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## Two's Company, Three's a Crowd? Teacher, Student, & AI Viewpoints on Learner Development in PBL

### STARTING QUESTIONS

For the last few years one of my areas of interest has been understanding learner development in project-based learning (PBL), particularly in a year-long PBL course focused on global-local issues such as the climate crisis, food supply and food waste, forced migration, and minorities.<sup>1</sup> In this course students complete four 7-week projects, in which they research for each project a different local-global issue that interests them, use various sources for their research, keep notes, write a weekly project narrative, and create a final product for a wider audience beyond the class group itself. While following and keeping track of what 15 students are doing for one 7-week project is mostly manageable, it is challenging to hold in view their development from their first projects in April and May to their final projects 6 to 7 months later. Understanding such learner development over the year is thus both intriguing and difficult, raising the question of how to grasp that longer perspective on student development in a way that is trustworthy and that does not take excessive amounts of time. Previously, I would draw on my students' weekly project narratives and discussions with them in class each week. I would also refer to my own notes and reflections, regularly talk with colleagues teaching the PBL course, as well as turn to readings and podcasts about PBL. But in the last year I've also been using generative AI (Google Gemini) to see what kind of post-course perspectives it can provide on learner development in PBL. What might the benefits of using AI to understand learner development in PBL be? What drawbacks might it involve? These are some of the questions that I explore in this short article about arriving at diverse viewpoints on learner development in PBL practices.

### COURSE CONTEXT

Before looking at the specific ways in which I experimented with Gemini (Google, 2024), I'd like to introduce in greater detail the PBL course and the kind of work that students do for their projects. In this course students are required to focus on global issues that interest them and research how such issues impact local communities and people that they know. For each project the students plan and carry out research, using different material, human, and online sources, to gather information and make notes from. Doing visual research in their local communities and talking with "close others" (other students, family members, people in local communities, or local networks that the students belong to) helps the students both personalise and localise their projects, so that they can ideally come to make global, local, and personal connections in their research.

In the final part of each project students create an end-of-project product (e.g., blog post, campaign leaflet, poster, video, or youth magazine article) to reach an imagined audience beyond the class. Figure 1 includes two example posters from student projects in the 2023 academic year that bring together personal, local, and global perspectives on sustainable mobility and the climate crisis.

1. The course website <https://sites.google.com/g.chuo-u.ac.jp/global-issues-resources/home> has links for 18 core global issues.

### Sustainable mobility poster

# Sustainable mobility

#### What's sustainable mobility?

Aims to:

- \* reduce CO2 emissions
- \* improve access to basic transportation
- \* protect human health and the ecosystem

Effective method

#### Using bicycles

Bicycles emit less CO2  
↓  
Environmentally friendly

Holland is known as land of cycling

#### How did Holland get the high quality cycling paths?

- 1. Lack of infrastructure**  
There were few paths for cyclists because Holland had a car-centric policy before World War 2.
- 2. Accidents**  
After 1945, the number of cars increased, so there were many bicycle accidents. 3,300 lives including children were lost in 1971.
- 3. Protests**  
People protested to ask for safe cycling roads.

Holland turned away from a car-centric policy and made a lot of cycling paths.

#### The Global Bicycle Cities Index 2022

It is based on various factors such as safety, the number of accidents and the rate people ride bicycles.

Utrecht was chosen as the top most bicycle-friendly city!!

#### How did the Utrecht become so bicycle friendly city?

Infrastructure of cycling in Utrecht is well developed.

Population in Utrecht is 350,000. One third of population use bicycles on a daily basis.

#### The difference between lanes and paths

Cycle path is a detached roads for cyclists. Cycle lane is on roads that only cyclist use.

#### Bicycle garages

Good points

1. Safe ← no cars in the garage.
2. Durable ← made by concrete, steel and so on.
3. It has the capacity of 12,500 places.

#### Tokyo was ranked 16th bicycle-friendly city in 2019.

#### Personal perspective

I'm afraid to ride a bicycle in Tokyo because of the narrow roads. It is said that roads in Tokyo are not friendly for cycling:

- \* narrow cycle lanes
- \* not safe for cyclists
- \* not enough bicycle garages.

Local change-making is needed!

#### Chuo University, Myogadani

1. Create a bigger bicycle garage
2. Encourage students to use bicycles

#### Bunkyo City, Tokyo

1. Create safer cycling lanes and paths
2. Decrease the number of cars on roads to protect the health of people in Bunkyo City

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### Climate crisis poster

# Climate Crisis

#### What is climate crisis?

It is a serious environmental problem caused by global warming and climate change.

#### Cause

- Use of fossil fuels
- Co2 emissions in daily life

#### Influence

- Intensification of storm
- Acid rain
- Forest fires

#### Current Situation

- Global average surface temperature increased 0.85°C over the period
- Co2 concentration has increased 40% since the Industrial Revolution.
- Global average temperatures increased by 2.6°C ~ 4.8°C

#### Climate Change Performance Index

→ Evaluate and compare national CO2 emissions and climate change prevention policies for the world, which emits more than 90% of CO2

#### Ranking

No.1-3 No country is applicable  
No. 4 Denmark  
No. 5 Sweden

No.50 Japan

#### Climate emergency declaration

→ Declaration to take urgent and aggressive measures against climate change

(Fish Yield) 60% decrease

Recycling rate is 36% (The rate is the highest in Nagasaki Prefecture.)

#### Iki City, Nagasaki

reason Local economic aspect → Fishing is the main industry, which has been hit hard.

Target Virtually zero Co2 emissions by 2050.

Measures ① Utilization of renewable energy.  
② Energy conservation, 4R (Reduce, Reuse, Recycle and Refuse) promotion.

#### Conversation discussion

- ① My father (He live in Gifu until grew up.)  
→ He wasn't aware of any of this when he was little because there were no earth crisis measures in place at the time.
- ② My friend in high school (She volunteers on SDGs)  
→ She said that although knowledge about the global crisis is spreading, there is still a lack of public awareness, such as littering in the ocean.
- ③ My teacher in high school  
→ According to the teacher, the school does the trash at cultural festivals if it is not sorted, turns off the lights in the hallways during the day, and takes other thorough measures.

#### Reference

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- いわき地域環境科学界 (Date unknown) Sweden's Measures to Prevent Global Warming <http://www.essid.org/relay-essay-26.html>

Figure 1. Example student posters about global-local issues<sup>2</sup>

An important part of each project is the weekly project narrative that students write. Here they are asked to tell the story of their unfolding projects by focusing, for example, on their goals, what they are researching and find interesting, their discussions with other students in class, difficulties they face, and/or new questions and puzzles they have as their projects develop, and their next steps. In

2. For other examples of student PBL processes and products from this course, see the PBL Resources website for this course: <https://sites.google.com/g.chuo-u.ac.jp/resources-for-pbl/home>.

the 2023 year, with a class of 15 first-year students, the project narrative guidelines that I gave students required them to write at least 120 words a week in their first project of the year, which increased to 150 words minimum for Projects 2 and 3, and to 180 or more words for Project 4.

As the students' project narratives from Projects 1 and 4 were the input that I used with Gemini, let's look briefly at two pairs of narratives from Projects 1 and 4 to get some general idea of the students' writing at the beginning and end of the year.

The first two examples show student project narratives from Week 2 of Project 1 for two students, Akiko and Emi (assigned aliases).

### **Project Narrative 1 Week 2 Entry - Akiko (147 words)**

My goal in today's class was to convey to my partner the information I have researched about the climate crisis, and to ask what my partner has researched. I think this is important for acquiring new knowledge about the climate crisis by learning more about it and knowing what other people have researched.

I explored what the climate crisis is, what the greenhouse effect is, and various impacts of the climate crisis. What I found particularly interesting is that the term "climate crisis" is now being used instead of "climate change" to describe a more tense situation. Also, what really surprised me was that my partner said that the world is now 1.9°C warmer than it was in the 19th century.

Next, I would like to know what kind of efforts are being made to deal with the climate crisis, so I will do some research.

### **Project Narrative 1 Week 2 Entry - Emi (132 words)**

The goal of the previous class was to find connections with other students' research. I had thought that conflict was the only major cause of migration, but after listening to other students' research and learning how climate change is a serious problem we face, I looked into the relationship with migration and found that it is more deeply connected than I had thought.

What surprised me the most is that climate change could force 216 million people to migrate domestically by 2050.

I was also looking into the number of internally displaced persons (IDPs) and was shocked to see that the number would more than quadruple in just 30 years, compared to 532,000 in 2021.

My next focus will be on climate change migration and what Japan is doing about it.

The second pair of examples displays project narratives from Week 5 (Akiko) and Week 3 (Emi) of Project 4 for the same two students.

### **Project Narrative 4 Week 5 Entry - Akiko (196 words)**

In today's class my interaction goals are to talk with my friends actively and to share my own Conversation-discussions because I want to improve my talking skills.

My knowledge goal is to understand my partner's research in this project because I want to learn some new phrases and knowledge. As for my language goal, I'm going to try to talk in English as much as possible because I want to develop my English speaking skills. I want to be able to speak English more fluently.

I had a conversation discussion last week and interviewed three people: my mother, my cousin's mother, and my grandmother. It was great to hear in detail about the

energy saving methods they use in their own homes and individuals, as well as the energy resource initiatives being carried out in the places they live and the companies they work for. It was interesting to learn that in my hometown, power generation is being done using heat from hot springs.

I also created the first draft of the poster, using many visual elements to make it easier for viewers to understand. I would like to continue working on making even better posters.

### Project Narrative 4 Week 3 Entry - Emi (267 words)

In today's class, my goal is to talk fluently with my classmates about what they want to research and share with them about my interests.

My knowledge goals are to know about my classmate's topic because I want to expand my knowledge of SDGs and use their knowledge for my work today's work.

As for my language goals are to understand what X said in English and use new words when I speak to my classmates.

Last week I researched the Academic Humankind Pavilion<sup>3</sup> case and the stolen remains. As a result, I learned a lot about the problems faced by the Ainu and other ethnic minorities. In Project 4, I want to understand these problems a little better and learn more about the people who are trying to solve them.

This week I decided to research the history of Ainu more, especially the history of why Ainu became a minority. This is because last week I researched controversial history in a broad way, so I want to know the details of the history.

When I researched history I found a person who worked hard to solve the issues. He is Shigeru Kayano. He is from Nibutani. Also he is the first member of the Ainu Nation to serve in the Diet.

One of the goals of my project is to know about him and his work. I also have another goal for my project. It is to find out who tried to solve the Ainu bones problem. However, not only about historical ways, but also about their culture and people who try to promote that culture.

We can see that the two students' project narratives increase in length and complexity from Project 1 to Project 4. Akiko and Emi are each focused in their Project 1 entries on key concepts to do with the global-local issue that they are researching. Akiko's narrative shows how she is becoming familiar in English with basic aspects of the climate crisis (and the shift in terminology from "climate change" to "climate crisis"). She also articulates a general goal of wanting to find out about actions being taken to deal with climate change. On the other hand, Emi's Project 1 narrative entry records the fact that she learnt from other students in the previous class, implying that this led her to look into general connections between climate crisis and (forced) migration and displacement at a global level. Her next step is to find out about climate change migration at a national level in Japan. In contrast, in her longer Project 4 entry, Akiko focuses more on communicating her research and building understanding with other students; she also highlights clearly the localisation of her research from having conversation-discussions with different family members and learning about measures being taken in her local community. Similarly, Emi's Project 4 narrative entry is noticeably longer. Here, Emi expresses her goals more specifically, before going into extended detail about

3. By "Academic Humankind Pavilion" Emi is referring to the Jinruikan Incident or 人類館事件 / 学術人類館事件, an exhibition held in Osaka from March to July 1903, in which Ainu people from Hokkaido, and from Taiwan and Okinawa -- as well as India, Malaysia, and other parts of the world --- were put on public display (see Japanese Wiki Corpus, n.d., and The Mainichi, 2021, for more detailed accounts).

understanding local Ainu rights activists and issues. As with Akiko, localisation appears to be much more salient in Emi's Project 4 narrative than in the first project.

These examples help to illustrate some basic differences (and overlaps) between student project narratives at the start and end of the 2023 academic year. What, though, would Gemini make of the students' development between Project 1 and Project 4? This was what I was interested in finding out by taking a retrospective AI look, so to speak, several months after the 2023 course had finished.

## WORKING WITH GEMINI

Gemini is a form of AI that can recognise, analyse, and produce text, among other tasks (such as translation, for example). It is known as a "large language model" (LLM) because it has been trained on vast amounts of data, and, like the better known ChatGPT (OpenAI, 2022), it produces responses with remarkable speed. To prepare the students' project narratives for Gemini, I deleted all personal names and combined their Project 1 and 4 narratives into two single texts per student. Each combined text included 7 entries (assuming there were no absences). The students' combined Project 1 narratives averaged 1278 words in length, ranging from 905 to 2253 words, while their composite Project 4 narratives had an average word count of 1449 (range 982-2118 words). Intent on limiting the amount of information that Gemini would produce, through trial and error over about 10 iterations, I came to settle on the following three questions for eliciting different perspectives about the students' Projects 1 and 4 narratives:

This student is doing a first-year Project-Based Learning course in English on global-local issues. The course involves four 7-week projects.

**Q1** *Identify four significant differences (significant in the case of this student) in the way that the student does, and reflects on, the first 7-week project of the academic year (see Project 1 Narrative) and their last 7-week project of the year (see Project 4 Narrative). Explain your response in 50 words maximum, and at the end of your response, summarise your response in 4 keywords/key phrases.*

**Q2** *What is the key success of this student in terms of project-based learning? (Maximum 20 words)*

**Q3** *What is surprising about this student's development? Why? (Maximum 20 words)*

**Project 1 Narrative** *(combined project narrative inserted here)*

**Project 4 Narrative** *(combined project narrative inserted here)*

After the third question, I then inserted within the two sets of brackets the combined text for a particular student's Project 1 and 4 narratives, before pressing the "Submit" arrow in Gemini. Once repeated for each student, I had, within several minutes, 15 individual analyses from Gemini of the students' project narratives. For reasons of space I will focus mostly on Question 1 in what follows.

## EXAMPLE ANALYSIS BY GEMINI

To understand the kind of analysis that Gemini made, let's have a look at its respective responses to the combined project narratives of Akiko and Emi, the two students whose example project narrative entries were presented above. Gemini's analysis for each of the three questions is shown in Table 1 (Akiko) and Table 2 (Emi).

**Table 1. Gemini’s Analysis of Akiko’s Project 1 and Project 4 narratives.**

<b>Q1: Four Differences</b>	<ul style="list-style-type: none"> <li>* <b>Focus:</b> Shifted from broad global issues (climate crisis) to a specific local topic (energy saving methods).</li> <li>* <b>Research Depth:</b> Increased focus on details and local initiatives. (Started with general info, then local companies)</li> <li>* <b>Communication Goals:</b> Evolved from basic information exchange to active discussions and interviews.</li> <li>* <b>Presentation:</b> Developed skills in creating visuals for easier understanding (graphs, posters).</li> </ul>
<b>Key Phrases:</b>	Increased Focus, Deeper Research, Active Communication, Visual Learning Aids
<b>Q2: Key Success</b>	<b>Self-Directed Learning:</b> The student demonstrated increasing ability to set goals, conduct research, and present findings independently.
<b>Q3: Surprise</b>	<b>Local Connection:</b> The student’s growing interest in connecting global issues to their own hometown was unexpected. (Started with global problem, ended with local solutions) (Google, 2024)

**Table 2. Gemini’s Analysis of Emi’s Project 1 and Project 4 narratives.**

<b>Q1: Four Significant Differences</b>	<ol style="list-style-type: none"> <li>1. <b>Topic Focus:</b> In Project 1, the student focused on general migration issues. In Project 4, they focused on a specific minority group, the Ainu people.</li> <li>2. <b>Local Connection:</b> In Project 1, the student struggled to find a local connection. In Project 4, they actively sought local perspectives through conversations with friends and family.</li> <li>3. <b>Personal Voice:</b> In Project 1, the student wished they used a more personal voice. In Project 4, they expressed their own opinions and connected with the topic on a personal level.</li> <li>4. <b>Knowledge Goals:</b> In Project 1, knowledge goals focused on understanding migration. In Project 4, the student broadened their knowledge goals to include SDGs (Sustainable Development Goals) and minority rights.</li> </ol>
<b>Key Phrases:</b>	Topic Focus, Local Connection, Personal Voice, Knowledge Goals
<b>Q2: Key Success</b>	The student’s key success is developing a stronger ability to <b>connect research with personal experience and local perspectives.</b>
<b>Q3: Surprise</b>	It’s surprising that the student initially struggled with local connections (Project 1) but actively sought them out in Project 4. This suggests significant <b>growth in self-directed learning.</b> (Google, 2024)

What struck me was not so much the bewildering speed with which Gemini did this analysis (literally a few seconds), but rather that Gemini seemed to be picking up on resonant shifts in either student’s PBL practices. In both cases the perspectives offered by Gemini were concise, limited in length, and generally in line with what I had noted earlier from looking at their example Project 1 and Project 4 narrative entries. While the Gemini perspectives featured phrases (such as “*Local Connection*,” “*Personal Voice*,” “*connected research with personal experience*”) which were very much part of the discourse of the class, some of the terms it used (for example, “*developed skills in creating visuals*,” “*Visual Learning Aids*,” and “*Topic Focus*”) were not how I or the students’ talked or wrote about their projects.

It was intriguing, then, that, across all 15 students, the accumulated perspectives that Gemini identified formed - despite some discrepancies - a more or less credible web of PBL themes in this particular course. On the one hand, the themes might not always be exactly the way that I or the students

would put things ourselves; on the other, the Gemini analysis helped to bring into view aspects of the students' development that might otherwise not have been so visible for me.

### **BUILDING ON THE GEMINI ANALYSIS**

To identify key themes in student development from Project 1 to Project 4, I analysed Gemini's responses to Question 1 by counting, sorting, and grouping significant differences and key phrases across all the students. This took me to seven key themes (worded by me) as shown in Table 3 on the left. In the right column, I have included a representative phrase from the Gemini analysis that captures the meaning of each of the themes.

**Table 3. Key Themes in Student Development from Project 1 to Project 4.**

Theme	Meaning
<b>From general/global to specific/local focus</b>	"Shifted from broad global issues (climate crisis) to a specific local topic - energy saving methods"
<b>Greater research depth</b>	"Increased focus on details and local initiatives"
<b>Diversified sources</b>	"P1 Internet research ... P4 interviews with family and friends, academic articles & organization websites"
<b>Stronger local perspectives</b>	"In P1, the student struggled to find a local connection. In P4, they actively sought local perspectives through conversations with friends and family."
<b>More personal voice</b>	"In Project 1, the student wished they used a more personal voice. In Project 4, they expressed their own opinions and connected with the topic on a personal level."
<b>Greater range of communication modes</b>	"Evolved from basic information exchange to active discussions and interviews"
<b>Greater creative control</b>	"Developed skills in creating visuals for easier understanding (graphs, posters)"

Put together, these thematic perspectives suggest a repertoire of key macro-processes that students engage with and develop in this one-year PBL course:

*In doing projects on global-local issues students typically move from general-global to specific-local connections by diversifying their information sources and researching in greater depth and detail.*

*As they do this, they develop stronger local perspectives and express their understanding in a more personal voice.*

*To achieve this, over time, they not only learn to use a greater range of modes to communicate their knowledge, but also exercise greater creative control in the products that they produce.*

What I find interesting is that this composite view offers to some extent a new – at least partially different – sense of learner development in PBL as a multifaceted progression for students in developing and integrating their individual "project repertoires" over the course of a year. The repertoire metaphor entails understanding PBL learner development as developing a wide range of interconnected individualised and collective abilities and practices over time. In turn this may let us see such learner development as dynamic and incremental, ultimately a performance of engaging creatively (and critically? - see below) with the world. That said, it is important to emphasise that such a 7-part repertoire is by no means complete! For example, there is no mention of the development of critical thinking or criticality, and that may mean that this is an area to attend to differently in future PBL classes. The whole question of students' development of their PBL practices is evidently far more complex. It is good to remember that what we have been looking at



here is, after all, derived from analysis of student project narratives. This takes no account of how students explain and discuss their projects with each other in class, combine their use of English and Japanese and translanguaging, search for and select online information resources, plan and carry out conversation-discussions with close others outside the class, or conceptualise and create the different products that they produce at the end of a project. Yet, it does bring into focus some perspectives that may have been previously hidden.

Doing (and writing about) this small-scale experiment with Gemini on exploring diverse viewpoints about learner development in PBL practices has been useful in helping me grasp some alternative perspectives on learner development within PBL. Gemini acted as some kind of research interlocutor or research partner (Edmett et al., 2024; Pack & Maloney, 2023), whose analyses offered a slightly different point of view, nudging me towards the metaphor of students developing their “project repertoires” over time as a fresh way of thinking about learner development within PBL. Importantly, the analysis that Gemini provided included some discrepancies. This underlines the constant need to verify AI texts, analyses, and responses and to question the inevitable bias and potential hallucinations (see Lin et al., 2024) that such data include.

Responding to a near-final draft of this short article, one of the *Learning Learning* editors commented: “I wonder also whether it raises the issue of analytical sequence: AI analysis > researcher analysis; or vice versa? In other words, would it be better to use the AI analysis as a way of corroborating my analysis, rather than relying on the AI analysis from the start?” It’s a great question, and another part of the conversations about teachers using AI for practitioner research, as well as about students using AI in different courses, including PBL. In my view there is no fixed answer: It is an issue that we need to take up and discuss further, with other teachers, our students, and ... with the LLM tools that we use, too. “That question highlights a crucial point: the role of AI in research. It’s not a simple choice. Using AI for corroboration, after researcher analysis, may offer a valuable check, but exploring AI’s insights first can also reveal unexpected patterns. There is not a single right way to do it.” (Google, 2025) was Gemini’s response when I asked it: “What is your view about this question? Respond in 30 words or so.”! Through doing this small-scale inquiry I now tend - at least for the time being - to see Gemini as particularly useful for the dissonant, unexpected perspectives that it offers, rather than for its confirmations, and those potentially occur at any point in the process it seems to me.

All in all, then, doing this kind of low-stakes longitudinal exploration can help us as teachers develop our own AI literacy in areas that interest us, as well as become sensitised to new diversifying perspectives on our students’ development over time.

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