

Analysis of STeM Student Perceptions of a Re-Engineered General Education Program

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Abstract

This research analyzes the survey responses from university students enrolled or recently graduated who experienced a re-engineered general education (GE) program. The new GE program is modular and named Holokai (meaning “travel over the ocean” in Hawaiian). The research target population includes science, technology, and math (STeM) majors. Our objective is to analyze survey data from STeM students about the Holokai GE program in regards to student overall satisfaction, sense of autonomy, sense of utility, ease of use, and their general opinions. This modular GE program was launched Fall of 2018 and took approximately 18 months to plan, analyze, and design. Evaluation of the data reveals that students from Asia have more negative views of GE programs in general and 18 - 19 year-old students express high approval of the new modular Holokai GE program.

Keywords: General Education, Modular GE, Re-engineering, STeM Majors, Autonomy

1. INTRODUCTION

General Education (GE) has long been the hallmark of a quality education. Its inception in

modern times occurred as educators and government leaders called for a common curriculum shared by undergraduate students.

The objective of this research is to evaluate student survey responses regarding a modular GE program launched in Fall of 2018. Using Rochester University and The College of Idaho as a baseline, Brigham Young University–Hawaii re-engineered our legacy GE program and created a modular GE program uniquely designed for a student population that is 55% international and based on four faculty (college) categories: Arts & Humanities, Math & Sciences, Professional, and Religious Studies (Wolthuis, 2020).

2. BACKGROUND

Woodrow Wilson addressed the common curriculum issue in 1894 at Princeton calling for a review of history that would allow students to study the “common thoughts and struggles” of their ancestors (Crooks, 1979). In contrast, Harvard’s only required course in 1900 was English composition (Mintz, 2020). The general education curriculum has become broader and more complex over time. Presidential influence again provided support for GE in a 1947 report, *Higher Education for American Democracy*, commissioned by Harry S. Truman, stating colleges “must find the right relationship between specialized training on one hand, aimed at a thousand different careers, and the transmission of common cultural heritage toward a common citizenship on the other” (Crooks, 1979).

Over the past 150 years, GE has evolved from a combination of courses focused on a “society’s cultural heritage” and “intelligent citizenship” (Crooks, 1979) to what students now assess as an obstacle, a checklist, and irrelevant (Mintz, 2020). In a previous paper the authors noted that the “roots of GE go back several centuries. The common core content for Harvard, founded in 1636, used Plato’s classical liberal arts outline from the trivium and quadrivium published in Plato’s *Republic* (O’Banion, 2016).” (Wolthuis, 2021).

Cafeteria style GE programs are in flux with changes in work on many college campuses (Flaherty, 2014). University mandates for students to take two of this and two of that frustrate Millennials and Gen-X’s who want an education that reflects their world of “learn a skill” by watching online videos. Student attitudes towards GE can be summed up in a 2018 tweet shared 72,000 times and liked by 209,000: “general education courses in college are a complete scam for your money to keep you paying for 4+ years. If gen ed courses weren’t a requirement, major really only require 2 years of

classes. All of highschool (sic) was gen ed- it’s simple unnecessary” (Hanstedt, 2020). GE must certainly adapt to student expectations or higher education may suffer enrollment downturns. The United States Department of Education reported that college enrollment rates have remained at 42%, virtually unchanged from 2010 to 2019 for 18- to 24-year olds (NCES, 2021). A flat progression over 10 years indicates no growth in this economic sector that commands a significant portion of the GDP in most first and second world countries.

If there is no growth in the number of students choosing higher education, then how else can we measure success? Speaking in a broad sense, education is successful when a human being is able to harness power within themselves that allows them to do and to think, autonomously (Rödl, 2016). This is the basic characteristic students yearn to have, Modular GE programs leverage this idea and build a process that allows students to create and follow their own educational journey.

Our past research found two universities who have leveraged this idea and attempt to confront changing student expectations by re-engineering GE, removing the cafeteria style programs and replacing them with modular programs that provide students with the autonomy they desire to create and follow their passion (The College of Idaho, 2020; University of Rochester, 2020).

Before developing the Holokai we evaluated these two benchmark modular GE programs.

Benchmarks

The Modular GE programs at The College of Idaho and University of Rochester have been live since 2010 and 2015, respectively.

Interviews with a University of Rochester admissions officer revealed that students do not compare their current open curriculum (modular GE) with their past GE program. Additionally, he stated “our students need to drive their own educational narrative” (R. Alexander, personal communication, May 31, 2021).

Our personal observation of university student behavior indicates that students desire the ability to choose their educational path. Research in East Asia, Europe, and the USA link learner autonomy with positive life satisfaction (Henri, 2018). At the college level, students expected autonomy in their educational experience to support their interests (Rusetskii, 2014). This is

particularly true of the process that supports their educational experience.

From our previous paper on re-engineering general education, we provided the following summary of the modular GE programs developed at our two benchmark universities.

The University of Rochester created a simplified GE program with three basic parts (University of Rochester GE URL, 2020):

1. Primary writing requirement, mastery of written communication, with dozens of choices.
2. Course requirements for the major, three broad areas to choose: Humanities, Social Sciences, or Natural Sciences and Engineering.
3. Cluster in two other areas:
 - Politics and math
 - Sonic arts and technology
 - Power and inequality

The College of Idaho fashioned a similar approach requiring students to graduate with 1 major and 3 minors, in 4 years. (The College of Idaho GE URL, 2020).

1. This program is called PEAK and offers 24 majors and 40 minors allowing students to pursue their "passion."
2. The categories, or "Peaks" – include the humanities, social sciences, natural sciences and a professional field.

Motivation

We have been deeply involved with the design and implementation of the Holokai Modular GE program. As advisors, mentors, and curriculum creators we have a vested interest in this program.

Anecdotal feedback from students lead us to believe that they genuinely like the Holokai Modular GE program and prefer it over cafeteria style legacy GE programs. Our research about the Holokai Modular GE Program at Brigham Young University–Hawaii centers around four key areas aimed at gathering foundational insights about their GE experience.

- Overall satisfaction
- A sense of autonomy
- A sense of utility
- Ease of use

We expect most of our target population have experienced the Holokai Modular GE program. A portion of the target population could also be in two other cohorts: first, those that already completed the legacy GE program and second, transfer students who completed their GE requirements at another institution.

3. GE MODULAR DEVELOPMENT

Understanding the process of how the Holokai Modular GE program was created at Brigham Young University–Hawaii is essential to set the context for this research. Part 3 is provided from our previous paper to provide this context as follows.

In June 2016 [the administration formed] a Modular GE committee led by a dean and formed of all department chairs, 17 educators, who had all experienced GE firsthand as students and teachers. Our charge was to "craft a proposal for a GE approach that can offer students both breadth and depth of education to help them be both more prepared and more marketable as they move beyond the University."

Two specific charges the committee was asked to address were student autonomy and allowing students to follow their passion.

As this diverse group met each month, for over a year, we discussed and crafted a new modular GE program that now has the name Holokai and was implemented Fall of 2018. Holokai means to travel over the ocean and fits the seaside location of BYU–Hawaii.

Early in this process the authors were reminded that many of our students come to our university with a directive from their parents on what major they should pursue.

The new modular GE program, Holokai, allows a student the autonomy to select their own journey; they could still major in computer science for the family business, but they could follow their passion and select a minor in film and a minor in entrepreneurship, see Figure 1.

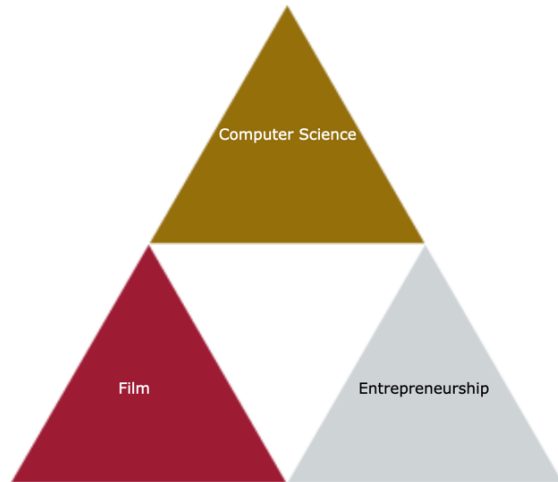


Figure 1. Sample Holokai

The Figure 1 graphic represents the majors, minors, and certificates in three categories, the fourth and central triangle represents the GE core and spiritual and religious learning.

- Crimson represents Arts & Humanities
- Gold signifies Math & Sciences
- Silver stands for Professional Studies
- The White triangle stands for the Religion, Math and English Core.

All students are required to complete basic classes in Math, English and Religious studies. A student could also be a Mathematics major, hence the apparent duplication of Math in the Figure 1 graphic and explanation.

Details for each of these categories appear on the Holokai website, this also acts as an application that allows the student to graphically setup their plan. Figure 2 and 3 in the appendices of the previous paper, (Wolthuis, 2021), shows the student website for creating a Holokai.

Before this significant GE change, the number of minors was very small in the technology area at Brigham Young University–Hawaii. Each major (CS, IS, and IT) had an *existing minor.

To meet the expected demand of many more students seeking options for minors under the Holokai, the Computer & Information Sciences Department created 10 new minors/certificates. Our excitement to create these new options has not matched the expected traction, and those marked with a “^” may be suspended, Table 1.

| <u>Professional Category</u> | Cr Hrs |
|-------------------------------------|--------|
| - Agile Project Mgt Cert | 15 |
| - Digital Business Cert | 14 |
| - Digital Security Cert | 18^ |
| - Digital Security Minor | 12^ |
| - Digital Tech. Minor | 18 |
| - Enterprise Business Systems Minor | 15 |
| - Information Sys. Minor | 18* |
| - Intro. to Digital Tech. Minor | 12^ |
| - Intro. to Mobile App Dev. Minor | 12 |
| - Intro. Web Des. Minor | 12 |
| <u>Arts and Humanities Category</u> | |
| - none | |
| <u>Math and Sciences Category</u> | |
| - Comp. Science Minor | 18* |
| - Information Tech. Minor | 18* |
| - Web Development Minor | 18^ |

Table 1. Minors and Certificates Created for New GE Program

Another consideration that was a common discussion by the Modular GE Committee was what will happen to GE service courses (classes only taught for GE credit and not part of a major) currently part of the as-is GE Program? Time has proven that these courses were replaced or redesigned to meet the needs of the to-be Holokai GE Program with a zero-sum gain.

Another area of concern was the need to assure the students received both a depth and breadth of experience that was the impetus of the previous traditional GE programs. This was solved with the categories designed in the Holokai and the requirement that a student’s major and two minors must be selected from different categories: Professional, Arts & Humanities, Math & Sciences. See Table 3 in the appendices for details.

Additionally, all students doing a Holokai are required to complete 14 credit hours of religious education, selecting from 23 courses; students are also required to complete core classes, at least three credits in Math and six credits in English labeled here as areas.

Math area called Mathematics-Quantitative and Logical Reasoning (3-5 credit hours) allow the following choices:

- Statistics: MATH 121, BIOL 340, PSYC 205, POSC 300 & POSC 304, or EXS 339
- Calculus: MATH 212, MATH 213, or MATH 119.
- Trigonometry: MATH 111
- Quantitative Reasoning: MATH 107
- Discrete Mathematics: CIS 205

From the Reading/Writing/Speaking area the following choices are provided to students:

Reading/Writing/Speaking (6 credit hours)

ENGL 101 Communication in Writing, Speaking, and Reading (3)

And the last area, Advanced Writing (3 credit hours).

The advanced writing requirement can be completed by taking one of the following: ENGL 314 Exposition and Analysis in the Humanities (3) or ENGL 315 Topics for Advanced Writing and Analysis (3) or ENGL 316 Technical Writing (3) or an Approved Senior Seminar in the major: CHEM 494, HIST 490.

The remainder of a student's academic program is their choice, or their Holokai, selecting one major and two minors from the different categories of Arts & Humanities, Math & Sciences, and Professional Studies.

4. METHODOLOGY

The team for this research included professors in science, technology, and math (STeM) and a student advisor who is also an adjunct professor for social work. Our purpose was to survey the impressions of STeM students and evaluate those impressions of the new GE program. The science majors include students majoring in biology, marine biology, chemistry, and bio-chemistry. Our survey population for technology includes students studying computer science, information systems, and information technology. Math majors include applied mathematics and students studying to teach math. Finally, we also included our science education majors.

Operationalizing the Survey Instrument

Given that we were interested in four key areas, the following survey questions were developed and data gathered using a 7-point Likert scale, from strongly agree to strongly disagree.

Q1: Please indicate which GE program you experienced (three choices):

- Holokai (1 major, 2 minors; plus 7 religion, 2 English and 1 Math classes), go to *
- Traditional GE (commonly referred to as the Old GE program at Brigham Young University-Hawaii), go to **
- Exempt, completed GE requirements at another college/university (transfer student), go to ***

The remainder of questions in this survey will ask for your opinion based on a Likert scale. A "1" means you **strongly disagree** with the statement, a "7" means you **strongly agree** with the statement. The other numbers may be selected to express your level of disagreement or agreement. A "4" means you do not agree or disagree with the statement.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

***Holokai survey questions:**

Q2: I like the HOLOKAI General Education program.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q3: The HOLOKAI General Education program gives me independence.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q4: The HOLOKAI program will help me succeed after I graduate.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q5: I like my major and minor choices in the HOLOKAI General Education program.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q6: I feel I am in charge and responsible for my general education.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q7: I feel I am missing out on classes that could broaden my education.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q8: With the HOLOKAI program I feel I am getting the depth (detail) I need in my education.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q9: Choosing my major and minors was simple for me.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

Q10: My family had a significant influence on what I chose as my major and minors.

Strongly Disagree Strongly Agree
1 2 3 4 5 6 7

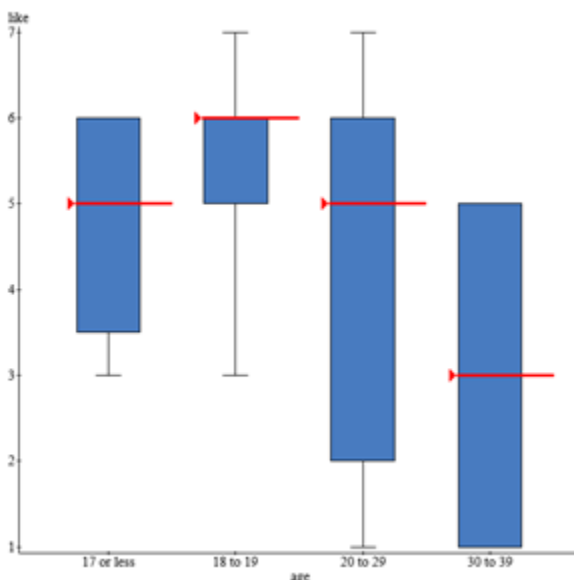


Figure 3. Student Satisfaction by Age

Among the Likert-scale items we performed sample t-tests to explore which factors might have the greatest influence on the degree to which students liked or disliked their program.

Two sample t tests of whether the students liked the new modular GE based on whether they agreed (μ_1) or disagreed (μ_2) with the items in Table 2, column 1.

| Factors | $\mu_1-\mu_2$ | Std. Err. | DF | T-Stat | P-value |
|--------------|---------------|-----------|-------|--------------|---------|
| independence | 3.26 | 0.31 | 57.61 | 10.42 | <0.0001 |
| succeed | 3.67 | 0.30 | 44.87 | 12.33 | <0.0001 |
| choices | 3.15 | 0.35 | 44.81 | 8.98 | <0.0001 |
| in charge | 2.87 | 0.45 | 26.64 | 6.37 | <0.0001 |
| fomo | -1.49 | 0.42 | 84.50 | -3.51 | 0.0007 |
| depth | 3.58 | 0.32 | 36.65 | 11.15 | <0.0001 |
| simple | 1.85 | 0.38 | 87.85 | 4.91 | <0.0001 |
| family | 0.91 | 0.45 | 70.13 | 2.03 | 0.0458 |
| friends | 0.39 | 0.46 | 74.87 | 0.85 | 0.3984 |
| acad adv | 1.09 | 0.46 | 72.71 | 2.37 | 0.0205 |
| time | 0.93 | 0.58 | 19.67 | 1.59 | 0.1283 |

Table 2. t-Test based on Survey Factors

Although many of the item scores tended to vary together, four of the factors had very large t-statistics:

Succeed: The Holokai program will help me succeed after I graduate.

Depth: With the Holokai program I feel I am getting the depth (detail) I need in my education.

Independence: The Holokai General Education program gives me independence.

Choices: I like my major and minor choices in the Holokai General Education program.

6. CONCLUSIONS

We had intended to conduct deep analysis across different cohorts based on age groups and geographical home areas, but due to the low response rate we had to forgo this approach. Our next research survey will attempt to reach a much larger population, and efforts to improve the response rate will support this deep analysis. The student survey responses did reveal some useful insights. Although student critics of the Holokai Modular program are loud in their complaints, the data from this study indicates that most students, 62%, are satisfied with the program.

There are some regional differences in responses. Improving the new GE program will require that we understanding these differences and why they occur. This will be helpful as we improve the Holokai Modular GE program and improve communication to students about the program and its intended benefits.

In the future we hope to expand the scope of our research to include all majors (Table 3, appendix) and all students at Brigham Young University-Hawaii. Furthermore, we will share our findings with curriculum developers, faculty, and administrative staff as we fine tune our Holokai Modular GE program.

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Appendices

| Arts & Humanities | Math & Sciences | Professional Studies |
|-------------------------------------|---|---|
| Art Education Major | Biochemistry Major | Accounting Major |
| Asian Studies Minor | Biochemistry Minor | Accounting Minor |
| Chinese Minor | Biochemistry Major – Environmental Science Emphasis | Agile Project Management Certificate |
| Communication Major | Biochemistry – Neuroscience Emphasis | Business Management Major – Economics |
| Communication Media & Culture Major | Biology Major | Business Management Major – Finance |
| Creative Writing Major | Biology Minor | Business Management Major – Human Resources & Org. |
| Cultural Anthropology Major | Biology Major – Ecology, Evolution, & Population | Business Management Major – Marketing |
| Cultural Anthropology Minor | Biology – Marine | Business Management Major – Supply Chain, Operations, and Analytics Concentration |
| English Minor | Biology – Molecular Biology | Coaching Minor |
| English Major – Creative Writing | Biology Education Major | Criminal Justice Certificate |
| English Major – Literature | Chemistry Minor | Digital Business Certificate |
| English Major – World Literature | Chemistry Education Major – US Teaching Certificate | Digital Security Certificate |
| English Major – Writing | Computer Science Major | Digital Security Minor |
| English Education Major | Computer Science Minor | Digital Technology Minor |
| Film Minor | Exercise & Sport Science Major – Biomedical Science | Economics Minor |
| Foundational Language Study Minor | Exercise & Sport Science Major – Health & Human Performance | Education Minor |
| Hawaiian Language Certificate | Exercise & Sport Science Major – Sports & Wellness Management | Elementary Education Major |
| Hawaiian Language Minor | Exercise & Sport Science Major – US Certification | Emergency Management Certificate |
| Hawaiian Studies Major | Health & Human Performance Minor | Enterprise Business Systems Minor |
| Hawaiian Studies Minor | Information Technology Major | Entrepreneurship Certificate |
| History Major | Information Technology Minor | Entrepreneurship Minor |
| History Minor | Intro Conservation Biology Minor | Governance Certificate |
| History Education Major | Intro to Chemistry Minor | Hospitality & Tourism Mgt Major |
| Integrated Humanities Major | Intro to Marine Biology Minor | Hospitality & Tourism Minor |
| Integrated Humanities Minor | Intro to Mathematics Minor | Human Resources Mgt Minor |

| Arts & Humanities | Math & Sciences | Professional Studies |
|---|---|--|
| Intercultural Peacebuilding Major | Intro to Natural Science Minor | Information Systems Major |
| Intro to Linguistics Minor | Intro to Nutritional Science Minor | Information Systems Minor |
| Japanese Minor | Intro to Physics Minor | Intercultural Peacebuilding Certificate |
| Linguistics Minor | Mathematics Minor | International Development Certificate |
| Music Minor | Mathematics Major – Applied Mathematics | Intro to Digital Technology Minor |
| Music Major – General Music | Mathematics Major – Pure Mathematics | Intro to Mobil App Development Minor |
| Music Major – Instrumental Performance | Mathematics Education Major | Intro to Social Work Minor |
| Music Major – Piano | Physical Science Education Major | Intro to Web Design Minor |
| Music Major – Vocal Performance | Physics Education Major | Intro to TESOL Minor |
| Music Major – World Music Studies | Political Science Major | Leadership Minor |
| Pacific Islands Studies Minor | Political Science Minor | Legal Studies Certificate |
| Pacific Islands Studies Major | Psychology Minor | Marketing Minor |
| Painting Minor | Psychology Major – Clinical/Counseling | Organizational Behavior Minor |
| Piano Performance Minor | Psychology Major – General/Experimental | Professional Writing Minor |
| Sculpture Minor | | Public Management Minor |
| Spanish Minor | | Social Work Major |
| TESOL Major | | Social Work Minor |
| TESOL Education Major | | Sports & Wellness Mgt Minor |
| Theatre Minor | | Supply Chain, Operations & Analytics Minor |
| Visual Arts Minor | | TESOL Certificate |
| Visual Arts Major – Visual Arts – Painting | | |
| Visual Arts Major – Visual Arts Graphic Design | | |
| Visual Arts BFA Major – VA Graphic Design BFA | | |
| Visual Arts BFA Major – Visual Arts – Paint Fine Arts | | |

Table 3: Categories with majors/minors/certifications offered for the Holokai Modular GE Program (Holokai Website)