PPOHA Project Evaluation:

Promoting Program Quality and Accessibility for STEM Graduate Degree Completion*

(Evaluator Report on Year 1 Operation)

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Contents

Abstract

California State University, Bakersfield (CSUB) was awarded a five-year grant, "Promoting Excellence in Graduate Education and Increasing Hispanic STEM Related Degree Completion", that began in Fall 2019. Despite the COVID-19 impact during the first year of grant implementation, the institution has established a co-director leadership structure to complete seven tasks committed in the grant proposal: (1) Establishing physical space for a Graduate Research Center (GRC), (2) Purchasing computers and software for the GRC, (3) Hiring the essential personnel (Project Assistant), (4) Creating mechanism for fiscal management, (5) Organizing the Advisory Committee, (6) Hosting the First Grad Fair, and (7) Facilitating 11 Graduate Student Center workshops. The evaluation outcomes, as illustrated by attainment of the seven milestones, indicate that the program expectation has been met for the first year. Additional accomplishment in formative evaluation is demonstrated by development of a *Rate of Progress* to track student performance toward degree completion. The conclusion section includes three recommendations for improving *program quality*, expanding *STEM education capacity*, and strengthening *graduate school-going culture* in Year 2 of the grant administration.

PPOHA Project Evaluation:

Promoting Program Quality and Accessibility for STEM Graduate Degree Completion

On October 1, 2019, the U.S. Department of Education's *Promoting Postbaccalaureate Opportunities for Hispanic Americans* (PPOHA) program awarded California State University, Bakersfield (CSUB) a five-year grant (CSUB-PPOHA), "Promoting Excellence in Graduate Education and Increasing Hispanic STEM Related Degree Completion", to attain two goals:

- Enhance and create additional capacity – by strengthening existing STEM related programs and developing two new programs – for the CSUB STEM graduate programs, which facilitates increased enrollment, provides needed student support, improves research facilities and engages faculty to better serve Hispanic graduate students through degree completion.

- Develop a university-wide "graduate school-going culture" (GSGC) through a robust and comprehensive program that encourages, supports, engages, and prepares students to pursue graduate education.

The dual emphases jointly reflect the fact that "quality in research and scholarship rests not just on skills which can be trained or practised or even knowledge that can be taught or learnt, but also on dispositions and qualities which can only be cultivated over time" (Ridley, 2011, p. 286). Development of the GSGC is particularly important for graduate programs in Science, Technology, Engineering, and Mathematics (STEM) education due to increasing demands on the depth of learning for knowledge advancement (Leshner & Scherer, 2018). The project also addresses the need to expand postbaccalaureate academic offerings and raise graduation rates for Hispanic and low-income students per PPOHA authorization under

Title V, part B (Title Vb) of the Higher Education Opportunity Act.[1]

Since its inception, PPOHA has incorporated external evaluation for justifying program returns to federal investments (Colón-Rivera, 2010). As a practice widely adopted by the professional community, "external review is now a critical element that has become an internationally accepted aspect of quality assurance" (Kelum, Gamage, Pradeep, Najdanovic-Visak, & Gunawardhana, 2020, p. 8). Affiliated with a stand-alone doctoral program at CSUB, the evaluator has no subordinate connection to the project personnel, and thus, is qualified for conducting the independent evaluation as an outsider. By design, this evaluation report is intended to offer external assessment on the impact of the CSUB- PPOHA project during the first year of federal funding (October 2019 - September 2020).

Theoretical Framework

The goals of Titles III, V, and VII grants are set for strengthening "an institution's capacity to serve low-income and minority students" (U.S. Department of Education, 2020, p. 2). To sustain the grant impact on the capacity building, effectiveness of the federal resource *input*, as reflected in the *Process* and *Product* of project administration, is inseparable from the local university *context*. Thus, a model of *Context, Input, Process*, and *Product* (CIPP) is employed to guide the report development. As Finbarr Sloane (2008), a director of NSF, asserted, sustainability is important, and hence, "We change the basic research question from *what works* to *what works for whom* and *in what contexts*" (p. 43).

Since its inception in the mid-1960s for federal grant evaluation (see Stufflebeam, 1983), the CIPP model became the backbone to support development of national evaluation standards over the past 50 years (Program Evaluation Standards, 2010; Yarbrough, Shulha, Hopson, &

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[1] https://www2.ed.gov/programs/ppoha/faq.html#q3

Caruthers, 2010). While the *product* phase of CIPP is relevant to summative evaluation, the

model itself places more emphasis on the *process* of program improvement through formative

evaluation. As Stufflebeam (2000), the developer of CIPP, insisted, "the most important purpose

of evaluation is not to prove, but to improve" (p. 297). Accordingly, the PPOHA grant requires

annual formative evaluation reports to facilitate ongoing improvement during the funding period.

At end of the grant support, a summative evaluation report is expected to justify result-based

accountability. In preparation for the result accumulation in the *product* phase, this annual report

of formative evaluation is focused on the use of federal resource *input* in the CSUB *context* to

maintain the *process* of improving the STEM program enrollment, retention, and graduation

rates for Hispanic and low-income students.

Evaluation Tasks

In the first year, the CSUB-PPOHA project facilitated 11 workshops in Fall, 2019 and the

first two months of 2020. Since then, "the outbreak of COVID-19 fundamentally altered the

global higher education landscape in 2020" (Kelum, Gamage, Pradeep, Najdanovic-Visak, &

Gunawardhana, 2020, p. 6). Consequently, the policy of social distancing has caused conference

cancellation, lab unavailability, and inventory delay that directly impacted the project

contribution to *research, knowledge,* and *practice* of student retention and support. At CSUB, all

in-person and on-campus activities were halted on March 18, 2020 and they did not resume

within the current evaluation period. All activities beyond this date were either cancelled,

postponed, or altered to virtual and/or remote modes of delivery.

More critically, enlargement of the enrollment gaps occurred across different tiers of

higher education institution. In California, while freshman applications increased 15% in the

University of California system, the California State University (CSU) system encountered an

average of 5% drop across its 23 campuses (Watanabe & Agrawal, 2020). To cope with the negative instability, CSU announced a *policy* of no tuition increase to reduce student hardship (Agrawal, 2021). Meanwhile, the university president acknowledged federal grants as an important source of support for CSUB students (Zelezny, 2021). In this context, the PPOHA funding is delivered at a critical time to facilitate recruitment and retention of Hispanic and low-income students in STEM education.

To lead the effort of strengthening STEM education at the graduate level, CSUB has established a Co-Director structure for the PPOHA project supervision. As a result, the federal funds have been successfully employed to establish a Graduate Collaborative Research Program (GCRP). The grant team also purchased equipment and supplies for Year 1 according to the *Equipment and Supplies Plans*. In March 2020, CSUB transitioned to virtual instruction due to COVID-19. While room renovations were on hold, additional resources were channeled by the U.S. Department of Education to purchase equipment and supplies for Year 4.

As Hedding, Greve, Breetzke, Nel, and van Vuuren (2020) pointed out, "the pandemic has taught us that academics must be innovative in the way we do our science and facilitate learning" (p. 2). As part of the innovation, adjustments have been made in the *process* of grant implementation to switch the funds from *supporting graduate student mentors* to *sponsoring GCRP activities for graduate students*. A logic model has been developed to articulate local needs with institutional mission and values to support student services. A Graduate Student Center (GSC) is in full functioning to host nearly a dozen workshops.

Under the unprecedented context of campus closedown, funding resource input from the PPOHA grant has sustained the capacity building process toward achieving the overall project goals. To capture the impact of these grant activities, the scope of evaluation tasks includes

reviewing research literature, digesting internal records, participating in zoom meetings, and tracking email exchanges to triangulate qualitative and quantitative data across four aspects of the CIPP paradigm (Table 1).

Table 1: Scope of Evaluation Tasks in the First Year

Aspects	Data and Documents	Purposes
Context	· External PPOHA reports and literature disseminated by other institutions · PPOHA report guidelines from U.S. Department of Education · Local documents related to grant activities, · Baseline data and annual milestones from similar PPOHA projects	· Position the local evaluation effort in a broad context of research and scholarship related to student success · Confirm report elements to best practices suggested by the funding agency · Link grant administration to milestones of the grant proposal · Assess appropriateness of the grant goals, objectives, and strategies
Input	· Documents on resource entry/fund spending · Resource support from others · Background data about CSUB students	· Describe extents of the project support from the federal government · Evaluate partnership sustainability · Identify key service recipients on demographic dimensions
Process	· Literature for configuring the rate of progress · Information on unexpected results · Technical documents on psycho-metric features of instrument design	· Support formative assessments of project implementation and improvement · Detect extraneous factors · Ensure validity, reliability, accuracy, and generalizability for result reporting
Product	· Alignment data to link milestones with grant goals and objectives · Information on (1) *the extent of the grant support*, (2) *effectiveness of the funded activities*, and (3) *success stories of students*	· Aggregate grant results for formative and summative assessments · Support annual recommendations from triangulation of the quantitative and qualitative measures according to milestones of program success

In summary, evaluation tasks for this report include both formative and summative components. The formative evaluation focuses on the proposed major milestones reached in Year 1. The summative feature is represented by examination of the project foundations that support attainment of the project goals at end of the fifth-year funding. Overall, justification of

the result-based accountability depends on accumulation of three-fold information, (1) how much has been done in the capacity building, (2) how well the project performed in strengthening program quality and enrollment, and (3) whether students are better off. These three components have been identified in the *Product* aspect of Table 1 to sustain the evidence accumulation on an annual basis.

Results of the Federal Grant Supports

The PPOHA grant support has resulted in development of innovative methodology and assessment outcomes in Year 1. Inquiries on the methodology front is primarily rooted in literature review and needs assessment to create a *rate of progress* for formative evaluation across the entire funding period. The outcome of capacity building confirms to the annual milestones delineated in the original grant proposal.

Creation of the *Rate of Progress* Indicator

The grant proposal contains four objectives. The first two are stated as:

1. By September 2024, there will be a 20% increase in the number of Hispanics and other underrepresented students that enroll in CSUB's STEM related graduate programs.

2. By September 2024, the number of graduate degrees awarded annually to Hispanics and other underrepresented minorities will double from the current baseline.

With the funding period, the first cohort of freshman enrollments occurred in Fall, 2019. By September 2024, the grant may support around two cohorts of graduates. With the majority of students remaining in the program pipeline toward degree completion, the *rate of progress* are not only needed in formative evaluation to monitor student support toward graduation, but also important for configuring sustainability of the project impact in the summative report. Bahr (2009) pointed out,

Variables that address student enrollment patterns (e.g., persistence, enrollment

inconsistency, completed credit hours, course credit load, course completion rate,

procrastination) constitute a longstanding fixture of analytical strategies in educational

research, particularly research that focuses on explaining variation in academic outcomes.

However, nearly all measures of enrollment patterns are handicapped by untested

assumptions about a more fundamental measure, namely students' rate of progress. (p.

691)

With a clear focus on this measure, Calcagno, Crosta, Bailey, and Jenkins (2007) stressed

the need of clarifying stepstones along the path to a degree. Toward end of Year 1, one of the

project co-directors found stepstones from the Peoplesoft record documentation that are

generally applicable for all graduate programs. Similar to freshman, sophomore, junior, and

senior steps at the undergraduate level, graduate students have three status standings, *GRA1

Conditionally Classified, GRA2 Fully Classified*, and *GRA3 Graduate Candidates*, in each of the

STEM programs. In higher education, the course completion sequence is a longitudinal process

(Hagedorn & Lester 2006) and the stepstone attainment is dependent upon variables that vary

over time (Singer & Willett 1993). Therefore, the number of years needs to be tracked for

students at each stepstone (or stage) toward graduation on an annual basis (Bahr, 2009).

Accordingly, a *rate of progress* is defined as

$$rate\ of\ progress = \frac{Median\ Year_{ps}}{Year_{ips}}$$

where i = individual, p = program (e.g., Math, Science, Engineering), s = stage (GRA1, GRA2, GRA3).

When the values are strictly greater than 1, it indicates a faster rate of progress relative to

the median group of students at the same stage; values strictly less than 1 indicate slower

progress, and values equal to 1 indicate that the student has taken the median number of years to reach his/her particular stage of progress.

Development of this important index has a solid literature support. For instance, Millett and Nettles (2009) testified that "We constructed our rate of progress measure by grouping individuals by their fields of study and reported stages of progress" (p. 68). Also, on page 68, they reconfirmed that the rate of progress measure was a ratio of dividing a field- and stage-specific median value by the time each individual reported being in the program at the time of data collection (see Millett & Nettles, 2009). Therefore, the carefully-defined *Rate of Progress* indicator can be employed to monitor student progress from enrollment to degree completion (i.e., the first two objectives of the PPOHA grant0.

In addition, the third objective of the original proposal was set as:

By September 2024, the completion rate in STEM related graduate courses for all STEM graduate students (with Hispanics equitably represented) will increase by 20%.

The tracking of course completion clearly fits a common goal of Titles III, V, and VII grants on strengthening *persistence* of low-income and minority students in higher education (U.S. Department of Education, 2020). However, the current literature suggests various ways for computing the course completion rate, including a ratio of courses passed to courses attempted (e.g., Hagedorn, Maxwell, Cypers, Moon, & Lester, 2007) or, conversely, as a ratio of courses dropped, withdrawn from, or left incomplete to those attempted (e.g., Cabrera, Berkum, & La Nasa, 2003).

Given the importance of *persistence* measurement, the concept has been generally defined as the length of time that a given student was enrolled in college within some predetermined window of observation, where time is measured in academic terms (semesters or

quarters), months, or years (e.g., Bahr 2007; Jensen 1981; Kalamatianou & McClean 2003).

Thus, the indicator could vary across programs and stages of graduate education, which

connected it back to the *rate of progress*. As Bahr (2009) observed, "If persistence and rate of

progress are correlated positively, the explanatory value of persistence increases" (p. 694). The

empirical connection has made the *rate of progress* a more consistent and meaningful indicator

than the *course completion rate* in formative assessment of the project progress toward

attainment of Objective 3.

In summary, "Students' rate of progress is a fundamental concept in educational research,

.... Only recently has the literature begun to hint at its import" (Bahr, 2009, p. 710). In the first

year, creation of this indicator is not only grounded on its intellectual merit in meeting the

PPOHA project needs to quantify the stepstone passage in the final summative report, but also

linked to its broad impact on assessing the project attainment in the first three objectives.

Accomplishment of Year 1 Milestones

The original proposal contains an evaluation plan to clarify the project development and

provide milestones for monitoring the progress. As a result, the project has its fourth objective

stated as:

> *By 2024, the number of CSUB students (with Hispanics equitably represented) that are*
>
> *accepted in Master's and PhD partnership programs not available at CSUB will double*
>
> *from the current baseline.*

Although the final outcome won't surface until the project conclusion, results need to be

summarized according to the annual milestones to assess whether adequate progresses have been

made toward the long-term objective.

For the first year, the PPOHA project has seven milestones. The status of milestone

attainment is listed in Table 2. The high school outreach effort was interrupted by COVID-19.

Information in Table 2 suggests that the project has completed its tasks for Year 1. The

milestone examination also indicates that the project is on track toward achieving its two goals

and four objectives according to the original proposal.

Table 2: Year 1 Milestone Attainment

Milestone	Outcome
Faculty mentor selection	Seven in Faculty Fellows program; Eight in GCRP program
Student mentor choice	Eight graduate students supported through GCRP
Mentor assignment	Assignment completed in fully established programs*
Weekly management meetings	Zoom meeting accommodation occurred due to COVID-19
High school outreach	Activities on hold due to school closure**
First grad fair	Event held on November 7, 2019 with 99 attendees
GSC workshops	Eleven workshops attended by a total of 318 students

 * Fully established programs are these with student graduation prior to the project beginning.
** It is clarified in the second recommendation that these activities might not occur due to the PPOHA funding policy.

Furthermore, sustainability of the program support is built on the local context with

additional resource input from partnership building. Pertinent to the *faculty mentor selection*

section in Table 2 is another initiative funded by Chevron Corporation to recruit 13 faculty

mentors for a summer research program at the undergraduate level. Based on an axiom that the

whole could be larger than its parts, a plan has been developed by the PPOHA grant co-directors

to offer additional support for five professors and eight graduate students to strengthen STEM

mentorships in graduate-degree granting programs. In addition, the PPOHA support for graduate

studies is partnered by a grant of NSF to fund graduate student research scholars in the sciences

through its Centers of Research Excellence in Science and Technology (CREST).[2]   From the

CIPP perspective, the PPOHA grant funding has been augmented by other resource inputs from

private (e.g., Chevron Corporation) and public (i.e., NSF) partnerships. The process of

partnership building has facilitated establishment of program capacity, as part of milestone

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[2] NSF award # 1547784

attainment for summative evaluation, in the local context.

Effectiveness of the GSC Workshops

Besides tracking the scope of task completion in formative assessment, evaluation data have been gathered to indicate GSC workshop effectiveness. Among 11 workshops offered in Year 1, introduction to *Cal State Apply Open Lab* was attended by only four students on January 10, 2020. In general, the university has a policy of collecting instructional feedback from classes with more than five students. Perhaps due to the small number of respondents, no data were collected from the *Cal State Apply Open Lab* workshop. The number of participants for the remaining 10 GSC workshops is listed in Table 3.

Table 3: Number of Participants for 10 GSC Workshops

Semester	Workshop Topics	N_{RSVP}
Fall, 2019	Techniques in Writing Part I	15
Fall, 2019	Pre-Doctoral/ Chancellor's Doctoral Incentive Program	18
Fall, 2019	Grad Slam 101 – Getting Started	14
Fall, 2019	Grad Slam 201 – Crafting a Memorable Message	10
Fall, 2019	Grad Slam 301 – Designing a Compelling Visual Presentation	6
Fall, 2019	Grad Slam 401 – Communicating with Confidence	8
Spring, 2020	New Graduate Student Orientation	14
Spring, 2020	Using Statistics	10
Fall, 2020	New Graduate Student Orientation	111
Fall, 2020	Financial Aid & Financial Literacy	108

Results of the feedback surveys are plotted in Figure 1. Based on the percent of students considering the workshops in "Excellent" or "Good" categories, the approval ratings ranged between 83% - 100%. In addition, students offered comments in their responses to each workshop. In contrast, for student orientation in 2019 prior to the grant funding, five respondents indicated no room for improvement. Others suggested (1) participation of all departments to offer program-specific information, (2) announcement of workshop schedules at a

convenient time, (3) organization of more interactive groups, and (4) arrangement of tours inside buildings. With the PPOHA support, the ratings were improved for student orientation in 2020. The comments for improvement were reduced to requests for more information and more social/fun activities, as well as better parking and schedule arrangements. Students in the other GSC workshops wanted to have more workshops and expressed interest in obtaining more information, examples, and clarifications.

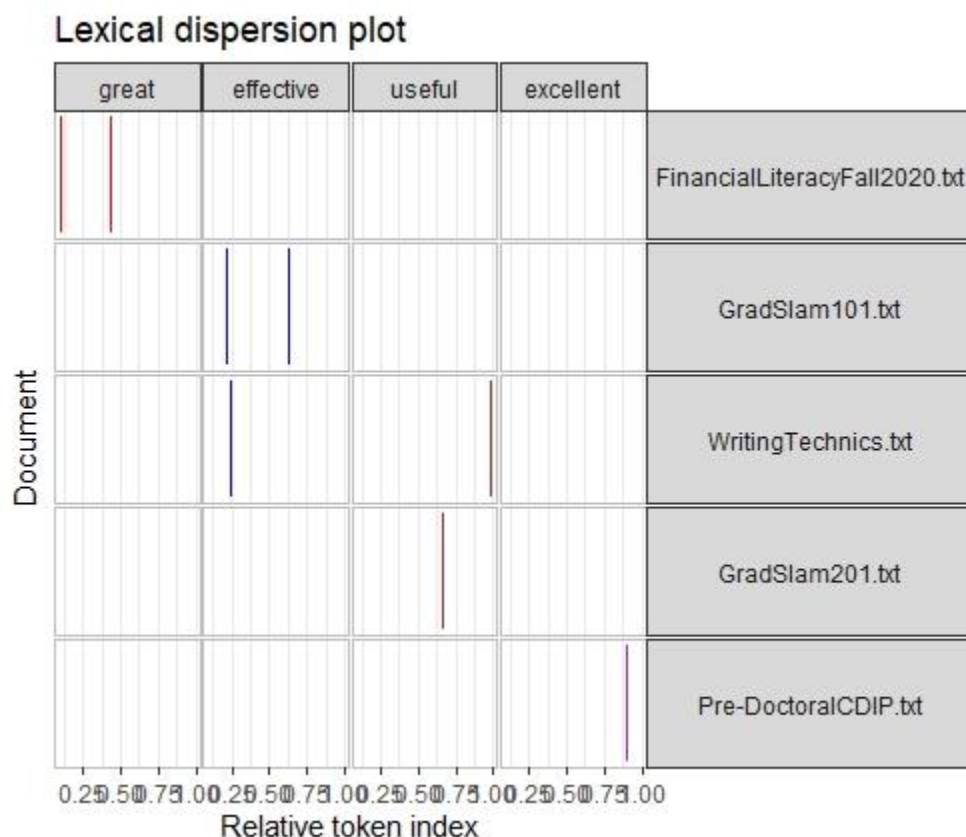Figure 1: Percent of Positive Ratings on GSC Workshops
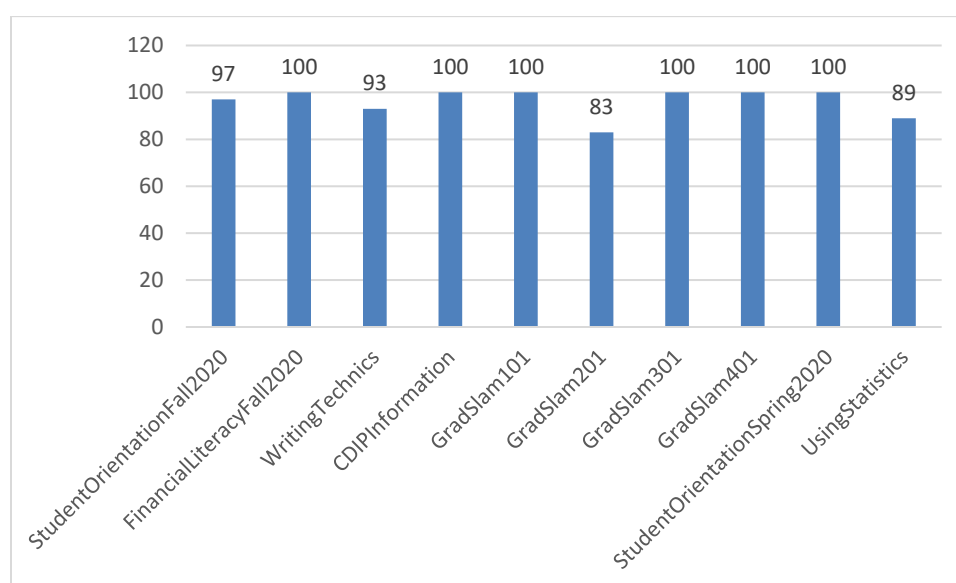
To facilitate aggregation of the qualitative data, R scripts have been developed in Appendix 1 to create a Lexical Dispersion Plot on the positive keywords students used in the GSC workshop feedback. For these workshops that received student comments, the feedback showed respondent choices of "great", "effective", "useful", and "excellent" for describing the learning experiences (Figure 2).

In summary, GSC has offered beneficial workshops to support quality of graduate studies at CSUB. All topics in Table 3 are of great interest to these survey respondents. The workshop effectiveness, as represented by both quantitative ratings and qualitative comments in student

responses, has laid a solid foundation for GSC to offer test prep, critical thinking, and financial literacy workshops for at least 45 students in Year 2 of the PPOHA grant administration.

Figure 2: Student Positive Words for Workshop Description

Lexical dispersion plot

great	effective	useful	excellent	
				FinancialLiteracyFall2020.txt
				GradSlam101.txt
				WritingTechnics.txt
				GradSlam201.txt
				Pre-DoctoralCDIP.txt

0.25 0.50 0.75 1.00 0.25 0.50 0.75 1.00 0.25 0.50 0.75 1.00 0.25 0.50 0.75 1.00

Relative token index

Document

Conclusion

As an external evaluation report to justify the return of PPOHA funding in the first-year grant administration, it is important to revisit three key questions of result-based accountability (RBA) according a well-disseminated RBA model (see Friedman, 2005): (1) how much has been done? (2) how well did the project perform?, and (3) is anyone better off?

The approach in this report development is built on the CIPP paradigm to first examine local capacity building within the CSUB context that impacts the project setup for sustainable

progresses in the next five years. Under the co-director leadership, the project team has completed seven tasks committed in the grant proposal:

- Establish physical space for Graduate Research Center
- Purchase computers and software for GRC
- Hire the essential personnel (Project Assistant)
- Create mechanism for fiscal management
- Organize the Advisory Committee
- Host the First Grad Fair
- Sponsor 11 GSC workshops

In addition, an indicator on the *Rate of Progress* has been identified to monitor the project impact in formative evaluation. Hence, much has been done by the project team to keep the PPOHA funding on track toward reaching its goals and objectives in five years.

To address the question on the *how well* part, the project team has minimized the interruption of COVID-19 to attain its milestones for Year 1 (see Table 2). More importantly, the input of federal resources from this grant has been augmented by additional support from private (Chevron) and public (NSF) grants. The broad-based partnership building not only expanded the effort on faculty mentor recruitment, but also enriched the opportunity to support research scholars at the graduate school level for the PPOHA project.

In addition to the outcome of capacity building in Year 1, assessment data have been gathered in both quantitative and qualitative categories to triangulate the results of workshop offerings. Based on the results of satisfaction in Figures 1 and 2, most students were better off with the effective training to improve their learning experiences in graduate school. With the accomplishment of Year 1 preparation and establishment of partnership collaboration from the local context, a conclusion has been reached in this evaluation report that the PPOHA funding has demonstrated clear merits of result-based accountability in meeting the grant expectations.

Recommendations

As the PPOHA project enters its second year of federal funding, major news media announced President Biden's projection that life may be back to normal by Christmas 2021 (Liptak, 2021). Thus, the experiences accumulated from Year 1 during the pandemic can be used to make recommendations for improvement of the grant performance in Year 2.

In the tradition of PPOHA evaluation result dissemination, significant challenges prior to the project funding can be addressed in the annual report (Bahr, 2016). Immediately before the grant started at CSUB, a graduate student orientation was held in Fall 2019, and the student feedback included the five comments:

1. It would've been a lot more effective if all the department directors were present during the orientation.
2. Seeing the inside of the buildings during the tour would have made it more effective.
3. Having program specific information and offering a second tour for latecomers would have made it more effective.
4. Staff who were no shows should have attended.
5. Have booths of departments or activities like a job fair.

Many lessons have been learned during the pandemic to create alternative ways for information dissemination. As Kelum et al. (2020) noted, "The COVID-19 situation has forced HEIs [higher education institutions] to amend existing processes in order to open campuses for students and staff following public health advice and government rules on social distancing" (p. 11). With the widespread use of digital technology in university operation, **the first recommendation is on expanding video presentations in these GSC workshops**. The digital technology will allow program directors to resolve their time conflicts and become virtually available during the orientation. A video tour will also help students see the inside of a building and repeat the tour for latecomers for multiple times. Furthermore, staff can be arranged to

attend the presentation and answer questions through zoom conference connections. The "job fair" flavor can also be conveyed through video demonstrations to display department booths and activities. Since the orientation is needed for new students each year, the improvement may facilitate creation of a good first impression that "facilitates increased enrollment" and "provides needed student support" (see Goal 1 of the PPOHA proposal). An attractive presentation will also strengthen development of a university-wide "graduate school-going culture" per Goal 2 of the proposal.

In supporting the goal settings, efforts have been made in the grant proposal to clarify the project needs in terms of its broad impact. In particular, data were cited from the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) to address the expansion of Hispanics student participation in STEM education as a necessary measure to cope with the global market competition. While the STEM workforce preparation has an indisputable advantage in promoting a country's wellbeing, Garibay (2012) cautioned that "Prioritizing economic interests creates a dominance-oriented disciplinary culture that guides scientific teaching, learning, and practices" (p. 214). The culture consideration is particularly relevant to this project evaluation because the second goal of the proposal is on developing "a university-wide 'graduate school-going culture' through a robust and comprehensive program that encourages, supports, engages, and prepares students to pursue graduate education".

In the broad research literature, however, the emphasis on economic competition only represents one aspect of STEM education. To address why many students of color leave STEM studies, it is important to replace the dominant economic rationale for equity by a new rationale that prioritizes the needs of the disenfranchised populations under different education conditions (Boaler & Greeno, 2000; Cobb, 2004; Gustein, 2006). Accordingly, the federal government has

stratified grant supports for high school concurrent enrollment students in a category of *Section 101 Institution of Higher Education.*[3] In contrast, the PPOHA grant is designed to promote postbaccalaureate opportunities for Hispanic and low-income students, which seems to have delinked the PPOHA support for the *high school outreach* milestone in Table 2. Although that activity was on hold due to COVID-19, one may wonder the pipeline of a PPOHA program can be extended to high school students, instead of the adjacent level of undergraduate students. Therefore, **the second recommendation is to switch the focus of *high school student outreach* to innovative graduate student supports that meet the PPOHA funding requirements**.

While Goal 2 of the PPOHA project addressed culture development for graduate education, STEM education depends on sequential knowledge inquiries and lab training. Hence, sustainability of the program impact is inseparable from improvement of undergraduate student quality prior to the graduate program entry. As part of CSU system, CSUB implemented Graduation Initiative 2025 (GI 2025) at the undergraduate levels to increase graduation rates for all students while eliminating achievement gaps for minority students. Tools and resources to support GI 2025 have been provided online.[4] Similar to the objectives of this PPOHA project, GI 2025 has substantially increased institutional support for enhancing program quality, student resilience, and course completion rates toward graduation. **The third recommendation is for the PPOHA project team to study effective measures of GI 2025 and borrow tools, ideas, and resources to help achieve its designated goals of expanding and strengthening STEM graduate programs at CSUB**. Since one of the goals for this PPOHA project is to develop a university-wide "graduate school-going culture", the *university-wide* context naturally includes the GI 2025 service target, i.e., undergraduate students, as part of the pipeline for graduate

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[3] https://fas.org/sgp/crs/misc/R43159.pdf

[4] https://www2.calstate.edu/csu-system/why-the-csu-matters/graduation-initiative-2025/Pages/gi2025-resources.aspx

program admission. Therefore, the third recommendation may strengthen the seamless

institutional support for CSUB student advancement from undergraduate to graduate levels.

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Appendix 1:

R Scripts for Creating the Lexical Dispersion Plot on GSC Workshop Feedback

```
install.packages(c("ggplot2", "quanteda"))
library(readtext)
data1<-readtext("D:/USB DISK/Debra&Ann/Year1/*.txt", docvarsfrom = "filenames",
         docvarnames = "Workshop")
library(quanteda)
d1.corpus<-corpus(data1)
library(ggplot2)
theme_set(theme_bw())
tplot <- textplot_xray(kwic(d1.corpus, pattern="great*"), kwic(d1.corpus, pattern="effective*"),
      kwic(d1.corpus, pattern="useful*"),kwic(d1.corpus, pattern="excellent"),
      kwic(d1.corpus, pattern="help*"),kwic(d1.corpus, pattern="informative"),
      kwic(d1.corpus, pattern="interesting"))
tplot + aes(color = keyword) + scale_color_manual (values = c("red", "blue", "green", "purple",
      "orange", "brown", "pink")) + theme(legend.position = "none")
```