If you pay for it, they will come – fostering innovation in teaching and learning

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Introduction

Over the years, research in the science of learning has allowed instructors and educational developers to acquire a more profound understanding of how people (including students!) learn, retain, and apply their knowledge [1], [2]. This has led to the use of more student-centered teaching approaches such as active learning, flipped learning, inductive learning, and team-based learning, as well as simple instructional strategies such as retrieval practice, spaced practice, interleaving, and feedback-driven metacognition [3], [4]. There is also a growing body of evidence that demonstrates the effectiveness of these student-centered approaches and instructional strategies [3]-[6]. However, despite evidence for the relationships between teaching effectiveness and gains in student learning, the use and adoption of effective teaching practices in higher education amongst engineering faculty remains limited. Even among those who report using nontraditional teaching methods, passive teacher-centered instruction remains the most prevalent pedagogical strategy used by engineering instructors [7].

Different frameworks have been used to investigate why faculty adopt and/or use effective methods of teaching, including motivational systems theory (MST) [8], expectancy-value theory (EVT) [9], and self-determination theory (SDT) [10], or change strategies such as developing reflective teachers [11]. MST is "grounded in the premise that motivation provides the psychological basis for individuals' development of competence" [8] and that motivation can be determined by the individual's goals, emotions, capability beliefs, and context beliefs [12]. Colbert *et al.* postulated that the use of certain teaching practices depended on a faculty member's demographic characteristics, (such as gender, rank/position, and ethnicity), experience, and motivation, where motivation included goals for teaching, skills, and context beliefs (rewards and perceived adequacy of teaching resources). In EVT, the motivation to engage in an activity is based on an individual's expectancy (i.e., their belief in the ability to succeed as influenced by self-efficacy, past experiences, and task difficulty) and value (intrinsic value, utility value, attainment value, and cost). In SDT, individuals are "inherently self-motivated to master their environment" [10]. Components of the SDT framework include basic psychological needs (autonomy, competence, and relatedness) and different types of motivation (intrinsic and extrinsic). Extrinsic motivation can be further subdivided into external regulation (e.g., teaching awards), introjected regulation (e.g., factors derived from an internal pressure such as fear of failure), identified regulation (e.g., when the faculty member is engaged due to their beliefs of the value and importance of teaching), and integrated regulation (e.g., when the faculty member's identity and values are aligned). With SDT, the type of motivation can play a greater role than the strength of motivation in predicting an outcome.

These and other studies (e.g., [13], [14]) have allowed for the identification of various factors that can influence instructors' adoption of effective teaching practices. These factors, in turn, can be associated with the different motivational components in MST, EVT, and SDT frameworks, including goals and expectancy, beliefs, and value, and include the following [8]-[10]:

- institutional infrastructure and culture,

- value of teaching and recognition,
- faculty's knowledge and skills of effective teaching practices,
- class size, balancing content and activities,
- time required/workload,
- opportunities to network and engage with fellow faculty on teaching practices, and
- support for teaching.

University teaching and learning units, as well as teaching-specific initiatives, often provide resources, support, and development opportunities for faculty. These include individual consultations, workshops, and organized gatherings for faculty to learn about different technologies or instructional and assessment strategies. Faculty learning communities (FLCs) and communities of practice (CoPs) also offer professional development opportunities in teaching. FLCs tend to exist for shorter periods, where the community meets during one semester or for one year and focus on one specific topic. They provide good opportunities to explore a particular strategy in depth, such as the reasons and benefits for adopting a particular strategy are examined in addition to operational details for its implementation. On the other hand, CoPs exist for longer periods and focus on one or more topics that are of interest to the community members. Research has shown that these communities, as well as Faculty-specific teaching initiatives, can have a significant role in encouraging faculty to use more student-centered teaching approaches [15]-[20].

Background on ELATE

Enhancing Learning and Teaching in Engineering (ELATE) is a Faculty-specific teaching initiative at McGill University whose mission is to foster communities of undergraduate and graduate students, teaching assistants, and academic and non-academic staff with the objective of enhancing and promoting excellence in the teaching and learning experience in the Faculty of Engineering. It was established thanks to a generous donation from an alumnus, who wished to give back to their alma mater and improve the quality of teaching and learning in the Faculty. The endowment pays for dedicated staff and supports different activities and programs centered on enhancing educational excellence focused specifically on best practices for engineering education instruction, research, and educational technologies. ELATE has no recognition nor status as a center of engineering education or as an academic unit, and it is not a branch of the university's Teaching and Learning Service. It should be noted, though, that two members from ELATE are also appointed with the university's Teaching and Learning Service, highlighting the strong connection and collaboration between the two. Moreover, although it is led formally by the Associate Dean of Academic Programs and the Associate Director of Academic Programs, its structure and characteristics involve a mix of those that describe both FLCs and CoPs [18]. However, unlike conventional FLCs or CoPs, it has an operating budget, part of which is dedicated to encouraging and supporting the use of new and/or effective teaching practices through its Teaching and Learning Improvement Funds (TLIF) program.

ELATE was inaugurated in 2014 and identified the following four strategic objectives in support of its mission:

- support a culture of critical thinking about teaching and learning,

- promote the use of evidence-based practices in teaching and learning,
- nurture a community of life-long learners within the Faculty of Engineering, and
- develop and support research in engineering education.

To meet its strategic objectives, ELATE's core activities cover the following 6 areas:

- *instructional support and training*, such as providing teaching consultations, mid-course evaluations, and teaching portfolio consultations; conducting new faculty teaching workshops; and supporting professional development,
- *development of pedagogical resources*, e.g., quick teaching guides that include writing learning outcomes, accessible education toolkits, and a reference 'library',
- *support with educational technology*, e.g., availability of a learning technology consultant and audio/video production equipment,
- *community building*, especially organizing informal gatherings for faculty to talk about teaching and learning, creating communities for new faculty, organizing an annual conference on teaching and learning, and collaborating with other teaching and learning units and communities within and external to McGill,
- *student support and training*, e.g., running orientation sessions and workshops for teaching assistants (TAs), developing and providing learning resources for a student success program, and supporting the undergraduate student community (ELINE – Engaged Learners in Engineering), and
- *funding for engineering education research and practice*, including through faculty scholar awards and summer undergraduate research in engineering experience awards.

Teaching and Learning Improvement Funds

One of the core activities aligned with ELATE's *engineering education research and practice* focus is the TLIF program, which launched in 2018. Based on the funding available from the endowment, the TLIF program has about $40,000 annually to support the implementation of projects, completed by individual or teams of instructors, that aim to provide concrete teaching and learning enhancement in specific engineering courses. Projects include the development of alternative assessment strategies, the implementation of new instructional approaches, and the integration of design activities and learning opportunities, among others, and are meant to be completed within one or two years.

Project proposals are submitted by interested instructors to the ELATE team, who provides both funding (up to $10,000) and project development support to awardees. In their application form, instructors are asked to summarize the learning outcomes and goals of the project, identify which course or courses the project will impact, outline an anticipated timeframe for project completion, and write an estimated budget. Once a project is completed, awardees are asked to fill in a short post-project report.

The purpose of this evidence-based practice paper is to share our findings on how the TLIF program fosters innovation in teaching and learning.

Approach

In evaluating the TLIF program, we were interested in the following questions:

(1) What motivated instructors to apply for a TLIF project?
(2) How did the TLIF project contribute to enhancing teaching and learning (including thinking more critically about teaching and learning)?
(3) How can the TLIF program be improved to support instructors further?

To answer these questions, during the summer of 2024, we surveyed faculty that had led a TLIF project (i.e., applied for funding). Since we wanted to consider the TLIF program and ELATE context specifically, we developed our own questionnaire comprising 14 questions (see Appendix A): 4 items with a nominal scale, 7 items with a 5-point Likert scale (ranging from strongly disagree to strongly agree), and 3 open-ended questions. The questions explored the following themes: (1) reasons for applying for a TLIF project, (2) support received, (3) satisfaction, and (4) impact of the project on teaching and learning.

We sent email invitations with a link to the online survey to the 25 faculty that had led one (or more) TLIF project(s) on July 31, 2024 and the survey was available until August 31, 2024. The survey was conducted anonymously, and we received 18 responses, corresponding to a response rate of 72%. While we have data on the demographic characteristics of faculty that led a TLIF project (e.g., gender, rank/position, and department) based on the applications, due to the anonymous nature of the survey, we cannot break down the responses in terms of these characteristics.

To analyze the data, we use descriptive statistics for responses to the nominal and Likert scale items and thematic analysis for the responses to the 3 open-ended questions (we used an iterative process to code the themes). We also analyzed the 34 applications in terms of the nature of the project and how the budget was used.

This study was conducted as part of a quality assurance and improvement evaluation of the ELATE initiative and TLIF program and as per Article 2.5 of the Tri-Council Policy Statement : Ethical Conduct for Research Involving Humans [21], Research Ethics Board review was not required.

Findings and discussion

Details on the TLIF projects

Since the inception of the TLIF program, 34 projects, including those in progress at the time of writing, have been funded. These 34 projects involved 32 different faculty members (approximately 20% of the Faculty's academic staff), of which 25 served as project lead. We categorized the TLIF projects under 6 main categories, where some fit under more than one category: implementation of specific instructional methods, (re)design of assessment methods, integration of design activities and learning opportunities, development of instructional resources

or materials, design or integration of new software or hardware, and scholarship of teaching and learning. We assigned each project to one or more categories and the results are summarized in Table 1, along with sample projects.

Table 1. Categorization of TLIF projects (34 total projects, each can fit more than 1 category)

Project category	Number of projects	Examples
Instructional methods	12	Implementing flipped learning, deductive learning, and active learning
Integration of design activities and learning opportunities	11	Experiential learning, evaluating engineering practices in bioengineering prototypes, new laboratory experiences (including virtual experiments), exploring bikeability in Montreal
Development of instructional resources or materials	10	Videos to support laboratory experiments
Assessment methods	4	Implementing formative assessments, using GenAI and the implications on student assessment
Scholarship of teaching and learning	4	Studying the impact of small teaching strategies in engineering, investigating team work and CATME on student development of leadership skills, using students as partners to improve an introductory course on the engineering profession
Software or hardware	2	Access to ANSYS Granta Edupack for materials engineering, updating a lightboard for creating instructional videos

A total of $203,255 was budgeted to support the 34 projects, corresponding to an average of $5,978 per project. The largest amount awarded was $10,000 while the smallest amount requested was $1,125. We identified 3 broad categories of expenses: personnel, consumables (e.g., to develop laboratory experiments), and software/hardware (e.g., for software licenses). Table 2 shows the breakdown of the total budget in the 3 expense categories.

Table 2. Breakdown of TLIF total funding budgeted ($203,255) by expense category

Expense category	Amount ($)	% of total funding
Personnel	$155,457	76.5%
Consumables	$33,148	16.3%
Software or hardware	$14,650	7.2%

The majority of the funds (76.5%) was used for personnel, i.e., hiring a graduate student or researcher to assist with developing and implementing the project or carrying out research. Note that these amounts are based on the budgets submitted as part of the project proposal; individual faculty were responsible for managing their budget and we have no way of confirming the actual expenses.

Results from the survey

The first two questions of the survey asked faculty about their reasons for applying for a TLIF project and the results are summarized in Fig. 1.

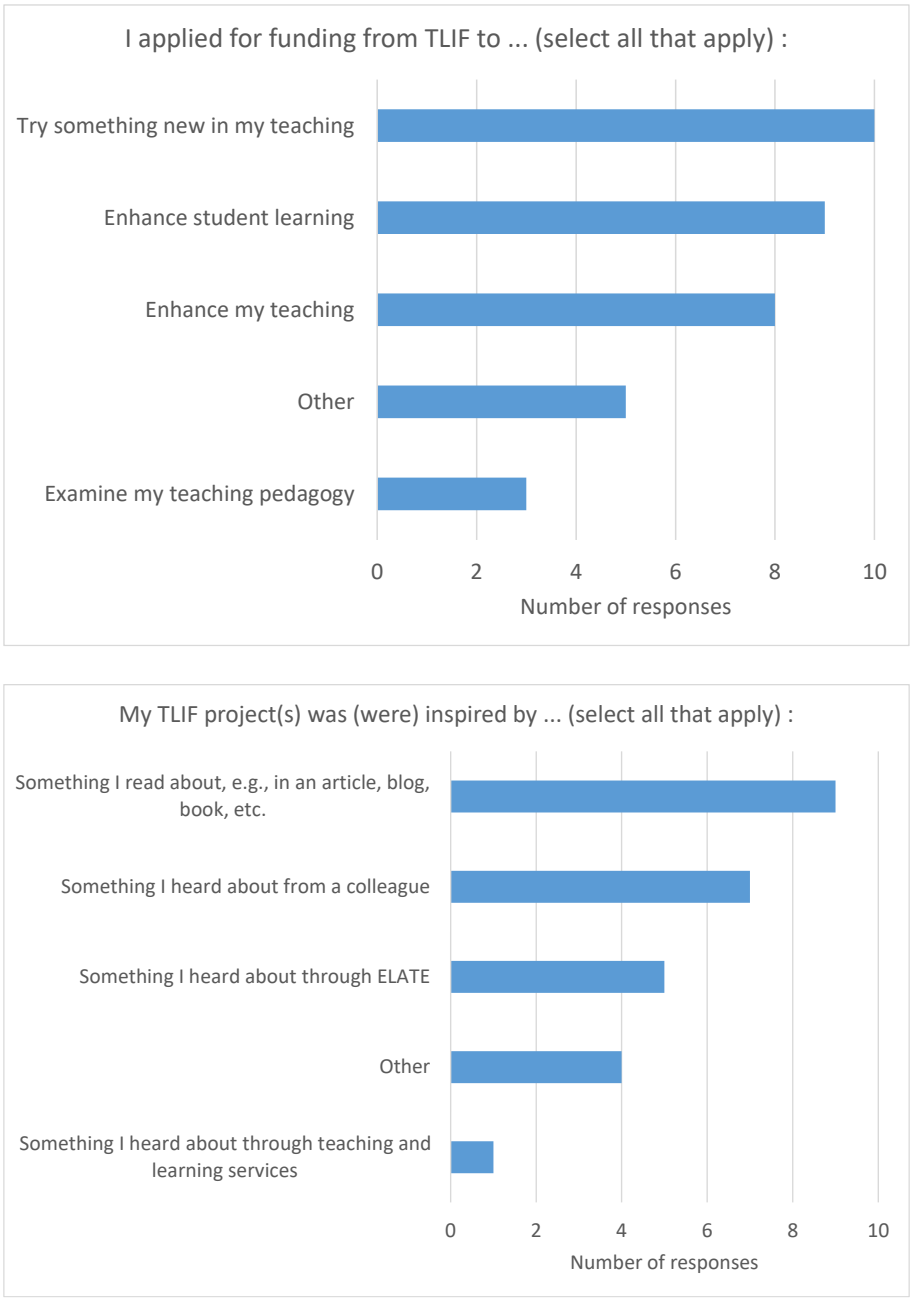

Figure 1. Motivation of faculty for applying for a TLIF project.

The top reasons to apply for funding were to try something new in teaching followed by finding ways to enhance student learning. Other reasons included adopting new assessment platforms, developing new teaching materials, and creating virtual or on-line laboratory experiences during

the pandemic. While most faculty were inspired by something they had read about or through discussions with colleagues, a few mentioned that their project originated as a result of brainstorming with their TAs or through feedback received on end-of-course evaluations.

We can relate these responses with different motivational factors from MST, EVT, and SDT or the change strategy associated with developing reflective teachers. For example, the willingness to try something new that can enhance student learning might be associated with faculty's perceptions of attainment value. Responding to student feedback can highlight an engagement with reflective practice as well as faculty's views on capability beliefs and attainment value. Finally, being inspired by other colleagues (including ELATE) relates to the need for opportunities to network and engage with fellow faculty on teaching practices which, in turn, are associated with expectancy, intrinsic value, and attainment value [8].

Table 3 shows the responses to the 7 items with Likert scale.

Table 3. Responses to Q3 – Q9 from the survey (N = 18).

	Questions	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
	Support					
Q3	Support from ELATE was available to develop my TLIF project(s).			1	2	15
Q4	Support from ELATE was available to implement my TLIF project(s).			3	4	11
Q5	The budget I received was sufficient to support my project(s).			2	6	10
	Satisfaction					
Q6	I am satisfied with the overall impact of my TLIF project(s).			1	4	13
	Impact					
Q7	The TLIF project(s) encouraged me to be more innovative in my teaching.				7	11
Q8	The TLIF project(s) helped me to improve my teaching.			3	6	9
Q9	The TLIF project(s) enhanced my students' learning experience.				6	12

The majority of faculty believed that ELATE and the community provided assistance to develop the project and, equally important, felt supported during its implementation. The amount of funding provided can be a concern and even though the average budget for each project might appear limited (~ $6,000), 16 faculty felt that their budget was sufficient. These responses can

be related to faculty's context beliefs and expectancy in terms of the adequacy of teaching resources and support available in the implementation process.

Seventeen faculty were satisfied with the impact of their TLIF project. All agreed that it encouraged them to be more innovative with their instructional or assessment strategies, and that this had a positive impact on student learning. While most acknowledged that the TLIF project also helped them improve their teaching, it is interesting to note that 3 responses were neutral.

While TLIF projects help faculty launch an idea, it is also important to ensure that the new practice can be sustainable. We asked faculty how many times they implemented the idea(s) from their TLIF projects in their courses (Q10) and to explain their answer (open-ended Q11). The majority (13) indicated that they had implemented their ideas at least two times; reasons included the minimal time required to implement the strategies, that the implementations could be improved each time they were used, and that the materials developed could be used in subsequent offerings. On the other hand, 4 indicated that they only implemented the idea(s) once; one justification was because the project focused on replacing hands-on lab experiences with online/virtual opportunities during the pandemic and the practice was discontinued once in-person teaching returned.

Of the 11 faculty that answered 'strongly agree' to Q7 (the TLIF project(s) encouraged me to be more innovative in my teaching), 9 strongly agreed that the project improved their teaching (Q8) and that it enhanced student learning (Q9), and 8 implemented the idea(s) at least two times (Q10). Of the 14 of the respondents who answered 'yes' to Q13 (i.e., they would consider applying for another TLIF project), 7 strongly agreed that the TLIF project helped to improve their teaching (Q8), 10 strongly agreed that it enhanced student learning (Q9), and 8 strongly agreed that support was available to develop and implement their project and that the budget was sufficient (Q3, Q4, and Q5).

Having stronger capability beliefs (Q8) may be associated with a higher perception of attainment value (Q9) while a higher perception of attainment value may suggest a greater willingness to sustain a practice or try something new. It is clear, though, that if a practice is to be sustainable, its cost in terms of time and ease of implementation must be low.

Faculty offered different examples of how their TLIF projects prompted them to think more critically about teaching (open-ended Q12), especially with regards to instructional and assessment strategies, as well as empowering students in their learning. Several noted that the reasons for implementing changes to instructional and/or assessment strategies ('why') was as important as the actual implementation details ('how'). One faculty member stated,

> "*I don't think there are lack of thinking critically about my teaching with/without financial support. However, it is easy for such critical thinking to never lead to any change in teaching contnet/module* [sic] *or to any innovation/exploration due to the rigidity of McGill Engineering's course offcering* [sic] *& beaureaucratic* [sic] *structure. However, TLIF allowed me to hire human resources to at least try and do something different/innovative in modularied* [sic] *fashion.*"

Finally, 5 faculty indicated that the TLIF program was fine as is or had no suggestions for improvement. Specific recommendations included ensuring greater awareness of the program or the projects completed, creating a repository of the projects with shareable samples of material developed, increasing the budget, and providing continual pedagogical support.

Limitations

One of the limitations of the study is the one-sided view of the effectiveness of the TLIF program. Specifically, we did not deliberately survey students for their perspectives of how their learning may have been impacted from the projects. At the same time, students may not have been aware of any new strategies being used by the instructor – this is dependent on whether the instructor informed the class that they were experimenting with some form of teaching innovation.

In this study, we focused on faculty that had applied for a TLIF project. However, it would be equally interesting to survey all faculty to learn their reasons for not applying. We are in the process of conducting a more general study to understand faculty's perspectives on teaching, assess the support provided by ELATE and its impact in helping faculty with their teaching, and improve the support and resources offered by ELATE.

Summary and Conclusion

In this paper, we have examined how a Faculty-specific initiative (ELATE), through its TLIF program, can foster teaching innovation among faculty by providing funding and a supportive community. While faculty can have different motivating factors for making changes and embracing innovation in their teaching, many expressed wanting to try something new in their teaching as well as enhancing student learning. Our survey also highlighted the importance of support and resources, as well as a community to develop and implement their projects. We are currently seeking additional funding sources (either through philanthropy or institutional support) to enhance the TLIF program. This will enable us to either expand the budget for projects or support a greater number of projects in the future. By reducing barriers, providing resources, and building a community that supports evidence-based practices, Faculty-specific initiatives with available funding to support such programs can have a positive impact on engaging faculty more deeply in their teaching.

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Appendix A. ELATE Teaching and Learning Improvement Funds Survey

Q1. I applied for funding from the TLIF to… (select all that apply)

- Try something new in my teaching
- Enhance my teaching
- Enhance student learning
- Examine my teaching pedagogy
- Other (please specify)

Q2. My TLIF project(s) was (were) inspired by…. (select all that apply)

- Something I read about
- Something I heard about through ELATE
- Something I heard about through teaching and learning services
- Something I heard about from a colleague
- Other (please specify)

Q3 – Q9 use a 5-point Likert scale from 'Strongly disagree' to 'Strongly agree'.

Q3. Support was available to develop my TLIF project(s).

Q4. Support was available to implement my TLIF project(s).

Q5. The TLIF budget was sufficient to support my project(s).

Q6. I am satisfied with the overall impact of my TLIF project(s).

Q7. The TLIF project(s) helped me improve my teaching.

Q8. The TLIF project(s) encouraged me to be more innovative in my teaching practice.

Q9. The TLIF project(s) enhanced my students' learning experiences.

Q10. How many times have you implemented the idea(s) from your TLIF project(s) in your courses?

- Only once
- Twice
- More than twice
- Prefer not to answer
- Other

[Open-ended] Q11. Please explain your answer to Question 10 above, e.g., reasons for the number of implementations, which classes the ideas were implemented in, etc..

[Open-ended] Q12. Has (have) the TLIF project(s) prompted you to think more critically about your teaching? In what areas (instructional strategies, assessment strategies, learning outcomes, curricular alignment, other). Please explain.

Q13. Will you consider applying for another TLIF project?

No
Maybe
Yes

[Open-ended] Q14. Do you have any suggestions for improving the TLIF?