

Developing Student Agency to Support Student Application and Implementation of Design Thinking

Phase One

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Student agency in education places more of the responsibility and accountability of learning in the hands of the students to significantly impact student achievement. In April of 2017, the American Institutes of Research conducted a study titled, "Maximizing Student Agency: Implementing and Measuring Student-Centered Learning Practices," whose purpose was "to identify the instructional practices that may be useful for the development of different aspects of student agency" (Zieser, K., Scholz, C., & Cirks, V., p. 1, 2018). Participants of this research study, both students and teacher, identify as part-Native Hawaiian, an underserved and underrepresented population in science, technology, engineering, and mathematics careers. This research study uses the findings and methods of Zieser, et al, to develop student agency as a means of supporting student application and implementation of design thinking in his/her competency-based personal student curricula. In this, the first year of a planned four-year study, researchers collect baseline data of study participants self-efficacy, perseverance of interest, perseverance of effort, locus of control, mastery orientation, meta-cognitive self-regulation, self-regulated learning, and future orientation. Additionally, it implements networked improvement community protocols of teacher promotion of student agency. Data collected from these protocols will be analyzed as indicated in the original study. Findings and conclusions from this first year will be used to adjust future years' research methods.

Key Words: Student agency, Student achievement, Native Hawaiian, Engineering Design Principles. Teacher practice

Introduction

Rising 4207.3 meters above the ocean surface, stands Mauna Kea, first born child of Hawai‘i, residence of the gods. “In the Hawaiian worldview, natural and cultural resources were treated alike, the well-being of one depended upon the well-being of the other,” as such, Mauna Kea is one embodiment of “how a people identify with, and personify the environment around them ... the intimate relationship ... that people ... feel for the sites, features, phenomena, and natural resource etc. ... their sense of place” (Maly & Maly, 2005, p. 4). Native Hawaiians, like many other cultural groups around the world, hold reverent many elements of nature because they are natural personifications of gods, and as the first born of Wākea and Papahānaumoku, Mauna Kea is a most sacred *‘āina mauna*.

Native Hawaiians introduced the world to their sacred mountain on 02 April 2015, when a small group of cultural practitioners prevented heavy equipment from accessing the construction site for the newly proposed Thirty Meter Telescope (TMT). Adamantly against the desecration of a valued cultural property, Native Hawaiians work tirelessly to educate state officials, the University of Hawai‘i officials, and the Astronomy community of the horrific injury construction on Mauna Kea would bring to the heart of a community.

Native Hawaiians supported both camps, with advocates indicating the importance and need for looking deeper into space to find answers to the universe, while dissenters continued to cite cultural significance

and the domino effect on environmental damage since Mauna Kea is critical to the island watershed. This debate and protest brought back a long-fought issue of self-determination for Native Hawaiians and demonstrated the need for an increased number of Native Hawaiian students pursue post-secondary degrees in science, technology, engineering, and mathematics careers, areas where Native Hawaiian students are an underrepresented and underserved population.

Student agency, when students come to “believe deeply in their own capacity to master difficult material through sustained, thoughtful effort” (Jackson, 2003, p. 583) in order to “actively construct knowledge” (Gorzelsky, 2009, p. 67), “determine their own course of action (Vaughn, 2018, p. 63), and “control and affect their own learning” (Lindgren & McDaniel, 2012, p. 345), supports beliefs in a growth mindset and increased self-efficacy, perseverance, meta-cognition, self-regulated learning, and future orientation (Zeiser, Scholz, & Cirks, 2018). Agency supports students’ development of cognitive, intrapersonal, and interpersonal competencies (National Research Council, 2012) and better prepares them to successfully transition from secondary education to college and/or careers.

Schools acknowledge the somewhat unknown future job market they are preparing their students to enter – jobs that do not yet exist, technologies not yet invented, and problems not yet revealed. Students need to be equipped with the competencies necessary to prosper in an unknown future. As such, the purpose of this research study is to support the development of student agency in part-Native Hawaiian secondary students and to determine how increased and/or improved student agency might impact students design thinking knowledge and skills.

Research questions

In the Spring of 2017, the American Institutes of Research (AIR) conducted a research study to “learn more about the [instructional] practices that support student agency” (Zeiser, Scholz, & Cirks, 2018, p. 1). The AIR research study used a mixed-methods approach to address key research questions aligned with four areas of concentration, as shown in Table 1. The first phase of this research study, from September 2019 through May 2021, also implements the same methodology and addresses three of the four research questions.

Table 1. Areas of concentration and research questions.

Areas of Concentration	Primary Research Question(s)
Teacher practices designed to promote student agency	What practices do teachers employ to provide feedback to students on their performance that assist with the development of student agency? How do teachers use data to inform their practices?
Lessons learned about surveying student agency over time	How does student agency change over time?

Literature Review

Student agency

Student agency provides students with the knowledge, skills, and experiences necessary for advocating for their educational needs and goals. It supports their ability to improve and strengthen their own beliefs in themselves, specifically focusing on their ability to succeed and the confidence they have in themselves to succeed, to persevere regardless of the circumstances, to be in control of their lives, including their educational journey, which is followed by their career journey, to master the knowledge and skills they choose, and to reflect on their learning and use the reflection data to further their personal goals.

Survey development identified nine key constructs of student agency and their corresponding measures (e.g., scales), which were used in the development of the Student Survey used here. These key aspects include general self-efficacy (a person's belief in his/her competence to succeed (Chen, Gully, & Eden, 2001)), grit (a person's ability to maintain his/her effort and interest (Duckworth & Quinn, 2009)), locus of control (a person possessing the ability to differentiate between those components within his/her control and those controlled by external sources (Levenson, 1981)), mastery orientation (a person's desire to pursue excellence in learning and understanding (Midgely, et al., 2000)), metacognitive self-regulation (a person's awareness of his/her thinking and his/her ability to manage said thinking (Pintrich & De Groot, 1990)), self-regulated learning (a person's ability to develop the behaviors promoting learning (Farrington, et al., 2012)), and future orientation (a person's planning for his/her future, specifically life after graduation (Hart, Young, Chen, Zou, & Allensworth, 2020)).

Research demonstrates the positive outcomes gained through the development and maintenance of student agency (National Research Council, 2012). Students with strong agency tend to succeed at future endeavors because they possess the positive characteristics and qualities of strong-minded confident individuals.

Design thinking

With origins at Stanford University in California, design thinking developed as a method for creative action and can now be seen in use in a wide variety of disciplines, from education to business to engineering. Since its origin, the design thinking process has been revised and adjusted by different schools and organizations to fit its needs. Regardless of individualized processes, design thinking encapsulates key elements of being human centered, collaborative, and iterative in design (Dosi, Rosati, & Vignoli, 2018, IDEO, Noel & Liub, Plattner, Meinel, & Leifer, 2016, Rapp & Stroup, 2016).

Design thinking supports student agency by supporting self-efficacy, promoting perseverance when faced with challenges, and allowing individualism within a collaborative setting. It provides students with a method for developing critical thinking and problem solving skills, while exploring creative elements as a means for developing personal creative knowledge and skills. Design thinking creates a place for students to grow through failure.

At this time, while a design thinking survey has been identified, we await permission and access to the design survey.

Methodology

Participants

Seven students, three girls and four boys, and one female teacher participated in the first phase of the research study, from September of 2019 through May of 2021. Student participants range in age from 13 through 16 years (grades 9 through 11) and the teacher participant is 48 (with an advanced professional degree). Six of the eight total participants are categorized as low socio-economic status (as determined by the number of books in the house) and 100 percent of the participants are part-Native Hawaiian.

The seven students attend a Native Hawaiian language- and culture-focused, integrative design-centered STEAM competency-based independent high school. Currently, the teacher participant is the only teacher at this high school.

Materials and procedure

This research is designed as a multi-year study with three phases. The first phase of the study, from September 2019 through May 2021, prepared to conduct the research study, collected baseline data of student agency and design thinking, addresses teacher practices designed to promote and develop

student agency and design thinking, and publishes first phase findings. The second phase of the study, from June 2021 through May 2022, continues to measure student agency and design thinking to identify the degree of change over time for both, address new teacher practices designed to promote and develop student agency and design thinking, and publishes second phase findings. The third, and final, phase of the study, from June 2022 through August 2023, collects the last measures of student agency and design thinking and organizes and analyzes the data to publish and present results, discussion, and conclusions.

Table 2. Schedule for phase one actions and events

Month, Year	Activity
September 2019	Research student agency. Formulate study definition of student agency. Research design thinking. Formulate study definition of design thinking.
October through November 2019	Read and review the AIR study, <i>Maximizing Student Agency</i> . Prepare the AIR student and teacher survey.
December 2019 through January 2020	Research design-thinking measures. Identify a design-thinking measure to use in the study.
January 2020	Conduct student survey of student agency. Conduct teacher survey of instructional practices designed to promote student agency.
February 2020	Conduct student survey of design thinking. Organize and analyze student baseline data from student agency survey. Organize and analyze teacher baseline data from teacher practices survey.
March 2020	Organize and analyze baseline data from design thinking survey. Select and document (using the Change Idea Hypothesis Worksheet) change idea to test.
April 2020	Review of Change Idea Hypothesis Worksheet with outside consultant. Design and develop measures aligned to goals of Change Idea Hypothesis Worksheet.
May through July 2020	Prepare and plan for implementation of change ideas.
August 2020	Conduct student survey of student agency and design thinking. Conduct teacher survey of instructional practices to promote student agency.
August 2020 through December 2020	Implement change idea and Plan-Do-Study-Act (PDSA) cycle.
January 2021	Conduct student survey of student agency and design thinking. Conduct teacher survey of instructional practices to promote student agency.
January 2021 through May 2021	Continue implementing change idea and PDSA cycle.
May 2021	Conduct student survey of student agency and design thinking. Conduct teacher survey of instructional practices to promote student agency.

The change idea hypothesis and associated instructional hypothesis created in March and finalized in April 2020 will be implemented in the second half of phase one of the research study, which is marked by the 2020-2021 school year calendar. Data will be collected and analyzed three times during the second half of phase one. The research team will complete a written report of the phase one results for publication.

Phase two begins with completion of a second change idea hypothesis and creation of a second PDSA cycle to be implemented and applied during the 2021-2022 school year calendar. As with the second part of phase one, data will be collected and analyzed three times during phase two and a second written report will be published with results and findings.

Phase three starts in the summer of 2022 and continues through the 2022-2023 school year calendar. Like phases one and two, a third change idea hypothesis and PDSA cycle will be completed, implemented, and applied throughout the phase. Data for phase three will be collected and analyzed three times. In addition to the phase three data, the complete research study data will be analyzed and the results, findings, discussion, and conclusions of the full study will be written for publication.

Data

Teacher practices designed to promote student agency

This study first concentrates on teacher practices to promote student agency as indicated by the following two research questions:

1. What practices does the teacher employ to provide feedback to students on their performance that assist with the development of student agency?
2. How does the teacher use data to inform her practice?

The teacher has taught at the secondary level (grades six through 12) for 19 years, with the last four of spent teaching multiple grade levels and multiple content areas. The data collected using the teacher survey, which collected baseline data of the implementation frequency of practices used to promote student agency is presented in Table 3. The data show only three practices – contribute to and provide feedback on key decisions in the classroom, develop personal relationships with students to better understand their agency strengths, needs, and motivations, and provide students with extrinsic motivation to build agency skills – were implemented more than three times a week.

Table 3. Practices implemented with most of the students.

Practice	Rarely	1-3 times a month	1-3 times a week	More than 3 times a week
Make connections between outside agency and its application in the classroom.	●			
Revise assignments or tests after they have received feedback.			●	
Self-reflect using journals, logs, or other structured templates or tools.	●			
Lead instruction on a particular skill or concept.	●			
Contribute to and provide feedback on key decisions in the classroom				●
Develop personal relationships with students to better understand their agency strengths, needs, and motivations.				●
Guide students in the process of asking for feedback.	●			
Help students set goals to complete coursework while improving their agency to do so on their own.		●		
Hold one-on-one meetings with students to discuss elements of student agency and its relationship to academic work.	●			
Design formative and summative assessments to evaluate student agency.	●			

Provide students with extrinsic motivation to build agency skills.				•
Provide explicit instruction to develop skills related to student agency.	•			
Model agency skills to demonstrate those skills to students in a meaningful context.			•	
Provide positive reinforcement for demonstration of agency skills.		•		
Provide students with tools, strategies, and resources to coach them toward mastery of agency skills	•			
Provide brief spoken prompts in real time to highlight or remind students of behaviors that demonstrate agency	•			

Surveying student agency over time

Baseline student agency data for the seven students (three females and four males) were collected on 13 and 14 January 2020. Responses to each survey item ranged from 1 (strongly disagree) to 4 (strongly agree). The survey measures used and collected followed the AIR study (Zeiser, Scholz, & Cirks, 2018), which means “we calculated a scale score by averaging responses to relevant survey items” (p. 6). Table 4 provides the averages and standard deviations for the student agency measures.

Table 4: Student agency constructs and example items

Construct	Example Item	Whole	
		Mean	Standard Deviation
Self-efficacy	In general, I think that I can achieve goals that are important to me.	3.21	0.31
Perseverance of Interest ^a	New ideas and projects sometimes distract me from previous ones.	2.11	0.24
Perseverance of Effort	I finish whatever I begin.	3.00	-0.12
Locus of control	I can pretty much determine what will happen in my life.	3.02	0.53
Mastery orientation	An important reason why I do my classwork is because I like to learn new things.	3.10	0.31
Metacognitive self-regulation	I ask myself questions to make sure I understand the material I have been studying in class.	2.79	0.25
Self-regulated learning	I set aside time to do my homework and study.	2.81	0.44
Future orientation	What I learn in class is necessary for success in the future.	3.57	0.14

^a Items in the perseverance of interest construct were reverse-coded so that higher values indicate a higher level of perseverance.

Mean and standard deviation were also calculated by gender and socioeconomic status (SES), as indicated in Table 5. High SES was indicated by those students who indicated having at least 100 books in the home.

Table 5. Difference in student agency by subgroups: gender and SES

Construct	Gender				Socioeconomic Status			
	Female		Male		Low		High	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Self-efficacy	3.50	0.72	3.00	0.76	3.28	0.77	3.13	0.77
Perseverance of interest	2.00	1.04	2.19	0.91	2.25	0.93	1.92	1.00
Perseverance of effort	3.42	0.90	2.69	0.70	3.06	0.85	2.92	0.90
Locus of control	3.43	0.75	2.71	1.01	2.96	0.89	3.10	0.89
Mastery of orientation	3.22	-0.55	3.00	0.83	3.04	0.81	3.17	0.62
Metacognitive self-regulation	2.82	0.64	2.77	0.77	2.84	0.81	2.73	0.57
Self-regulated learning	3.04	0.94	2.64	0.82	2.92	0.94	2.67	0.83
Futuer orientation	3.53	0.74	3.60	0.50	3.65	0.49	3.47	0.74

Demographic data were collected for race/ethnicity and English language learner (ELL) status. All students identified as Native Hawaiian and as not ELL, so subgroup analysis was unnecessary for these two subgroups.

Results

Teacher practices designed to promote student agency

These data indicated the implementation of providing “students with additional resources and feedback so they can revise and improve their work” (Zeiser, Scholz, & Cirks, 2018, p. 13) to be most appropriate since it was being used one to three times a week. Consequently, student data would be collected using the Individual Assessment of Knowledge and Thinking (IAKT) survey and the Growth Mindset survey (pp. 39-40) developed by School B. The plan involved providing opportunities for students to revise their work before grading by building in revision opportunities into project timelines, after grading by allowing students to resubmit assignments if they choose, and during a project by giving students opportunities to seek out feedback throughout the project timeline. See Figure 1.

REVISION: Teachers provide students with opportunities to revise assignments or tests after they have received feedback.

Key Elements of Revision

Providing Opportunities to Revise Before Grading. Teachers embed the revision process into their project timeline, providing students with feedback and an opportunity to revise before grades are provided.

Providing Opportunities to Revise After Grading. Teachers provide students with the option to revise and resubmit an assignment or test if they are not satisfied with the grade they receive.

Providing Student-Led Opportunities to Revise. Teachers provide students with opportunities to collect feedback and make revisions if they choose to do so.

Figure 1. Menu of teacher practices: student opportunity

Discussion

The Principal Investigator is conducting this research study with three secondary age students, which makes this both a research study and a design challenge for the students. Consequently, to support the students' learning and knowledge and skills acquisition, the PI includes many instructional classes to provide the students with necessary learning investigations and activities. Evidence of this process can be illustrated by the Fall 2019 actions and events. During this time period, the PI developed learning investigations and activities for the students to learn about and understand student agency, teacher instructional practices, and PDSA cycles, as well as to learn about and how to conduct post-secondary level research. Additionally, time was allotted for the students to become knowledgeable about the AIR research study through a thorough reading, review, and discussion. Skills workshops took place to give the student the skills necessary to help with creating the three survey measures, student agency survey, student design thinking survey, and teacher survey of instructional practices to promote student agency; to learn qualitative and quantitative research methods, including quantitative statistical analysis and qualitative thematic analysis; and to understand researcher bias.

With this research study, the research team hopes to provide secondary teachers with high Native Hawaiian student populations with instructional practices to promote student agency. As with any teaching practice, the development and promotion of student agency benefits all students regardless of culture and/or ethnicity. Additionally, it hopes to encourage other independent schools and the State of Hawai'i Department of Education schools to include design thinking curricula at all grade levels, especially in those schools with high Native Hawaiian student populations.

In thinking ahead, the research team believe future research might include a comparative study between student agency and student achievement in English language arts and mathematics, high stakes testing disciplines, to determine if one influences the other. Additional research might also include longitudinal studies to determine if there might be a correlation between increased student agency and post-secondary educational success for Native Hawaiian student populations.

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Chad Kamakoa Kyota is a tenth grader at Nā Hunaahi. He is currently interested in becoming a video game programmer and pursues this interest by focusing on projects involving coding. As a member of the educational board game team, Kyota hopes to develop an app version of the game.

Quinn Waiki is a tenth grader at Nā Hunaahi. She is currently interested in pursuing a study in criminal justice with a focus on the law enforcement officer curriculum. Waiki is also a member of the educational board game team.