The Pracademic Pineapple Challenge

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P2: A Polyineering Pracademic Challenge

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A Polyineering Pracademic (P^2) Challenge: A Two-Fold Model

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Abstract – A Polyineering framework for student success is a model to invoke a pioneering spirit combined with many facets – *an entrepreneurial mindset, an engineering toolset, a design-thinking skill-set – for pollinating paradigms regarding global challenges;* the pineapple challenge evokes: *wild imaginations, spontaneous expectations, radical collaboration, generative learning, and anticipatory modeling tactics.* The Pracademic pendulum is a model to *scale high and low value, high art and low craft, and a specialist to generalist spectrum whereby both thinking and tinkering are measured*. Engineering educators are constantly searching for novel ways to inspire and immerse incoming engineering student's into their discipline. The intent of this paper and the workshop activity is to provide educators tools for inspiring the student's "Polyineering" spirit through immersive activities, such as the "Pineapple Challenge". The facilitators will discuss, describe, and demonstrate the workshop challenges. Moreover, the workshop exercise is designed to be interactive, hands-on, and to initiate arts-crafts-design (ACD) endeavors for sharing strategies to engage first-year engineering students.

Index Terms – Professional development, Pre-college engagement, college transition, first year engineering alignment

Overview

Pre-college engineering program activities come in many contexts. The new approach workshop follows a new-age process termed "Polyineering" – where entrepreneurship combines with a pioneering spirit using engineering toolsets, design-thinking skillsets, and pollinating mindsets. Most first year engineering coursework fosters the use of a systematic design process to develop and design solutions to engineering problems as well as to compare design alternatives in the learning schema transference. The Polyineering framework is a way of scaffolding and includes a transdisciplinary body of arts-crafts-design performance operatives to draw on individual and team lifelong learning content, assessment, and pedagogies. Recent education standards provide evidence for pre-college engineering knowledge inclusion across the country.

Theory Driving Workshop

The precepts behind the Pineapple Challenge spawn from a TEDx talk and from several variations of the challenge conducted in professional, community college, high school, and Montessori classroom settings – each with a unique offering and outcome as the process is extremely dynamic drawing on the skills in-hand from the randomly assigned teams to perform various engineering methods. The workshop begins to amalgam the design iterative process to what is possible with software including augmented reality in order to convey both generative design and generative learning possibilities; project management requires specific operations affecting the optimal outcome.

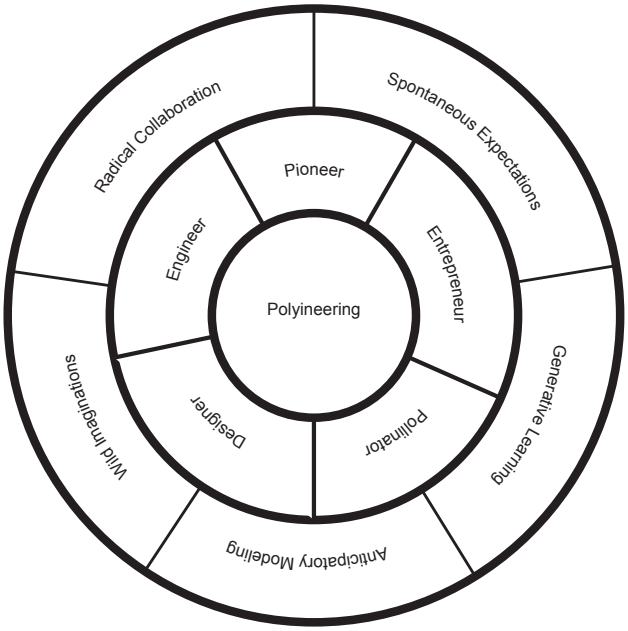
The workshop is a design challenge to engage engineering concepts, develop processes, and retain solutions; the process begins with a sketch, draws on concept inventories, and completes with a team discussion on possible improvements to the approach. The exercise is extremely hands-on and involves a myriad of engineering hard and soft skills to perform under time and resource constraints. Drawing on "How people Learn" the prototype for the workshop attempts to generate outcomes based on Svinicki's cognitive model of learning framework of deliberate, distributed, and practiced paradigms; further, skill learning meets apprenticeship and mentorship practices. The challenge has a team actually cut a pineapple under specific contexts including safety, sanity, efficiency, and artistic elements. The learning by doing and observing necessitates paying attention, retention, production, and motivation of feedback. Also, the

Wiggins and McTighe “curricular priorities” are evinced as in “good to know, important to know, and enduring understandings” are possible when participating and practicing within the actual challenge.

Workshop Description

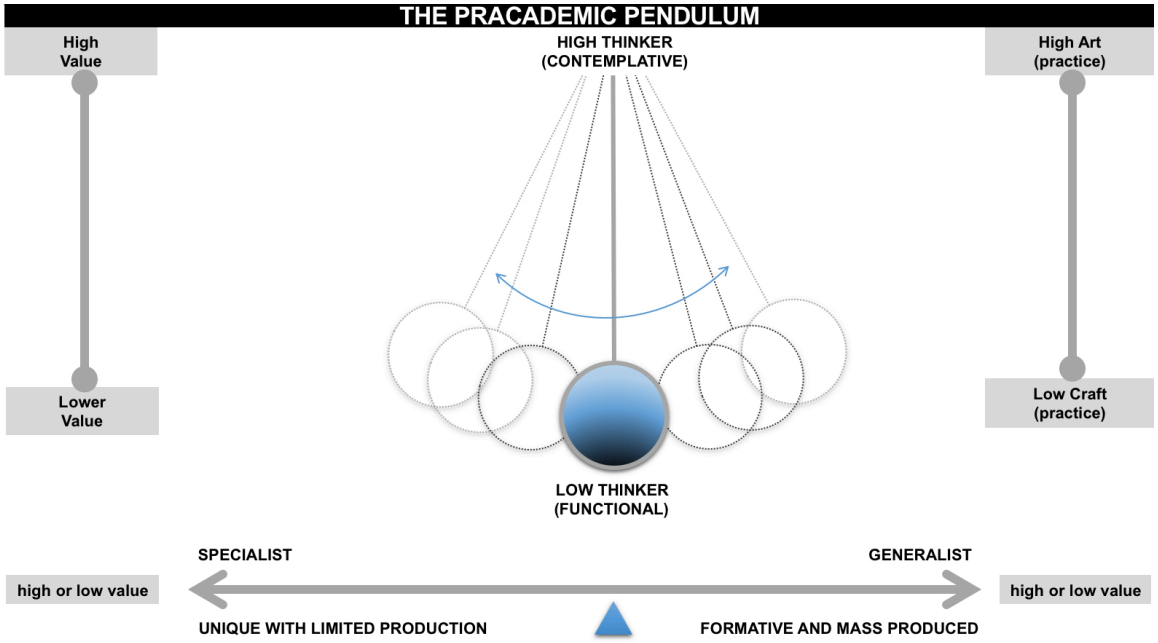
The Polyineering Framework Model endeavors to apply various symbols to aid and identify the five core fundaments to participating in cutting an actual pineapple; we augment the challenge with sequentially and arresting precepts designed to empower each team. Prior to the challenge, the audience is given lively examples to induce “Wild Imagination” (= innovating by evolving); to invoke “Spontaneous Expectations” (= resolving with ambiguity); to promote “Radical Collaboration” (= pollinating with diversity); to elicit “Generative Learning” (= designing by decision-making); and to foster “Anticipatory Modeling” (= predicting with focus). The use of symbolic codes for each affect is a way for the learner to easily identify, recall, and to remember principles. No two projects are ever identical, and there is not one way to solve the pineapple problem. The concepts conveyed are ways to framework, methods to test, and models to either simulate or emulate as the polyineer infuses a pioneering spirit by combining an entrepreneurial mindset, an engineering toolset, and a design-thinking skillset through a pollinating process.

The approach applies pracademic (practical and academic) learning concepts that are both engaging and worthwhile for student-centered learning. Supplementary pedagogical approaches are necessary to augment classroom learning for aligning active-learning topics within innovative course frameworks. This new approach will focus on four topics: innovation in teaching methods, introducing leadership education into the entrepreneurship curriculum, leveraging design-thinking within systems engineering management, and using rigorous research to drive transformational change in engineering education. The pracademic approach is included in the workshop series and presented as part of this paper where methods, leadership, quality, and research are the central tenets the authors propose for serious and thrivable consideration. The pracademic applies dynamic approaches that best fit to the direction as well as for the time, for the budget, and for the stakeholders.



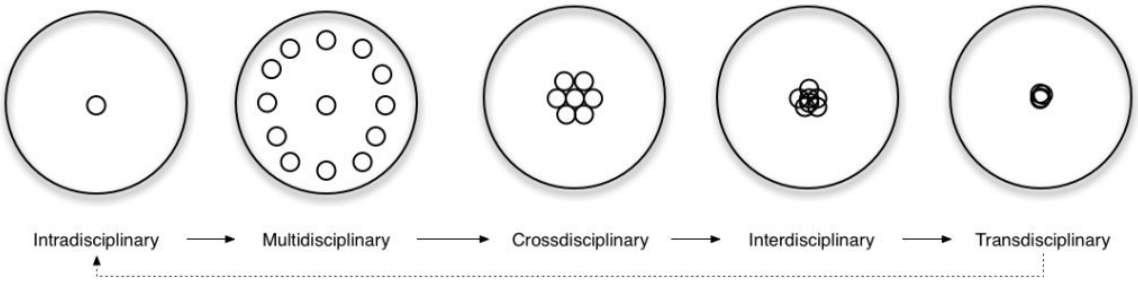
1. Polyineering Framework Model

The Pracademic Pendulum is used to initiate inner-workings and underpinnings of a many perspectives.



2.The Pracademic Pendulum

A pendulum is used to regulate motion and provide measures for timekeeping and other activities. An academic uses pendulums to explain forces or friction. Industry practices might use a pendulum to metronome the tempo of music. And yet, the pracademic uses a pendulum to create and transfer value; by regulating inputs and outputs, the pineapple challenge is reduced to a pendulum balance of money, management, and minutes. Thus the pracademic is a person that thinks, optimizes, produces, and practices with purpose.



3. Transciciplinary taxonomy

The basic drawing above accents the differences pictographically. The context for *Intradisciplinary* is occurring within the scope of scholarly disciplines; integrating reading, writing, and orating in language arts are an example. *Multidsciplinary* is when working on a problem, within silo or similar boundaries as when studying math, history, reading, and science, the teams use similar assumptions, restrictions, perspectives, and philosophies. *Crossdisciplinary* then integrates aspects from multiple academic disciplines to address problems arising from narrow concentrations or specialized fields. Whereas penultimately with *Interdisciplinary* there is an overlap or harmony of discipline boundaries forming sub disciplines and a blending of common assumptions, restrictions, and solutions drawing on established fields

of studies. *Transdisciplinary* is where new knowledge and theoretical solutions draw on non-traditional ideas to cross-pollinate contradictory assumptions, restrictions, and philosophies. Thus Transdiscipliary work moves beyond bridging with academia and engages directly with the production and use of knowledge outside of the academy. The catalyst is forming an outcropping of the new polyineering framework concepts.

POLYINEER VERSUS ENGINEER: **TINKER-THINKER** THEORETICAL MODEL

Polyineer -High Tinker-Thinker
- Low Theory
- High Practice

Bridge Builder -High Theory
- Low Tinker
- Low Practice

Mechanic -Low Theory
- High Tinker
- High Practice

Sub-Commander - High Theory
- Low Tinker
- High Practice

4. New Taxonomy: the morphology of the new millennium engineer:

GYPSY --> POT & PAN MENDER --> HOOP --> TINKER --> BRICOLEUR --> INVENTOR --> MACHINIST --> DESIGNER --> ENGINEER --> THINKER --> POLYINEER

Applying activities based on group and individual groups is a way to explore topics that provide collaboration. The crux of cooperative learning is successful interdependence – "students must believe they are linked with others in a way that one cannot succeed unless the other members of the group succeed and vice versa. In other words, students must perceive that they sink or swim together" (Streveler et. al, 2012). Experimenting with actual life skills on the spot, in the flesh, experiments pedagogically with worthwhile attributes. The identification of a skill set is often more potent than the actual practice in this exercise of extracting commonality from individuality. The opportunity herein is to implement new pedagogical stratagems underpinning bodies of literature, from longitudinal studies, but also from tactics that are of-the-moment. Real education needs to be authentic, not canned; students from all levels, from all cultures know the difference between real and rhetorical.

Appendix: The Pineapple Hands-on Workshop Exercise

The Pineapple Project is designed for teams where each group is provided with cutlery, a cutting board, and empowered to select an actual pineapple. The mission is spelled out in a one-page instruction sheet. Essentially the Pineapple Project is multidimensional in instruction seeking to have groups tap into individual skillsets, combined with spur of the moment ideas, and including being adventurous by using any resources found in the workshop room be it music, or other accouterments that might enable the project to be most situated for projecting team presentation, process, or forms of passion. The structure of the assignment allows for 45 minutes including time for each team to report what and why they did certain steps in their pineapple project. Again, a pineapple project demonstration for the least amount of cuts, for sanitation, for selection, for efficiency and for presentment are displayed by the workshop proctor using both live demonstration and enhanced through a quick video in order to explain and highlight according the challenge of the rubric provided to each team prior to performance in the pineapple challenge.

I. Clarity of Objectives – to develop a three (3) hour Workshop to train and teach first-year engineering educators on methods to educate and entertain incoming engineering students in applying *differentiation* tactics through dynamic assignments. The teachers will be able to modify and extend or expand the Pineapple Workshop curriculum for their particular classroom size, setting, and circumstances. The alignment is purposefully tiered and demonstrated in that the opening exercises tier and increase in complexity.

II. Learning Activities – the nature of the workshop is to establish a method of conveying content, understanding student alignment and measuring achievement through assessment. The content, assessment, and pedagogy attempts to engage while providing enduring

understanding for the life-long learner. High school teachers will be able to apply the workshop curriculum into their offering regardless of subject matter expertise. Specifically, the essence of teaching differentiation to teachers is to help connect theory into practice and to promote accountability (Kaplan, et al 1998). In order to accommodate teaching differentiation for accommodating ENE learning, there are five key points to the workshop. 1. Teaching pace – the students know the fundamental concepts through the workshop exercises the knowledge is extended. The use of pre-tests and anchoring activities is essential prior to engaging the activity. This ensures that the right pace is established at the onset. 2. Product – the workshop is hands-on but also can include the use of social media as in making videos about the process of cutting the perfect pineapple. 3. Depth – going beyond the basic issues; in this capacity tiered activities and treating the students as experts is a way to foster beyond the cursory knowledge sets i.e. where a pineapple grows, the conical shape with thorns can be stabilized by removing the crown are but a few examples covered in the workshop demonstrations. 4. Breadth – this is to establish flexibility in learning, the students can own the direction of the project by using boundary work and cross-disciplinary principles to include sanitation, physics and geometric configurations, how use of the skin is able to be salvaged and converted into a material to produce bumpers. The pineapple fruit bisects umpteen topics for students to delve into the historical as well as the futuristic attributes. 5. Delivery – the concepts are able to become at once more abstract. This is where the use of Kaplan's iconic symbol, the glasses as example, indicates that there are multiple perspectives in use of the pineapple depending on cultural and other diverse components. To enhance the point, a poem is presented that naturally displays 13 perspectives from Wallace Stevens poem entitled "Thirteen ways of looking at a blackbird." This provides a time-out-of-time expanse to motivate the student to think about their unique perspective as well as some from far off areas. Also, the use of Kaplan's lips indicates an open-ended way of incorporating languages not just of business but also of STEAM (Science, Technology, Engineering, Art, and Math) as the pineapple intersects both an art and science approach depending on the notion of the group or individual learner's attributes and inclinations. The differentiation occurs through the flexibility for interpretation of the open-ended assignment and the take away is at once loaded with similarities as well as stark differences depending on student proclivity and choice of framework exploration.

An important note to the workshop is that it is designed to implement and demonstrate the conceptual benefits to tiered instruction. The systematacity of performing translates the working memory of the three starter activities into the long-term memory for automatic recall. The majority of workshops include a large proportion of people that have never cut a real pineapple (approximately 80% of participants have never cut an actual pineapple). The experience is new and fresh and because of the dynamics to the fruit, the cutting is wide open for unique and distinct approaches. There is no one-way to dissect a pineapple, which is the universal teaching experience. Instructional Strategies include applying the grid found below: a model to construct differentiated curriculum for the gifted, Dr. Kaplan's layered curriculum approach is introduced to evoke scope and sequence through a series of symbol prompts for both the educator and the learner to roadmap and archive learning strategies for various styles, settings, and synapse levels.

III. Opportunities for Continued Learning – the nature of the workshop is problem-based and active learning. Each exercise is designed to sequentially enable the learners and learner teams to elevate critical thinking by considering stepwise aspects from the proceeding exercises. In this capacity, the learning taking the novice to eventual expert is extremely contiguous to concept inventories of the proceeding lessons. The scaffolding thus triggers both affect and intellect (Vygotsky, 1986). The idea behind the four integrated exercises is for students to understand the design and iterative process of problem solving. The design process is enforced to teach Teachers how to structure a learning environment where a framework can center a learner or group on applying critical thinking even where the learning

appears fuzzy or impossible. Understanding the principles of conducting electricity using a pineapple is a natural extension to the workshop. Also, one deep lesson beyond the scope of the demonstration is the notion of recycling and as the Native American's say, "using everything but the moo" – how does the project become a zero waste exercise. Which biological and chemical attributes are possible? A homework takeaway includes what can the chewy core be used for i.e. natural teething sticks or rubbing the citric pulp of the pineapple on dry skin. There are many homeopathic lessons instead of merely cleaning up the refuse and depositing. In this fashion, the continued learning extends to many ways of pivoting the concepts to drive unimaginable connections, unthinkable combinations.

IV. Evaluation – using a method of critical thinking tools to examine topics from multiple depths and perspectives. Additionally, the rubric is one dimension for evaluating the groups, the students, and the teacher performances. The workshop elicits valuable evidence of individual, pairs, and group participation. The last component is a feedback form (this is designed to be an online Qualtrics post-survey to collect feedback data about motivation, timing, and temporal attributes) for attendees to evaluate subjectively through comment cards and objectively through an anonymous survey on the workshop experience details. Thus, the workshop provider and the attendees both leave with forms of feedback to consider improving the learning opportunities for the teachers and ultimately for student benefits. Lastly, pictures of the final outcomes, as no two pineapple projects are ever identical in style or substance, is captured and shared with each participant as a reminder that pineapples intersect in our daily lives more than one realizes prior to participating in the dynamic workshop designed to expand ideas. The enduring understandings culled from the pineapple exercise are extensible to a variety of disciplines ranging from English, humanities, art, to physics, math, engineering and the sciences.

5. Kaplan's Iconic Symbols

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