

Student Assessed Integrated Learning: SAILing to a Holistic Design of Holistic Engineering Education

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Abstract—This Work-in-Progress paper presents a framework for students’ holistic learning, growth, and development recently created at and for Northeastern University. The Student Assessed Integrated Learning (SAIL) initiative was introduced for the first time to 179 first-year students who had not designated their major prior to entering the University. Our preliminary data indicate that most students felt the SAIL framework informed how they viewed their past experiences and helped them to shape their academic, personal, and/or professional goals. Further data collection and analyses to investigate the SAIL framework’s effectiveness in helping students articulate and shape holistic learning is ongoing.

Keywords—*holistic education, reflection, first-year students, self-regulation, self-directed learning*

I. INTRODUCTION

For more than three decades, leading engineering educators and engineering education scholars have been calling for a shift in the engineering education landscape, away from technical rationality that values linear technical disciplinary knowledge, detachment from an object of study, rigor, and objectivity, toward an educational paradigm supporting students’ holistic development [1-8]. However, the definition of “holistic” within constructs of “holistic education,” “holistic teaching and learning,” “holistic curriculum,” “holistic assessment,” “holistic thinking,” and “holistic mindset” has been vague in terms of its theorization (e.g., nature of learning vs. learning strategies vs. learning process, etc.) and operationalization. For example, when describing their model of holistic learning, Vanasupa *et al.*, (2009) focus on the nature of learning and propose a design of students’ experiences that includes development along cognitive and psychomotor as well as social and affective domains within a single course or activity [9]. Bernold *et al.*, (2000) describe holistic teaching as a set of pedagogical interventions that leverage learning strategies (e.g., Kolb’s 1984 model [10]) and psychological temperaments [11]. Others use the term synonymously with “inter-” or “trans-disciplinary,” where disciplines may be purely technical or a combination of both technical and non-technical courses (e.g., [12-16]). Recent literature on holistic engineering education has also seen an emergence of calls for inclusion of empathy and care [7,8,17,18] into engineering

curricula “as a teachable skill, practice orientation, and a way of being” as well as a way of “enable[ing] students and engineering practitioners to more holistically and thoughtfully engage with the complex, socio-technical challenges that characterize the current age” [8].

To our knowledge, however, there is little engineering education literature formulating “holistic” as both student development across cognitive and non-cognitive domains and, importantly, across all students’ college experiences, i.e., formal and informal, curricular and extra- as well as co-curricular, etc. (a notable exception is the work of Wilson *et al.*, (2014) on the link between co-curricular activities and academic engagement in engineering education [19]). Yet, education literature beyond the engineering landscape has long recognized that learning occurs well beyond formal educational experiences [20-27]. Among others, co- and extra-curricular activities such as athletics, participation in support and retention programs, research, study abroad, service-learning, clubs, internships, and learning communities contribute to a range of potential outcomes, including increased satisfaction [22], greater academic success [28], improved persistence, retention and graduation rates [23], higher levels of academic conscientiousness [21], improved critical thinking skills [29], and promotion of academic and social interactions [25].

In this Work-in-Progress paper, we discuss Student Assessed Integrated Learning (SAIL), a new framework for students’ holistic learning, growth, and development recently created at Northeastern University. We also present results of a pilot study investigating the effectiveness of an early implementation of this framework intervention.

II. STUDENT ASSESSED INTEGRATED LEARNING FRAMEWORK

A. Context: Northeastern University

With its mission of educating students for a life of fulfillment and accomplishment as well as creating and translating knowledge to meet global and societal needs, Northeastern University strives to offer students “a transformative experience, grounded in experiential education that ignites their passion for learning” [30]. As suggested by this language, at the core of Northeastern’s academic life lies

experiential learning, which the University defines as the integration of study with professional work, research, and global service. These authentic learning opportunities allow students to gain applied experience, fine-tune their learning path, better understand their classroom learning, and develop critical life-long learning skills that go beyond the formal classroom environments [31]. Rooted in a 100-year history, a primary example of experiential learning at the University is its co-op program, comprised of more than 3,000 global employers located on all 7 continents (133 countries). In the 2015-2016 academic year alone, 11,002 Northeastern undergraduates engaged in a co-op experience, many for the second or third time [32,33]. In that same year, more than 4,000 students completed close to 222,000 hours of community service through 80+ international and domestic service-learning partnerships, 900 presented their research results at Northeastern's annual Research, Innovation and Scholarship Expo, and 47% of graduating students took part in one or more global experiences [33,34]. Back in the classroom, and in a spirit of experiential learning, students continue integrating theory and practice through questioning, inquiring, and challenging their own learning and understanding as well as those of others in their learning environments [35].

Building on this history and context, Northeastern is now working to further enhance learning by explicitly integrating all experiences - formal and informal, classroom and experiential environments - into a coherent learning experience through SAIL initiative.

B. Student Assessed Integrated Learning (SAIL) Initiative

The Student Assessed Integrated Learning (SAIL) initiative is designed to expand experiential opportunities at Northeastern University by leveraging “the full resources of [its] educational ecosystem, adopting an inclusive view of the co-curriculum (e.g., clubs, organizations, service, co-op, athletics, student employment, leadership programs, etc.).” The goal of this initiative is to “create pathways toward competency development that are engaging, intentional, empowering, and transformative for students” [33]. Driven by the idea that learning happens everywhere, SAIL is designed to provide a mechanism for learning that is personalized, intentional, and explicit “in every interaction and in every environment” [33]. Furthermore, SAIL allows for all Northeastern stakeholders, students, staff, faculty, and alumni(ae), to come together in a process of co-creating learning experiences, with students at the center of and driving their own learning processes. Utilizing the entirety of the Northeastern network of learning opportunities, including people, programs, curricular and co-curricular opportunities, facilities, etc., students are empowered to direct their learning, growth, and development. By creating a scaffolding for students to engage in learning cognitively, affectively, and socially, and by engaging the entirety of students' selves in the learning processes, SAIL promotes the development of self-regulated learners intrinsically motivated in their learning [36].

As summarized by Ambrose et al., (2017), the goal of SAIL is that of “advanc[ing] the personalized and differentiated model of [the University's] experiential, global

education through a common framework, language, and set of tools that allow students to map every experience, in and out of the classroom, to a set of competencies and skills.” The University expects that “this approach will create deeper learning, and will provide students with the skills necessary to clearly articulate and integrate their learning, creating a career advantage” [33].

C. SAIL Framework

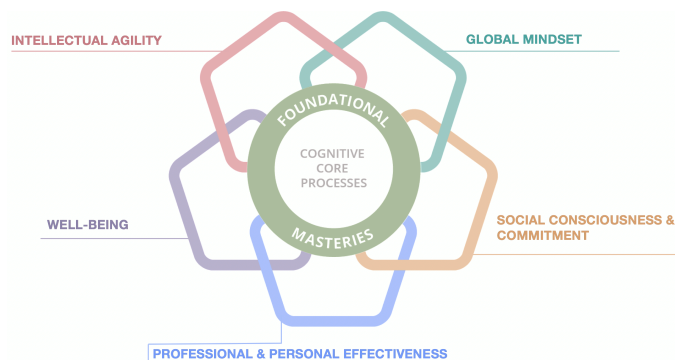


Fig. 1. The SAIL framework is represented by five overlapping dimensions of learning, growth, and development: 1) INTELLECTUAL AGILITY: Learners develop the ability to use knowledge, behaviors, skills, and experiences flexibly in new and unique situations to innovatively contribute to their field; 2) GLOBAL MINDSET: Learners develop knowledge, skills, and behaviors to live, work and communicate with people whose backgrounds, experiences, and perspectives are different from their own as well as to consider the global impact of their decisions; 3) SOCIAL CONSCIOUSNESS & COMMITMENT: Learners develop the confidence, skills, and values to effectively recognize the needs of individuals, communities, and societies as well as make a commitment to constructively engage in social action; 4) PROFESSIONAL & PERSONAL EFFECTIVENESS: Learners develop the confidence, skills, behaviors, and values to effectively discern life goals, form relationships, and shape their personal and professional identities to achieve fulfillment; and, 5) WELL-BEING: Learners develop knowledge, skills, and behaviors necessary to live balanced and fulfilling lives. A set of core cognitive processes as well as foundational skills and attributes underlie students' development in each dimension [37].

The SAIL framework represents a synthesis of learning science and student development theory. Similarly to Vanasupa *et al.*, (2009) [9], this framework makes explicit multiple factors that act contemporaneously with and on each other to affect students' development, learning, and growth, and acknowledges learners' holistic development without artificial boundaries created in traditional learning environments. The SAIL framework, however, is designed as a tool for both educators and learners to integrate the entirety of students' college experience into a holistic journey for the purposes of (1) more effectively designing, curating, and supporting students' development and evolution; and, (2) providing students an opportunity to iteratively and reflectively understand their past learning journeys to better position themselves and to be more intentional about their future personal and professional development. The SAIL framework, as it stands today, is a result of a co-design process among all University constituencies and is continually evolving to reflect and “facilitate innovation, relevance, and breadth of thinking” [33].

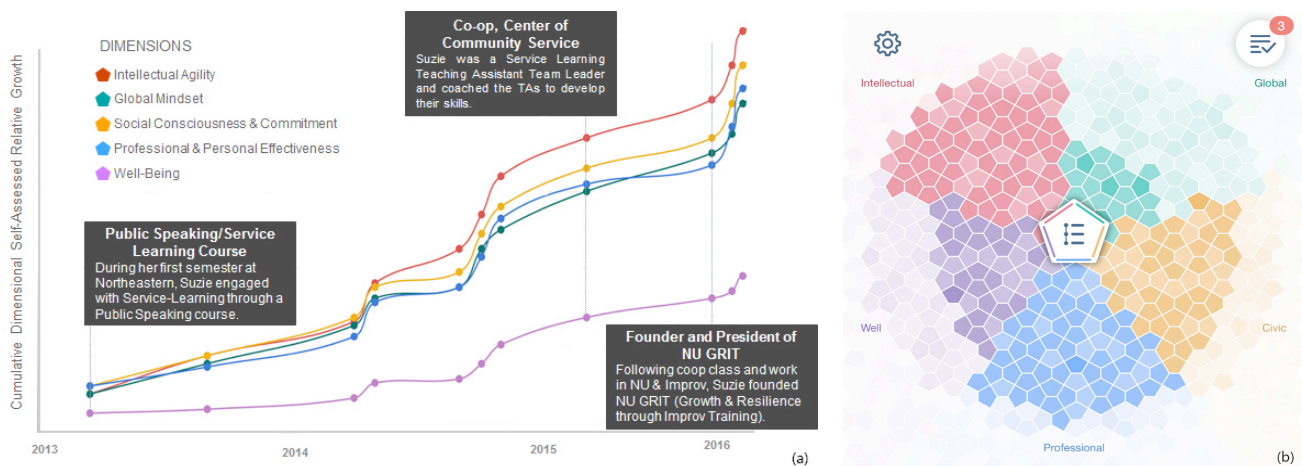


Fig. 2. (a) A sample representation of a student's learning journey through a set of learning opportunities mapped onto a timeline. Vertical axis represents a student's cumulative relative self-assessed growth in each dimension. (b) A sample visualization of a student's engagement in all five dimensions as depicted on the SAIL app.

The framework delineates five dimensions of student development: 1) INTELLECTUAL AGILITY; 2) GLOBAL MINDSET; 3) SOCIAL CONSCIOUSNESS & COMMITMENT; 4) PROFESSIONAL & PERSONAL EFFECTIVENESS; and, 5) WELL-BEING (see Figure 1). These overlapping dimensions share a set of core cognitive processes as well as foundational skills, attributes, and abilities that are identified in the literature as critical to students' future success (e.g., [36]).

To operationalize student learning, growth, and development along each dimension, the framework offers a set of associated skills, attributes, and characteristics. For instance, learners' development along the Global Mindset dimension calls for students to:

- engage and build relationships with people from different cultures and contexts;
- create inclusive environments;
- calibrate one's behavior and communication to exhibit cultural sensitivity in professional and social settings;
- make decisions and personal choices that reflect an understanding of global repercussions, including environmental, societal, cultural, political, and economic; and,
- articulate how exposure to multiple worldviews has impacted one's own perspectives and ways of being.

Over the course of their learning journey, students engage in a variety of learning opportunities that advance their knowledge and skills, as well as develop new mindsets and behaviors simultaneously along and across each SAIL dimension. A student's learning journey at the University, therefore, may be mapped across five dimensions and can be visualized as a function of time, as shown in Figure 2(a).

Students' learning journey can also be visualized at each discrete moment in time in terms of experience with each of the five dimensions as shown in Figure 2(b). As students continue on their journey through the University, their visualization may change, reflecting the multiple learning

opportunities they engage in and the associated knowledge, skills, and mindsets they have had the opportunity to practice.

Armed with these tools, students are not only in a better position to understand their learning journeys to date; they can also step beyond their comfort zone and create new as well as leverage existing learning opportunities throughout their academic experience at the University, maximizing their development within and across each dimension. The SAIL platform (web and mobile) further facilitates the identification of desired learning opportunities and pathways for growth and development that is individualized for each learner. In this way, SAIL also provides prompts and tools that encourage students to reflect on and record an activity's meaning and impact, thereby supporting their ability to recognize and articulate their learning.

III. SAIL PILOT STUDY

A. Study Site

The SAIL framework was piloted for the first time during Fall 2016 to students in Northeastern's Explore Program. The Program is designed for students entering the University with an explicit goal of exploring their interests and passions prior to choosing a major. The Program introduces students to a broad range of learning opportunities within Northeastern and engages them in deep personal discovery through close work with their peers, faculty, advisors, and undergraduate peer mentors. A seminar course and other activities aim to engage students in thoughtful and intentional conversations about their interests and motivations to help them shape their future. Although students may select their major at any time during their first two years, most do so by the end of their first year.

The SAIL framework was presented to 179 first-year first-semester Explore Program students within the context of their Connections & Decisions seminar course. The students mapped their learning opportunities on a timeline (see Figure 2(b)), and created a graph of their self-assessed cumulative dimensional growth (see [37] for examples of students' growth through their interactions with various learning opportunities.) Through a set of classroom discussions and activities, the

students then specifically focused on the PERSONAL & PROFESSIONAL EFFECTIVENESS and WELL-BEING dimensions.

B. Data Sources and Methods

Data sources included students' responses to mid-semester and end-of-semester open-ended questionnaires about (1) the ways in which the SAIL dimensions informed how they view their past learning experiences; and, (2) how the SAIL framework may have shaped students' academic, personal, and professional goals. For the end-of-semester questionnaire, we received 81 unique responses to the first question and 75 unique responses to the second. The response rate for the mid-semester questionnaire was smaller and students' comments were used to inform our analysis of the end-of-semester data, but did not serve as an analytical focus.

As this work is emergent, we have only begun the initial stages of analysis using a ground theory approach [38,39]. Preliminary analysis of data consisted of open-coding to capture major themes in students' responses and to identify emergent constructs, which were then further analyzed for emergence of new themes and theoretical constructs.

C. Preliminary Findings

Approximately two thirds of all respondents commented that SAIL informed their view of their past experiences. Of these responses, two emergent constructs were identified: (i) "SAIL as a reflective tool" to understand past learning experiences; and, (ii) "SAIL's value/use" in students' ability to make more informed choices in the future.

As a reflective tool, SAIL seems to have given students an opportunity to stop and think about their past learning journeys (e.g., "It was good to reflect back on past experience..."), some specified that it was a new way of performing reflection (e.g., "[It] has allowed me to reflect on my past experiences without too much bias, to take the lessons learn[ed]"), and yet others shared that SAIL allowed them to better connect with who they are or even define their new identity (e.g., "[SAIL] let me reflect in terms of my personal growth and how my past shaped me to who I am today").

Most students identified SAIL's utility in helping them to articulate their past experiences and define their future. In fact, 20% of all students (65% of all respondents) who found that SAIL informed how they viewed their past experience identified, without further prompting, a specific dimension(s) that they wanted to further develop (e.g., "It showed me that I have a high global mindset, but I should focus on intellectual agility in the future.") Interestingly, none of the students who responded in this way described how they may want to do so.

About half of all respondents stated that SAIL helped them to shape their academic, personal, and/or professional goals in some way. Two major emergent constructs in students' responses to this question were identical to the ones above, with the second one being more prominent. Responding to this question, however, allowed for further clarification of the emergent constructs, as students seemed to be more willing to describe in greater detail either the outcomes of their reflection (e.g., "I saw I needed more global mindset so I applied for a

Dialogue [of Civilizations course]") or value of SAIL in understanding their future (e.g., "SAIL helped me to identify the types of characteristics I want to develop academically, personally, and professionally. For example, I discovered that I wanted to become more of a leader"). This question also allowed for a more nuanced appreciation of students' understanding of who they are today, what their value system may be, what they are impassioned about, and how this affects their future decisions and choices (e.g., "I need to work more on getting a liberal arts education, I can't just learn about my specific major... it's great and important to be informed about the world around you, or else you can really screw up").

Of the students who responded neutrally or negatively to either or both open-ended questions (37% of all responses), about half shared that their exposure to SAIL was too limited to see any (significant) outcomes (e.g., "I think that I have a new perspective on wellness, but I don't know how... effective SAIL has been in altering my view").

IV. CONCLUSION

Although at the time of this pilot study, the SAIL framework and platform were in the process of beta-testing for further improvement, this effort has already demonstrated its potential. For example, the framework gives students the necessary language to describe not only their past experiences but also the ability to articulate their future goals, interests, and passions. Students seem to be able to identify their strengths and the dimensions in which further growth is needed. Of note, language of weakness is largely absent from students' responses; rather, the participants are using more agentic language when discussing their past and, more importantly, when identifying their future goals.

By far, the spirit of what SAIL may have brought forth for most students during the Fall 2016 is captured by the following quote from one of the students in the Spring 2017 iterations of the Connections & Decisions course, where SAIL was introduced more intentionally and with supporting technological infrastructure (i.e., mobile application):

In the past, I would have thought that not knowing was a bad thing... Northeastern has shown me that it's ok not to know what you want to do right now... as long as you have the commitment and motivation to research what you really want to do [or] to figure out a major, [the answer] will come naturally and it will be one that you wholeheartedly enjoy learning.

As SAIL continues developing and we investigate its implementation effectiveness, we hope to develop a better understanding of the ways in which SAIL may help students shape and articulate their narratives about their learning journeys, plan their future paths, support development of intrinsic motivation, and scaffold students' growth as self-directed learners.

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