Fall 2022 IJTL Editorial

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This IJTL special issue honors the late Robert Moses (1936-2021) who tirelessly advocated for African-American students' rights to gain mathematics literacy through the Algebra Project (Moses & Cobb, 2001). While Moses is known for his civil rights work, especially through the Algebra Project, this journal issue sheds lights on the profound influence he had in creating a student-centered pedagogical framework. Moses' life represents that of a pedagogical leader to advocate for minority students in bringing equal access to learning. I first encountered Bob Moses as a doctoral student. The Algebra Project was illustrated as an example of "intermittent cultural mediation" in which the teacher may "deliberately employ constructs from the students' culture and experiential background to facilitate learning" (Hollins, 1996, p.142). The five-step teaching procedure was introduced as a means to achieve this goal primarily in K-12 education, and it left a strong impression on me even after I completed the degree.

In 2007, I took a tenure-track position in a diverse state university in California. After I began teaching foundation courses in the preservice education program, I felt something was missing. I saw students getting bored and disengaged when I used standard linear PowerPoint presentations to transmit heavy theoretical knowledge for several hours. I knew that instead of lecturing at them as passive learners, I wanted to empower my students to become active learners who take ownership of their own learning. This led to a group presentation assignment. The students took center stage by presenting complex Educational Psychology concepts such as *episodic memory, formative assessment, cognitive apprenticeship,* etc. with their peers, using multisensory approaches (visual, auditory, kinesthetic, and tactile) and group discussions. The students were able to practice engaging, effective pedagogy to teach diverse populations, including students with special needs and multilingual learners. As a result, my Educational Psychology course was transformed from a lecture-based to a performance-based, active learning course. However, I was still unsatisfied by a lack of a solid pedagogical framework that would guide future teachers step-by-step to plan and carry out a lesson. After a long search, I finally came back to Moses' Five-Step approach. The potential power of Moses' approach became apparent when I realized that the principles of its scaffolding steps in teaching applied to all contexts beyond mathematics in K-12. In the Spring of 2015, I decided to test the waters by using Moses' Five-Step approach in the same Educational Psychology course as a *recommended* approach to frame and implement the group presentation assignment. While it was not without challenge for students to implement the framework due to the reverse sequence of teaching that they were familiar with in K-16 (see Figure 1), the students thrived at applying this model to make their presentations engaging. Because of its potential to impact diverse learners' learning, in the Fall of 2017, I took a step further to make it a *required* approach. The results were gratifying: It provided an incremental, solid pedagogical framework for novice teachers to plan and implement a student-centered lesson for diverse populations. It was a good fit with the multisensory approaches already being used, since they were inherently embedded in Moses' framework as an experiential learning model.

True to his mission, Bob Moses created an equitable and inclusive pedagogical framework that is not only experiential but also culturally based (Moses & Cobb, 2001, p.120) to

invite all students from diverse backgrounds to be at the table to experience the target concept. This model is composed of scaffolding steps that are beyond a superficial warm-up or motivational activity. Rather, teachers thoughtfully construct a student-centered lesson that supports active participation. Step 1 begins the lesson with a common physical experience that is aligned with the target concept. In the subsequent Steps 2 and 3, students are ushered to co-construct knowledge with their peers and the teacher by expressing their learning through non-verbal and verbal means based on the Step 1 experience. In Step 2, students draw a picture of what they experienced in Step 1 whereas in Step 3, they continue to talk about their Step 1 experience using their own words with their peers. In particular, Step 3 involves students' funds of knowledge (Moll et al., 1992), as students' home and everyday language is an important cultural aspect of learning. Until this step, neither the teacher nor students use the academic language, which is substantially different from traditional lessons that begin with the academic language that is teacher-driven. It is also important to note that the students with limited English or verbal skills use the everyday language and other expressions that they feel comfortable with in these scaffolding steps. The teacher carefully monitors what students are expressing during these steps, which is connected to the Feature Talk in Step 4. In Step 4, as a formalization process, the teacher connects from everyday to academic language by explaining the target concept. In this step, students are guided by the teacher to use formal academic language, connecting to the experience in the previous steps. Through Steps 1-4, students build an understanding of the target concept based on concrete experience and various scaffolding approaches. Finally, in Step 5, students express a creative way to show their understanding of their learning through symbolic representations such as drawing or hand gestures as an active production of their learning.

Figure 1.
Moses' 5-Step Framework
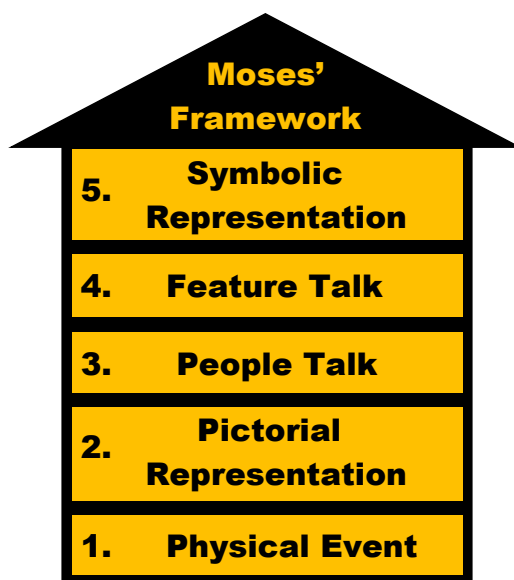
The description of Moses' Five-Step approach varied over the last several decades. In their classic book, Moses and Cobb (2001) described it as the "five crucial steps in the Algebra Project curriculum process" (p.120). Hollins (1996) called it as the "five-step teaching procedure" (p.143). When my colleagues and I published our first article in 2011, we used the term the "five-step approach." In the subsequent 2018 article, we described it as a "pedagogical scaffolding framework." At that point, it became clear that it was substantially more than an approach; we realized that the five-step framework had an explanatory power to analyze the phenomena in teaching and learning. It was capable of explaining, for instance, where students needed more scaffolding and what the teacher could do better to help the students attain the concepts.

Moses' framework uniquely stands out from other theoretical and philosophical models. In a typical teacher education program, teacher candidates learn major theories related to teaching and learning such as the sociocultural theory, social constructivist theory, information processing theory, social cognitive theory, motivational theory, and so forth. Under these theories, they learn various concepts and methods such as inquiry-based learning, problem-based learning, experiential learning, cooperative learning, learn-by-doing, and many others (Woolfolk, 2019). Moses' framework sets itself apart from these methods. For example, many educators and students resonate with the philosophy of learn-by-doing as an experiential learning approach to teaching. As a matter of fact, Moses himself stated that the Five Step procedure used a version of experiential learning (Moses & Cobb, 2001, p.119). This learn-by-doing philosophy is also the motto for my university Cal Poly Pomona that prides itself in giving students a hands-on experience. While many praise this pragmatic approach, for a long time, I could not find a specific method on *how* to implement this sound philosophy in my day-to-day teaching. After years of search, I realized that the missing link was found in Moses' framework: It includes learn-by-doing in Step 1, followed by continuous verbal and non-verbal scaffolding steps, ending in a symbolic representation done by the students. Thus, the alignment between the learn-by-doing philosophy and Moses' framework could not be stronger, as Moses' framework provides a specific step-by-step approach to implementing the popular student-centered philosophy.

Another example of a well-known conceptual model is inquiry-based learning. It is widely used as a method to teach science, history, and language arts in which students actively investigate a phenomenon and analyze data as they probe questions (Levy, Thomas, Drago, & Rex, 2013). Contrary to teacher-directed pedagogy, in this model, students are actively engaged in solving problems often through a self-directed, inductive process, leading to scientific discovery such as the 5E learning cycle model with five inquiry stages: Engagement, Exploration, Explanation, Elaboration, and Evaluation (Bybee et al., 2006). While the 5E instructional model and Moses' framework are both student-centered and experientially-based grounded in social constructivism, there are distinctive differences. First, the 5E model was created specifically for science and health programs by a group of professional science educators (Bybee, 2014) while Moses created his model as not only experientially based but also *culturally based* for experiences to be "meaningful in terms of daily life and culture of the students," notably for African-American students' algebraic learning to gain mathematical literacy (Moses & Cobb, 2001, p.120). Secondly, according to Bybee (2014), "the optimal use of the 5E model is a unit of two to three weeks where each phase is used as the basis for one or more lessons" (2014, p.11-12). In fact, he added that using the 5E model as the basis for a single lesson "decreases the effectiveness of individual phases due to the shortening the time and opportunities for challenging and restructuring of concepts and abilities—for learning" (p.12). On the other

hand, Moses' framework is appropriate for teaching a target concept in a short, single lesson as a *conceptual attainment model* in diverse subject areas even beyond mathematics (see Figure 2 and all three articles in this issue). Moreover, the 5E sequential model encompasses the whole cycle of inquiry, ending in evaluations that are more summative and formal in nature. In contrast, Moses' framework focuses on specific pedagogical steps of scaffolding without formal evaluation components. Rather, Step 5 serves as an informal way to assess student understanding for them to symbolically represent the concept attained in Step 4. Finally, while the 5E model, which is structured with the sequence of five phases, is advised not to be altered or shifted (Bybee, 2014), there is flexibility in Moses' framework (Ahn et al., 2018). Some of the scaffolding steps such as Steps 2 and 3 may be reversed or combined, depending on the student needs and circumstances. I have seen some cases where Step 3 was used before Step 2, which did not seem to cause any disruptions, as some students might be more verbal than artistic. In an extreme case, I have seen teachers with limited instruction time starting with Step 1, followed by Step 4, omitting other steps to teach smaller sub-concepts. This simplified version seems to happen among more experienced teachers who have deep conceptual understanding of this experiential learning framework: Put the physical experience with familiar everyday language first before explaining the concepts with formal academic vocabulary. As teachers deal with teaching many major and minor concepts on the daily basis, the versality of Moses' multi-step framework enables them to plan and implement lessons with appropriate scaffolding based on the nature of the course, student needs, and other circumstances.

       With these backgrounds in mind, in this 2022 special issue celebrating Bob Moses' work as a pedagogical leader, we have extended his Five-Step framework by adding two scaffolding steps: 1) Step 0 Introductory skit to contextualize and build student anticipation by intentionally using the everyday language connected to Step 4 feature talk; and 2) Step 6 exit skit to bring closure to the whole lesson by connecting back to the introductory skit and manipulating the academic language taught in Step 4 in context (see Figure 2). These extra scaffolding steps provide tighter cohesion to the overall lesson that arouses student curiosity and interest at the beginning and cements their learning at the end. These additional steps in the extended framework were found particularly useful in co-teaching or group presentations for the teachers to have dialogue with one another in a skit to grab students' attention. After experimenting the extended framework with numerous preservice teachers and graduate teaching assistants at the university level informally since 2018, there are several key areas we have identified that may benefit current and future teachers to successfully carry out the extended framework.

Figure 2.
Extended Moses' Framework
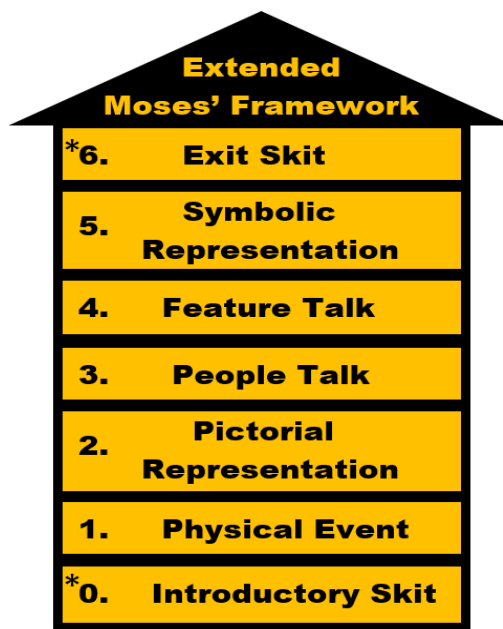
First and foremost, pacing is the area in which many teachers struggle. With the limited class time often ranging from 50 to 80 minutes in K-12 as well as college courses, fitting the lesson within the limited timeframe is perhaps the biggest challenge. In particular, there is a tendency to spend too much time on Step 1 and too little time on subsequent steps, since the Step 1 activity is the most engaging part. For example, if unguided, preservice teachers in my Educational Psychology course often spent 15 minutes on Step 1 activity out of the 25 minutes suggested presentation time, resulting in shortchanging other scaffolding steps. While the activity is critical in experiencing the target concept, students also need time to make sense of their experience in verbal and non-verbal means, leading to Step 4 feature talk for the teacher to explain the concept, followed by subsequent steps. To help teachers understand this potential pitfall, a pacing guide was created for extended Moses' framework with key components of each step in a 25-minute teaching assignment (see Figure 3). This is not used as a formula to plug in but as a suggested guide that provides balance among multiple steps.

Figure 3.
Pacing Guide for Extended Moses' Framework

Step 6. Exit skit. (30 seconds): Closing skit to manipulate the academic vocabulary in context to bring closure.

Step 5. Breakout room (2 min): Finally, students actively produce symbolic representations that describe what they have learned using hand gestures.

Step 4. Whole group (7-10 minutes): Bridge from everyday language to academic language. Students learn the academic jargon or "Feature Talk" through breaking down the vocabulary, connecting to students' prior knowledge.

Step 3. Breakout room (3 minutes): Using the guiding question, students discuss and write about the event in their everyday language or "People Talk" (verbal scaffolding).

Step 2. Breakout room (2 minutes): Using the guiding question, students draw pictorial representations of what they have experienced (non-verbal scaffolding).

Step 1. Whole group (7-8 minutes): Students participate in a common physical experience.

Step 0. Intro skit (30 sec): Setting the stage by dropping hints (e.g., many talents)

Total: 22-26 minutes

Another area that seems to help implement the framework successfully is to create a pre-constructed guiding question in Steps 2 and 3. Rather than posing a general question or prompt such as "draw and discuss your experience based on Step 1 activity," it would be more helpful to create a focused question that would encourage students to come up with the everyday language of Step 4 feature talk. For example, before teaching the academic concept/vocabulary of Multiple Intelligences, which is one of the concepts included in the Educational Psychology curriculum, a guiding question to facilitate Steps 2 and 3 based on the Step 1 activity could be, "what did you notice about different talents everyone experienced in the activity? Please draw and discuss with your peers." By creating an intentional, focused question like this, the teacher prepares the students to elicit anticipated responses such as "I noticed there wasn't just one but many talents." This process proved to be critical, as the teacher connects the people talk to feature talk. We found that this added guidance on creating a focused guiding question has resulted in a successful and smooth transition from Step 3 to Step 4.

Another notable area teachers often struggle with is the *assumption* that all students come with the same prior knowledge and experience. While it is true that all students come with some prior knowledge and experience based on their varying backgrounds, teachers cannot assume that, for instance, all first-year university students know how to write an academic essay or understand the concept of *unity* or *coherence* coming into the college freshman composition course. Courses are loaded with abstract academic jargon and students must find ways to figure

out the meaning and application of these academic concepts/words. Moses' framework provides solutions to this problem by providing a *common* physical experience in Step 1 for *all* students to experience the concept using the everyday language, followed by additional scaffolding steps, including the instructor breaking down the academic vocabulary such as *unity* in a meaningful fashion, using pictures and images of the words. As a note, breaking down the vocabulary in Step 4 was not specifically included in the original Moses' framework but was later added by the author (see Ahn et al., 2018). This additional language scaffolding was critical in light of the growing multilingual learner population in the U.S. and around the world. In the state of California alone, over 40% of the state's public-school enrollment speaks a language other than English in their homes (California Department of Education, 2022). As such, we need to provide intentional linguistic scaffolding when presenting the academic language in Step 4.

Finally, as we all know and experienced during the past few years, the COVID-19 pandemic brought many unanticipated changes, including online instruction. The greatest challenge for me was to enable preservice teachers, graduate teaching assistants, and faculty to apply Moses' framework effectively in an online setting. This was never attempted previously. Initially, I was concerned with how to engage students actively in the Step 1 physical activity online. However, to my pleasant surprise, Moses' framework proved to be highly effective if guided thoughtfully. For Step 0, teachers can easily set the stage by playing the background music and project a virtual background. For the Step 1 common physical activity, teachers can e-mail students a document, manipulatives, or other items to bring to class ahead of time. For instance, I invited my class to bring an apple to experience the limbic system in the brain and a rubber band to play with as a fidget toy to discuss attention as a frontal lobe function. Even smelling an apple was possible in online teaching on the other side of the camera. Other teachers have modeled a physical exercise for students to experience positive and negative reinforcement in front of the camera. These online accommodations in Step 1 address one of the biggest struggles of active learning in online teaching. For Steps 2 and 3, teachers create and send their students to a breakout room, which is often much easier than physically moving chairs and desks in face-to-face settings. It is also easier for the teachers to monitor group discussions on Zoom as it is only a click away. For Step 4, teachers can be creative in using a vocabulary poster in front of the camera or project images on Zoom. Based on many cases over the past several years, I am confident that Moses' framework can be effectively implemented in online as in face-to-face teaching and learning if planned and guided carefully.

Having examined Moses' framework in depth, we now turn to three outstanding self-studies from Japan and the U.S. in this special issue to advance the research and practice on Moses' pedagogical framework. In particular, these articles extended the pedagogical framework to address contexts beyond the U.S. (first article), K-12 (all three articles), and mathematics (all three articles) with promising student results. The qualitative and quantitative student data in these articles add to the existing data from 2011 in middle school mathematics (Ahn et al., 2011) and 2018 in university biology courses (Ahn et al., 2018). Importantly, the authors examined their own teaching and student learning by implementing Moses' framework, collecting and analyzing data, which all contributed to improving student learning outcomes as the narratives showed in these three articles.

The first article is written by Lassila and Ahn, exploring the potential of the extended Moses' framework in the cross-cultural context of Japan. In their qualitative case study of four undergraduate students enrolled in the elementary teacher education program at a university in Japan, the authors examined the pre-service teachers' learning to apply the extended Moses'

framework to teach abstract concepts of *pronouns* and *object pronouns* in English as a foreign language to elementary students online. Even though it was their first time to learn and apply the student-centered pedagogical model, the preservice teachers voiced three prominent areas that impacted their learning: Modeling teaching, formative feedback, and scaffolding steps, which were mutually supportive. Having a lesson modeled by the instructors enhanced formative feedback as both the pre-service teachers and instructors shared clear expectations of applying the framework. The modeling done by the instructors acted as a point of comparison for making concrete suggestions for improvement. Furthermore, the process of modeling as such represents a form of scaffolding, easing the pre-service teachers into the learning process. Similarly, the formative feedback served as a form of scaffolding for the pre-service teachers, as the instructors could adjust their guidance to the learners' zone of proximal development. This case study from Japan indicated strong potential for Moses' framework to be used in another cultural context and subject area.

The second article written by Amy Gimino examined the effects of Moses' framework on preservice teachers at a diverse university in California. In her effort to raise the student competencies in the lowest performing area of a high-stake state teaching performance assessment, the author taught the concept of *evidence* using Moses' framework. She compared student scores from the past semester when she used traditional teacher-centered presentations to the current semester when she used Moses' framework and found a 24.8% average increase. She also compared student scores from a second section of the same course taught by another instructor who used non-Moses teacher-centered presentations both semesters and found there was only a 8.2% average increase among his students. This quantitative self-study highlighted important differences between traditional teacher-centered and student-centered pedagogical approaches, impacting student learning outcomes.

The final article is authored by Kristin Tamayo, focusing on Generation Z university students who are disconnected from the academic-heavy language and argument-based concepts in first-year English composition courses. To address these challenges, the author used the extended Moses' framework in her classes to examine its impact in students' comprehension and application of key argument concepts of *ethos, pathos, logos*, and *synthesis*. The results were remarkable: In the first lesson on rhetorical appeals (*ethos*, *pathos*, and *logos*), there was a gain of 68% while in the second lesson on *synthesis*, there were 97% and 91% increases from pre-test to post-test in two courses respectively. In contrast, in the class where she used the traditional lecture method, the actual percentage gain was significantly lower at 32% from pre-test to post-test in the *synthesis* lesson. Interestingly, the author noted that the class that experienced most gain was the class that had 96% of the students repeating the course due to earning a failing grade or withdrawal whereas the class that experienced least gain was a high-performing class. While further study is needed, these results may suggest that students who struggle academically may benefit from different versions of Moses' framework, as it breaks down learning in a series of scaffolding steps. This study points to a promising solution Moses' framework offers to address the critical learning need of Generation Z university students in higher education.

In closing, in the midst of unprecedented challenges around the world, Bob Moses' work offers a promise of hope to educators. Moses' student-centered framework inspires us to reflect on our habits of mind on *how* we intentionally think about teaching difficult concepts and academic vocabulary to our students. It nudges us to *notice* students' puzzling and confusing look on their faces and other disengaged behaviors when the entry is made difficult and

overwhelming rather than an easier, more accessible entry through a physical experience with familiar language. We must be awakened by these messages students continue to send us verbally and non-verbally. Just as these self-studies transformed the authors' student learning, we are all called to impact our student learning by implementing student-centered pedagogy. We are empowered by this equitable and inclusive pedagogical framework Bob Moses left with us. His legacy continues, as his impact was, is, and will be passed on to many caring educators around the world to impact diverse students for generations.

Acknowledgement

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