

Nudging Lifelong Learning and Reflective Thinking in Engineering Students Utilizing LinkedIn Learning

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Abstract—Most engineering and technology-focused program curricula are firmly fixated on the required technical skills to meet the profession’s needs. However, in today’s rapidly changing, globalized world, engineers and technologists need more than technical competencies to meet the requirements of their professional work. This work illustrates how the LinkedIn Learning (LiL) platform was used as a “learning partner” to complement undergraduate engineering technology management courses to enrich reflective thinking and nudge lifelong learning tendencies. The rationale for integrating LiL into the course framework is examined, including study design and survey results. Summary research indicates that students appreciated the LiL coursework assignments. Most respondents perceived the LiL courses increased their knowledge and skills in the subject matter. The study illustrated a movement towards self-determined learning behaviour and improved reflective capabilities.

Keywords—engineering education, reflective thinking, digital learning tools, summarization, asynchronous learning, engineering management

1 Introduction

This paper illustrates how the LinkedIn Learning (LiL) platform was used as a “learning partner” to complement two engineering management courses’ content to enrich metacognition reflection outcomes and nudge students toward lifelong learning tendencies. Research on the contemplative dimension of learning and the importance of lifelong learning for engineering students is surveyed. The rationale behind integrating LiL as a learning partner and how the curated third-party learning content was interwoven asynchronously into the course framework are discussed. The study also provides research on the student’s perspective on using LiL as a complementary learning asset, including limitations.

Let’s begin by explaining the LiL platform and its use in higher education. LiL is a self-service curated digital learning platform owned and operated by Microsoft Corp. with over 16,000+ video tutorials (VTs) in multiple languages within the topic categories of business, creativity, and technology [1]. Microsoft promotes LiL enterprise licenses

to teams, companies, and organizations who wish to access the learning platform. As part of its Career KickStart strategy, the Ontario government funded access to the LiL platform on behalf of all higher education institutions in the province from 2017 to 2020 [2]. Building on this opportunity, McMaster University recently negotiated and secured a multi-year institutional enterprise license, allowing free access to LiL for all active students, faculty, and staff. This institutional access enabled the author to integrate LiL VT assets into two engineering management courses.

2 Learning perspectives

2.1 Metacognitive learning

Metacognition is thinking about one's thinking. More precisely, it refers to the processes used to plan, monitor, and assess one's understanding and performance. Metacognition includes a critical awareness of a) one's thinking and learning and b) oneself as a thinker and learner [3]. When learners engage in metacognitive reflection, it contributes to helping them understand what they have learned and transferring new knowledge into other contextual situations.

Most engineering and technology-focused program curricula are firmly fixated on the required technical skills to meet the profession's needs. However, in today's rapidly changing, globalized world, engineers and technologists need more than technical competencies to meet the requirements of their professional work. Reflection, or the contemplative dimension of personal learning, has not historically received much attention in engineering education, despite calls for more significant consideration of using reflection. For example, in a National Academies piece calling for curricular change in undergraduate engineering, Ambrose [4] suggests that learning happens with reflection, and instructors should "provide structured opportunities to ensure that reflection occurs." Indeed, published evidence indicates that students reflecting on their learning enhance metacognition and learner agency [5, 6, 7].

Although it is not mainstream, reflective practice is not new in engineering education. Many have drawn on Schon's [8] work on the "reflective practitioner" and how "reflection-in-action" and "reflection-on-action" can influence professional education [9, 10, 11, 12, 13]. Other researchers have emphasized the value of reflective thinking and underlined that students do not automatically learn from experience [14]. Instead, reflection as an intentional and dialectical way of thinking about an experience to inform future actions should be encouraged in engineering education [15].

Both technical skills and metacognitive development are essential for achieving the goals of a "whole" engineer education, but the latter is often shortchanged or not deliberately explored. It's usually only implicitly hinted at in teaching, if mentioned at all. One reason is that facts, technical knowledge, and skills are easier to measure, but reflecting on learning is much harder to assess. However, if you ask employers what they seek in an engineering graduate, they often state elements related to the candidate's learning character. They are not looking for applicants solely focused on technical abilities but individuals who are more metacognitively aware and reflect on their process for achieving specific results within organizational parameters.

2.2 Lifelong learning

The research literature on lifelong learning has grown exponentially in the past few decades [16]. The emergence of governmental and economic policies promoting lifelong learning, and the proliferation of curated digital learning platforms has ushered in a new era in which education is ongoing. Changes in technologies, increasing demands of the new economy, fierce global competition, and the growth of increasingly well-informed and well-educated consumers create new markets for the education sector [17]. Lifelong learning is, thus, becoming a sector of mass participation, particularly as people in developing countries realize that their financial survival depends on it.

For this reason, the Government of Ontario's Career KickStart strategy has emphasized the issue of lifelong learning [2]. According to Knapper and Cropley [18], lifelong learners are active learners who plan and assess knowledge rather than wait for others to prepare for them. They can learn from their peers, teachers, and mentors in formal and informal settings. They can apply their knowledge to different contexts and are astute users of different learning strategies for unique situations. This self-directed learning mindset is imperative in this era of unprecedented rapid and fundamental change, in which some graduates will never directly use the disciplinary knowledge they acquired in university [19].

Today's engineering technology professionals work in a continual change and innovation ecosystem. To meet this challenge head-on and remain competitive, technical professionals must be content experts, highly skilled problem solvers, team players, and lifelong learners [20]. Therefore, one of the critical issues for higher education should be whether students are developing a belief and commitment to lifelong learning. Nudging students to adopt early habits and tools for lifelong learning is something we need to help learners embrace before they leave our institutions. One way to enhance this awareness is to interact with curated learning platforms, such as LiL, typically outside university parameters. Indeed, as educators, we should encourage metacognitive reflection and endeavour to nudge students towards lifelong learning tendencies to achieve the ambitions of "whole" engineering education.

3 The study and results

3.1 The coursework

The undergraduate engineering technology programs within McMaster University W Booth School of Engineering Practice and Technology integrate technical comprehension with cross-boundary skills in business and management. The author integrated LiL into two engineering management courses, a fourth-year Entrepreneurial Thinking and Innovation course and a second-year Management Principles course. Both courses had students enrolled across the program streams of Automotive and Vehicle Engineering Technology, Biotechnology, and Automation Engineering Technology.

The Entrepreneurial Thinking and Innovation course introduces students to the interrelationship of entrepreneurial thinking and innovation at industrial and individual levels. It is project-based learning (PBL) course focused on developing an enterprise-level

business case for a real organizational opportunity. The Management Principles course, on the other hand, is a fundamentals course examining the management principles of planning, organizing, leading, and controlling in technology organizations.

In both courses, students were assigned to watch three separate LiL video courses throughout the term and complete a written VT Report assignment for each. The report was limited to 1500 words (3 pages single-spaced) with two parts. In Part A, the students were required to summarize what they considered the most important ideas/concepts from the VT, written in a straightforward narrative that assumed the “reader” had not watched the LiL VT course material. The reflection component of the assignment was Part B. Learners were required to explain and articulate multiple connections between what they comprehended from watching the VT and connect it to prior learning in other courses or life/work experiences and future goals. Students were provided but were not limited to the following questions to help guide and facilitate their reflection process:

- What was the most important part of this video tutorial for me? Why?
- What new skill or “piece” of knowledge did I acquire after the video tutorial? Why?
- I could see myself using this knowledge in my course or a future (or previous) workplace role. Why?
- After the video tutorial, I will change _____. Why?
- Now I understand _____ after watching the video tutorial. How will this new understanding be helpful for you?

The VT reports were worth 15% of the final course grade. However, the worth of each assignment is scaffolded, starting at 3% for the first report, 5% for the second, and 7% for the third. A lower percentage assigned to initial reports enabled students to practice and learn from their shortcomings. Each student was provided extensive written feedback from the Teaching Assistants and allocated a standardized rubric score. Grading was completed promptly, so students could incorporate the feedback to enhance their performance before submitting the subsequent VT assignment.

3.2 The assignment rationale

The author found LiL an efficient way to reinforce industry-specific approaches and bring complementary skill attainment into the course learning environment. It also allowed students to experience other voices through the LiL course instructors. A clear pedagogical advantage exists when students can access experts through platforms that ensure a rigorous talent selection process, such as LiL, versus the sometimes-dubious origins of many open-source videos.

Being able to summarize has become a skill that is more important than ever in today’s information overflow. Learning how to summarize helps learners understand the novel and challenging subject matter, which they can apply to solving problems or developing a project. According to Kintsch, Eileen et al. [21], summarization has several advantages: promoting deeper thinking and analysis to select the relevant information; teaching essential study skills, such as identifying important content and separating main ideas from details. Summarizing is a way to develop a solid understanding of complex material and articulate one’s understanding to be shared

with others. Converting the most important information concisely and accurately without wasting time or causing misunderstandings is a skill many engineering managers prize in their employees, and engineers appreciate their supervisors [22].

However, the fundamental pedagogical rationale for incorporating coursework requiring students to interact with the LiL platform was to encourage the development of contemplative learning and nudge lifelong learning tendencies. The work presents an innovative undergraduate training experience using LiL as a “learning partner” in two undergraduate engineering technology management courses. Analyzing students’ perceptions and the impact on knowledge and skills allows for an understanding of the effects of self-reflection and self-determined learning in the short-term. The work is positioned as a forerunner concerning improving the university engineering education models to prepare students for today’s dynamic workplaces.

3.3 Student perceptions

At the end of the term, students were invited to complete a short online questionnaire to explore their perceptions about the VT Report assignments and their experience using the LiL platform. The survey was entirely anonymous, and participation was optional. The questionnaire consisted of eight closed-ended question items. The first two dichotomous questions explored their use of the LiL platform for academic credit and usability. The following four questions surveyed their perception of the knowledge and skills gained in the subject matter from each of the three LiL courses. These questions used a five-point Likert scale, ranging from (1) strongly agree, (2) agree, (3) neutral, (4) disagree, and (5) strongly disagree, along with not applicable option. The final two questions probed the likelihood of the students using the LiL platform in the future and sharing their digital certificates of achievement on their social media platforms. These final two questions used a five-point Likert scale for likelihood, ranging from (1) extremely likely, (2) very likely, (3) moderately likely, (4) slightly likely, and (5) not at all likely.

Surveys were conducted across three different years in two separate courses — the first measured students in a fourth-year Entrepreneurial Thinking & Innovation course in the fall 2019 semester. There were 85 students enrolled across two sections that the author taught. The overall participation rate was 44.7%, with 38(n) students completing the survey. The other course was a second-year Management Principles course delivered in the winter semester of 2021. There were 250 students enrolled across four sections that the author taught. The overall participation rate was 34.4%, with 86(n) students completing the survey. Lastly, the Entrepreneurial Thinking & Innovation course was surveyed again in the winter 2022 semester. There were 118 students enrolled across two sections that the author taught. The overall participation rate for this cohort was 23.7%, with 28(n) students completing the survey. The questionnaire results indicated that students overwhelmingly felt the LiL platform was easy to use. The assigned LiL VTs were well received, and between the three surveys, there was an increased interest in using LiL for self-directed learning in the future.

Table 1 is the results from the first survey question, “Was this the first time you have used the LiL platform as part of a graded assignment in a university course?” For the most part, this was the first time students had used LiL for a graded assignment

in their courses. In 2019, a small cohort of students used LiL in another technical class, which would account for the 3% answering no to the question. The no response increased slightly in 2021, as more instructors within the school incorporated LiL into their courses during the switch to online instruction during the COVID-19 pandemic. The adoption of the LiL increased by 2022, with 29% of students indicating they had used it as part of their university education. This suggests that faculty members increased their use of LiL to complement their virtual course instruction during the pandemic.

Table 1. LinkedIn learning usage within academic courses

	Entrepreneurial Thinking (F2019)	Management Principles (W2021)	Entrepreneurial Thinking (W2022)
Yes	97%	91%	71%
No	3%	9%	29%

Table 2 illustrates the results from the second question, “Was the LinkedIn Learning platform easy to use?” Again, most students indicated that the LiL was easy to navigate. One of the contributing factors to the higher percentage in the “somewhat” category in the 2019 survey was that some students had challenges with the export functionality of the notebook feature within LiL that allowed users to take notes within a course while watching. The problem was detected after the first VT report assignment. Subsequently, the instructor encouraged the students not to use the notebook feature within LiL and to create summary notes outside the platform to reduce difficulties. The most likely reason for fewer problems with the LiL platform from the 2021 and 2022 surveys was that students were exploring LiL for personal use and becoming more adept at navigating online technology platforms due to the mandatory virtual classes during the pandemic.

Table 2. Ease of use of the LinkedIn learning platform

	Entrepreneurial Thinking (F2019)	Management Principles (W2021)	Entrepreneurial Thinking (W2022)
Yes	87%	95%	93%
Somewhat	13%	5%	7%
No	0%	0%	0%

Figure 1 depicts the four items that dealt with the educational value of the LiL VTs in the F2019 Entrepreneurial Thinking & Innovation course. The students perceived the grading criteria positively for the VT Report assignments. Most students concurred that the first two LiL VTs offered educational value. For both these LiL courses, 79% agreed or strongly agreed that the LiL course increased their knowledge and skills in the subject matter presented. Sixty-eight percent perceived that the third LiL VT, “Presenting as a Team,” was not as valuable in enhancing their knowledge and skills. Anecdotally, students believed they already had sufficient experience presenting, given they were seniors, so this LiL course content was allegedly less valuable from their perspective.

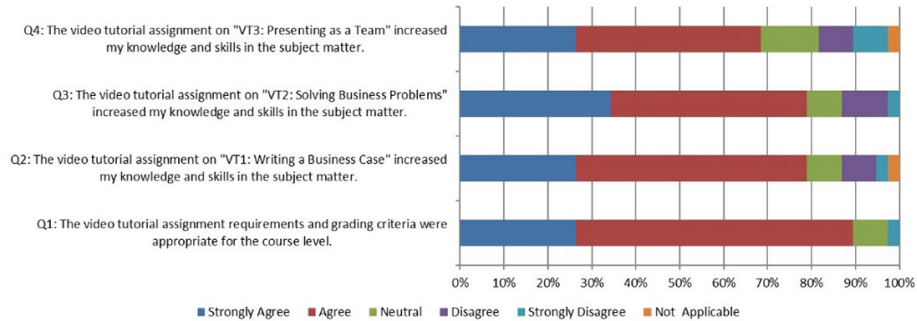


Fig. 1. Descriptive F2019 survey results for the LiL educational value in the entrepreneurial thinking & innovation course

Figure 2 depicts the four items that dealt with the educational value of the LiL VTs in the W2021 Management Principles course. Again, the students generally perceived the grading criteria positively for the VT Report assignments. Most students surveyed indicated that all three LiL VTs offered educational value. For the VT on “Being an Effective Team Member,” 88% agreed or strongly agreed that the LiL course increased their knowledge and skills in the subject matter. Just over 89% perceived the “Giving and Receiving Feedback,” as valuable, and the third LiL VT, “Management Foundations,” just shy of 92% agreed or strongly agreed it enhanced their knowledge and skills in the subject matter.

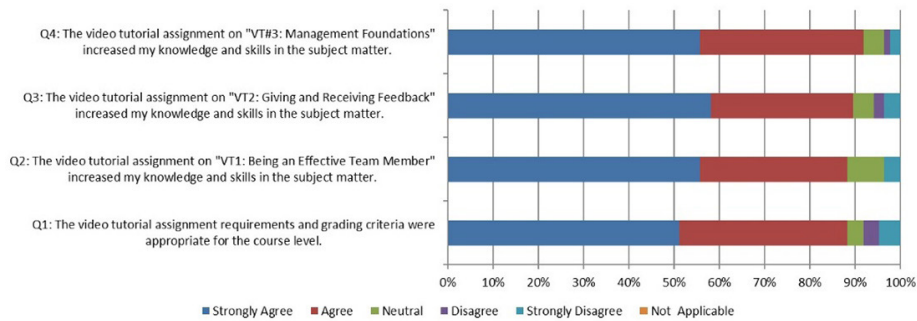


Fig. 2. Descriptive W2021 survey results for the LiL educational value in the management principles course

Figure 3 depicts the four items that dealt with the educational value of the LiL VTs in the W2022 Entrepreneurial Thinking & Innovation course. Again, students perceived the grading criteria positively, and all the VT Report assignments were useful in enhancing their learning. In the first two LiL courses, 93% and 89% agreed or strongly agreed that the courses increased their knowledge and skills in the subject matter. The third LiL VT, “Become an Entrepreneur Inside a Company,” replaced “Presenting as a Team,” leading to an increase of 82% agreeing or strongly agreeing of perceived educational value compared to the F2019 rate of 68%.

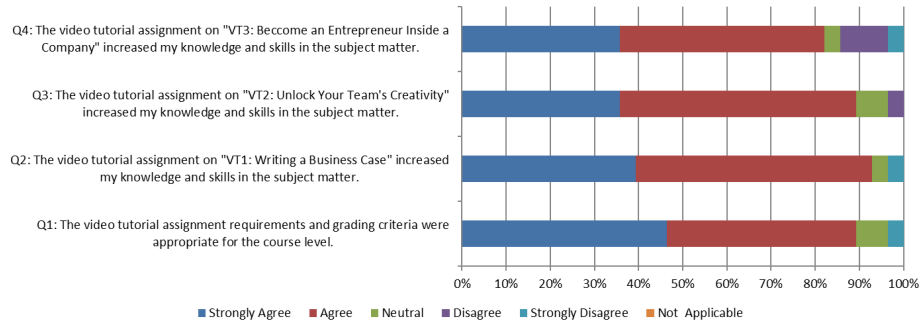


Fig. 3. Descriptive W2022 survey results for the LiL educational value in the entrepreneurial thinking & innovation course

Table 3 displays the results from the seventh survey item focused on the tendency to use the LiL platform in the future. This question aimed to validate whether the nudge toward lifelong learning predilection was beginning to take hold. In the 2019 survey, 31.6% indicated they were extremely likely or very likely to continue using LiL independently. Conversely, this measure rose to 47.7% in 2021 by survey respondents. The 2021 students exemplified a positive shift towards self-determined learning behaviour in the short term compared to the 2019 respondents. However, in the 2022 survey, there was a decline, with 39.3% indicating they were extremely likely or very likely to continue using LiL independently. It's still a positive indicator for learner agency; however, this decline compared to 2021 may imply online learner fatigue by the respondents because of the imposed virtual instruction during the pandemic.

Table 3. Future use of the LinkedIn learning platform

	Entrepreneurial Thinking (F2019)	Management Principles (W2021)	Entrepreneurial Thinking (W2022)
Extremely Likely	10.6%	18.6%	17.9%
Very Likely	21.1%	29.1%	21.4%
Moderately Likely	36.8%	34.9%	39.3%
Slightly Likely	18.4%	12.7%	21.4%
Not at all Likely	13.2%	4.7%	0%

The VT Report assignment deliverables clarified that a digital certificate of achievement would be awarded to students when they completed each LiL course. They could publish this digital certificate on their LinkedIn professional profile to display to potential employers and other career influencers. Table 4 indicates the respondent's likelihood of exhibiting their digital certificates. In the 2019 survey, 32% indicated they were extremely or very likely to display their earned LiL course digital certificate. The 2021 survey revealed that 55% of respondents were extremely or very likely to exhibit their digital certificates. Given that the 2021 students were sophomores, this positive difference could be rationalized because they wanted to enhance their professional profile to help secure a future paid workplace internship, a requirement for all students in the W Booth School. Forty percent of the respondents in the senior course in 2022

indicated they would exhibit their digital certifications, which was an upward trend compared to the 2019 cohort in the identical course.

Table 4. Likelihood of displaying LinkedIn learning digital certificate of achievement

	Entrepreneurial Thinking (F2019)	Management Principles (W2021)	Entrepreneurial Thinking (W2022)
Extremely Likely	13%	25%	11%
Very Likely	19%	30%	29%
Moderately Likely	24%	29%	21%
Slightly Likely	21%	7%	18%
Not at all Likely	18%	7%	18%
Unaware of Certificate	5%	2%	3%

3.4 Student reflection performance

As stated in section 3.1, students were required to explain and articulate multiple connections between what they comprehended from watching the LiL VT course and connect it to prior learning in other courses or life/work experiences and future goals. This reflective exercise aimed to help students enhance metacognition and learner agency.

The VT Report assignment reflective component was weighted at 35% of the overall assignment worth. It was assessed using a rubric that assigned points ranging from 17.5 to 0 based on performance identified as (1) target, (2) acceptable, (3) developing, (4) unacceptable, and (5) incomplete. A student achieving target performance exhibited an in-depth analysis demonstrating the value of the derived learning to self and enhancing the learner’s appreciation of the concepts. This involved articulating multiple connections between prior learning in other courses or life/work experiences and future goals. On the other hand, if a learner’s reflection only described the VT learning experience and did not articulate any connection to prior learning or life/work experience, they would earn an unacceptable performance score. Scores landing between the target and unacceptable performance levels were more descriptive than reflective. Generally, they lacked a personal connection to the learning, or the linkages were vague or unclear.

Table 5 displays the change in the overall average student scores for the reflective component from each VT Report assignment to measure the difference in reflective performance. The 2019 cohort of students enrolled in the Entrepreneurial Thinking and Innovation course exhibited positive change, just over 5% in their reflective performance from the first to second VT Report. However, there was a slight decline in performance from the second to third VT Report. However, the reflective performance improved slightly from the first to the final (third) VT Report.

In comparison, the student cohort enrolled in the 2021 Management Principles course exhibited a positive change in reflective performance across all the VT Reports. From the first to the second, just over 7% improvement and from the second to third, VT Reports indicated a 6.5% positive difference. The performance change from the first to the third VT Report exhibited slightly over a 14% improvement.

The 2022 students enrolled in the Entrepreneurial Thinking and Innovation course indicated less of a positive change in their reflective performance than the 2019 student

cohort and certainly compared to the 2021 Management Principles students. However, the reflective performance improved from the first to the third VT Report.

Overall, the students enhanced their reflective capabilities as they completed the VT Reports. This would suggest they benefited from the repetition of reflective thinking and receiving guided feedback to improve their learner agency.

Table 5. Changes reflective performance across VT assignments

	Entrepreneurial Thinking (F2019)	Management Principles (W2021)	Entrepreneurial Thinking (W2022)
VT1 to VT2	+5.41%	+7.11%	+2.50%
VT2 to VT3	-0.64%	+6.52%	+1.60%
VT1 to VT3	+4.73%	+14.10%	+4.10%

3.5 Study limitations

The study, as described, had several limitations. First is its small scope, with only 123 students surveyed across two courses with the same instructor. The small sample limits the study’s transferability, and the positive impact could be linked to the instructor’s familiarity with the students and unconsciously advocating for the LiL platform. Another limitation of the research was reliance on only eight closed-ended participant-reported questionnaire statements that primarily focused on students’ perception of the VTs and the LiL platform. Finally, students lacking English proficiency could have difficulty understanding and summarizing the LiL video courses. This notable lack of mastery and confidence in language skills has been identified by other researchers regarding writing tasks, like summarizing, which require articulating ideas, not their own [23].

Educational institutions’ changes may have influenced the shift between the 2019 and 2021 student cohorts through the 2020 pandemic, which involved much more intensive use of technology and remote learning platforms, such as LiL. The 2021 cohort’s positive shift towards self-determined learning could be a collateral outcome of comfort and familiarity with online asynchronous digital learning platforms. This cohort may also have a different predisposition toward diverse ways of learning or a more active interest in honing other skills, given that they were sophomores.

Future studies would benefit from a more deliberate research design incorporating longitudinal pre-and-post surveys from two different survey instruments: one, instrument measuring self-efficacy, and the other, lifelong learning tendencies. Self-efficacy is a construct studied in many contexts, including learning, individual entrepreneurship, technology solutions, innovativeness, change, and task completion. Studies have found that self-efficacy significantly relates to people’s engagement in change and personal development [24].

The challenge is to provide students with educational experiences that enhance their aptitude for continued self-directed learning and help them gain enough confidence to initiate, maintain, and finish any endeavour they like. So one of the most critical issues for engineering education should be whether students are developing a belief in and commitment to lifelong learning [25]. Investigating the factors contributing to reflection and lifelong learning is critical to encouraging dynamic engineering professionals.

4 Conclusion

Specifics were shared about the experience of using LiL as a “learning partner” in two undergraduate engineering technology management courses. The study revealed that students valued integrating the LiL assignments into the coursework. The work also demonstrated that most respondents strengthened their skills in summarizing industry-related best practices and self-reflection capabilities. Respondents showed a shift towards self-determined learning behaviour in the short term, indicating a nudge toward lifelong learning behaviours, essential 21st-century attribute graduates need to succeed in their careers, given the lightning pace of change in today’s technology organizations. Lastly, the study discussed several limitations that impacted its potential for replicability and recommended a more deliberate longitudinal research design for future exploration of metacognition and lifelong learning enrichment.

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