USR

We converted the DCF into a PCM model, more suitable for college students. This model empowered the students to believe in "I CAN MAKE AND CHANGE IT." We then completed a social service project at six rural primary schools. Our design involved three steps.

Place Exploration

College students visited rural primary schools, explained the key points of the "Small Plants, Big Discoveries" social practice project, and observed the primary schools' plant ecosystems. Observations and improvement suggestions were recorded for future reference and implementation.

Design Thinking and Making

We train college students to use digital fabrication tools to design and build a microscope. This involves using a laser cutter to create a three-layer microscope stand, along with a small LED desk lamp and a convex lens for magnification. Additionally, we offered "M2M (Micro to Macro) ChatGPT" procedures to explore the connection between microscopic plants and real-world landscapes. Through repeated testing, we eventually developed a set of effective and easy-to-follow practical procedures.

Place Change Practice

College students held the "Small Plants, Big Discoveries" workshops at six rural primary schools, guiding elementary students (DIT) to assemble digital microscopes, explore campus plants, and use ChatGPT for deeper learning as part of the USR initiative. During the workshop, primary school students first assembled their own digital microscopes and used them, together with their phones or tablets, to investigate the microscopic structures of distinctive plants found on their campus. In this hands-on exploration, students expressed surprise and delight. Remarking that "the bamboo leaves look just like bamboo!" and "the pennywort leaves look like umbrellas!" These observations revealed how students naturally connected microscopic images to familiar objects in their daily lives. Building on these discoveries, college students guided the primary school participants in using our "M2M ChatGPT" procedures to operate ChatGPT for AI-assisted analysis. Through AI-based image feature recognition, the students explored visual correspondences between microscopic plant structures and global landscape patterns. With AI support, they identified that the grid-like layout of an automotive factory in an aerial photograph resembled the segmented pattern of bamboo leaves, and that the aerial view of Place Charles in Paris mirrored the umbrella-like form of pennywort leaves. The activity not only enhanced students' digital literacy but also expanded their global awareness in an engaging and imaginative way.

Figure 1 illustrates the educational activities in which college students visited a rural primary school to engage with plant ecology. During the visit, they guided primary school students in exploring the school's ecological environment and demonstrated how to assemble maker microscopes for observing the microscopic world of plants.

Figure 1
The Process of College Students Performing PCM

Design "M2M ChatGPT" Procedures

The primary students' discoveries inspired us to explore how microscopic plants relate to the real world.

We searched several well-known aerial image datasets, including the NASA dataset, the Getty Images dataset, the U.S. Geological Survey Aerial Photography Collection (USGS), iSAID, DOTA, the Inria Aerial Image Labeling Dataset, xView, and others. After extensive searching and testing, we identified NASA's aerial photography archive as the largest and most reliable source, while Getty Images offered a wide range of high-quality landscape photographs. Together, these two collections became the core foundation of our dataset for "From microscopic plant images to real-world landscape photos."

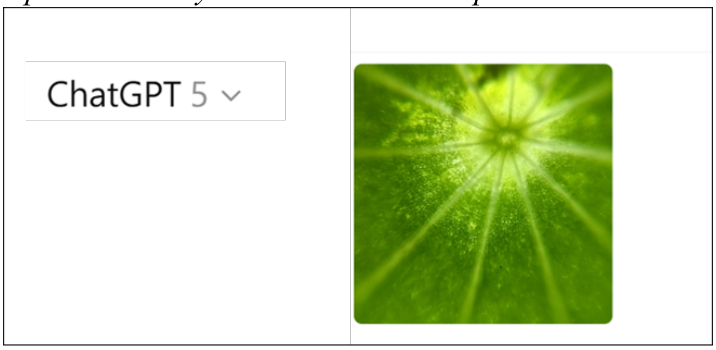
To support this investigation, we provided M2M ChatGPT exploration steps. The steps are as follows:

Step 1. Upload a microscopic plant image to the ChatGPT platform.
Step 2. Ask GPT to identify and describe the five key characteristics of the image.
Step 3. Using these characteristics, ask GPT to search NASA and Getty Images collections for four natural or urban landscape photos—with links—that best match them.
Step 4. Review and analyze the suggested landscape photos to determine how well they align with the microscopic plant's characteristics. If a good match is found, select the most suitable one. If not, use the provided links to explore further or return to Step 2 to refine the description.

Below, we will use pennywort as an example to illustrate the four steps of M2M ChatGPT mentioned above.

Step 1. Upload a pennywort plant microscopic photo on ChatGPT, as shown in Figure 2.

Figure 2
Upload a Pennywort Plant Microscopic Photo on ChatGPT



Step 2. In ChatGPT, we provided the following prompt to extract salient characteristics from the specimen: "Please describe the five features that most closely resemble those observed in this plant's microscopic photo."

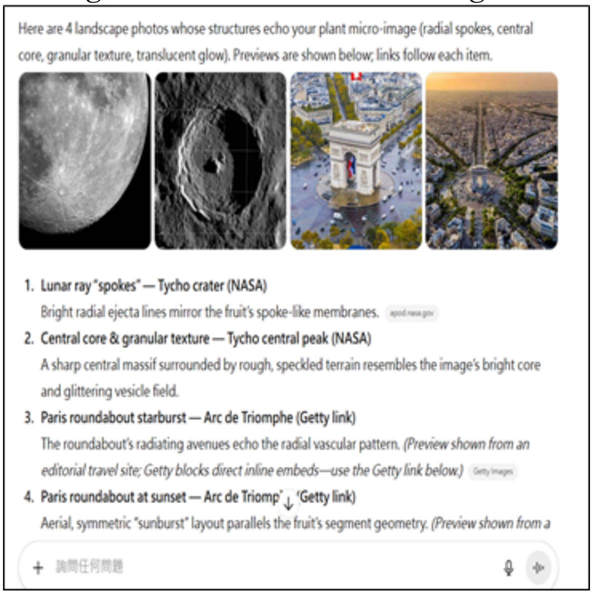
And we got five feature results of pennywort plant microscopic photo:

- Radial Vascular Pattern (like xylem and phloem distribution)
- Parenchyma Cells with High Water Content
- Epidermal Transparency and Light Diffusion
- Secretory Vesicles or Oil Glands (Citrus-like)
- Symmetrical Central Axis (similar to fruit carpel structure)

Step 3. Through ChatGPT, we applied the five features as criteria and prompted the model to search the NASA and Getty Images collections for four best-matching photos, each accompanied by its source link.

Using the selection criteria, we obtained four images: two from NASA and two from Getty Images, each with its associated source link. These results, illustrating the images that most closely correspond to the features identified in the microscopic photo, are shown in Figure 3.

Figure 3
The Figure Contains Two NASA Images and Two Getty Images, With Related Source Links



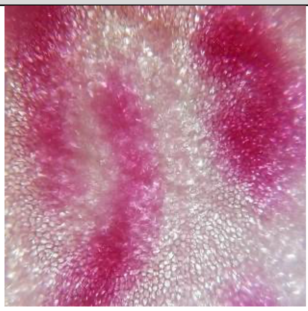
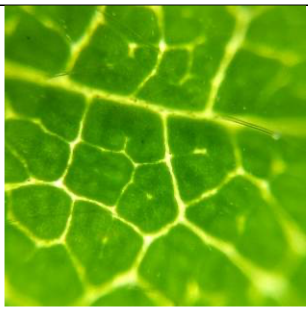
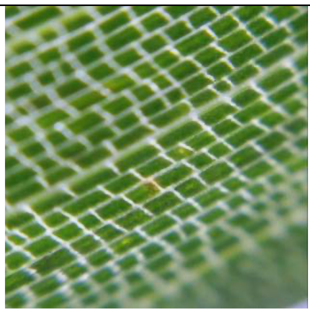
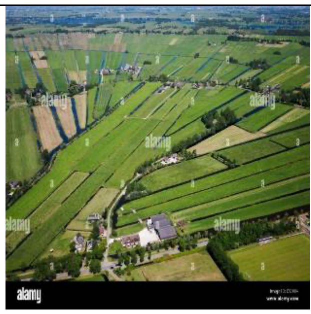
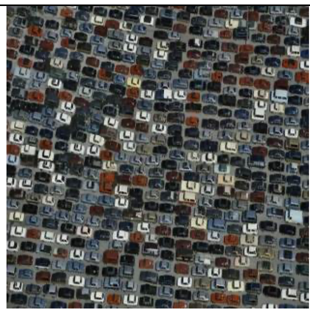
Step 4. Review and analyze the photos and links generated by GPT to identify those that are a good match.

We found and selected "Place Charles in Paris" as the most satisfactory landscape photo to match the microscopic Pennywort, as shown in Figure 4. If we cannot find the matched photo, we can investigate the related link provided by GPT. On the linked webpage, we can find some copyrighted photos that cannot be directly displayed in GPT.

Figure 4
"Place Charles in Paris" Is the Most Suitable Landscape Photo to Pair With Microscopic Pennywort

Following the implementation of our designed "M2M ChatGPT" procedure, students conducted further exploration of additional microscopic leaf images and their corresponding macroscopic aerial photographs. The notable observations and patterns identified during this extended investigation are presented in Table 1.

Table 1
Additional Results From the "M2M ChatGPT" Matching Procedures

microscopic plant image	landscape photo-1	landscape photo-2
 Rhododendron	 China- Badain Jaran Desert	 Republic of Namibia - Salt Lake
 Pennywort	 New Zealand - Mt. Taranaki	 Paris - Place Charles
 Strawberry leaves	 Arctic - Tundra	 Netherlands - Paddy field
 Bamboo leaves	 Netherlands - Polder area and Drainage canal	 America - Parking lots

As students explore using the "M2M ChatGPT" procedures, they witness the continuous collision of cross-domain thinking, demonstrating a learning approach that is not limited to a single type of knowledge, and the final exploration results are surprising. Students also felt that the new AI technologies opened up broader possibilities for exploring knowledge.

Result

Through this project, we successfully brought 38 university students into rural communities as part of PCM's USR initiative, conducting the "Microcosm Project – Small Plants, Big Discoveries" workshops across six primary schools. These activities not only sparked children's curiosity about the ecological world on their campuses but also demonstrated the potential of the AI-driven exploration approach supported by M2M ChatGPT. By linking microscopic plant structures with macro-level landscapes, the project embodied the vision of "Small Plants, Big Discoveries" and illustrated how AI can enrich cross-scale scientific inquiry.

Beyond its educational outcomes, the project further advanced the Sustainable Development Goals of promoting quality education and reducing inequality, while fostering stronger emotional ties between rural students and their hometowns. Moreover, the striking resemblance between magnified plant microstructures and aerial landscape imagery echoes Baudrillard's concept of simulacra (Baudrillard, 1994), revealing how nature generates its own hyperreal reflections. In this interplay, the boundaries between the small and the vast, the original and the representation, become fluid, offering students a unique aesthetic and conceptual lens through which to understand the interconnectedness of the natural world.

Future Work

Building on the success of the "Micro Project – Small Plants, Big Discoveries" workshop, future efforts will focus on expanding its reach to both rural and urban elementary schools to broaden its educational impact. In addition, university students can be encouraged to introduce the workshop to community senior colleges, promoting intergenerational learning, narrative exchange, and meaningful companionship, while enabling older adults to explore new scientific knowledge alongside younger learners.

Looking ahead, we will continue to refine the "M2M Exploration Procedures" learning strategy and conduct systematic surveys and analyses to better understand how primary school students engage with ChatGPT in their learning process. These evaluations will help us assess the effectiveness of AI-supported inquiry learning and guide future improvements.

Acknowledgements

We are deeply grateful to AOI (Applied Optoelectronics, Inc.) for their continued sponsorship and unwavering support of our interdisciplinary education initiatives in rural communities. It is through their generosity that we are able to expand educational opportunities, enhance our programs, and carry out impactful research that benefits society.

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