

Supporting Persistence and Identity Development during Applied Learning Experiences

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Abstract

Supportive programming is frequently designed to increase reflection and amplify the effects of applied learning experiences. We have developed a supportive curriculum that integrates ePortfolio practice, brief psychological interventions, advising, mentoring, family engagement, and professional development into a highly successful summer research experience for undergraduates. We describe our program and discuss evidence-based methods of supporting the development of a growth mindset, academic identity, scholarly community, and future planning as a means of increasing academic self-efficacy and persistence in students. Throughout this discussion we report on early indications that the modifications have met our goals. We conclude by considering principles that might guide design of supportive programming for other applied learning experiences.

Supporting Persistence and Identity Development during Applied Learning Experiences

Undergraduate research opportunities can increase confidence and interest in STEM careers (Russell, Hancock & McCullough, 2007). Many underrepresented ethnic minority (URM) students enter college

unaware of research-related careers (Ovink & Veazey, 2011). For these students, research experience can broaden their thinking about possible careers and help them learn norms of professional laboratory behavior. Since 2000, Purchase College, State University of New York has hosted the Bridges to the Baccalaureate (*Bridges*) six-week residential summer research program for community college students who are from an underrepresented ethnic minority (URM) group, or have parents who did not graduate from college. The *Bridges* program has served over 500 students, 77% of whom have transferred to four-year institutions. Program alumni include medical doctors, Ph.D. students, and scientists. In recognition of the program's success, Purchase College received the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring. In this paper we describe the supportive curriculum which we believe to be central to the success of the program.

The *Bridges* program is an intensive applied learning experience and a high impact practice (HIP). Students work in small groups conducting original research under the supervision of a faculty member. Students present research talks as part of a team and a poster individually. These intensive educational experiences are the first opportunity many students have to immerse themselves in a scholarly pursuit. The research experience is, and will always be, at the heart of the *Bridges* program. Although *Bridges* has had a high level of success, we sought to amplify the effects of students' intensive research experiences by creating supporting activities that would encourage students to reflect on their experiences and create comprehensive academic and career plans. Our research on early program outcomes revealed that *Bridges* students were more likely than matched peers to retake required courses until they received passing grades and to graduate in STEM majors. However, *Bridges* students did not receive better grades than matched peers. These findings led us to hypothesize that a key outcome of program participation may be a stronger commitment to the pursuit of a STEM degree. An examination of students' descriptions of themselves at the beginning and end of the program revealed that students showed increased academic identity, future orientation, and sense of scholarly community at the end of the program (Singer-Freeman, Bastone & Skrivanek, 2014). We hypothesized that the development of academic identity, future orientation, and a scholarly community helps students persist despite challenges.

Having identified elements of cognitive and social-emotional development that supported persistence, we created programming to target these areas. We also expanded our original set of academic learning outcomes that emphasized students' understanding of and ability to conduct scientific research. We added outcomes reflecting knowledge about academic success including: 1) steps needed to complete bachelor's and advanced degrees and 2) careers that can be pursued with different degrees. We also added identity outcomes including the development of: 1) academic identity; 2) a sense of belonging to a community of scholars; 3) a growth mindset; and 4) grit. Each modification to the program was informed by evidence-based practices. Below we describe research that informed program modifications, our implementation of these modifications, and evidence of efficacy.

Using a Systems Approach to Guide Program Development

Over the span of several years we assessed student needs and used our findings to inform program development. We adopted a systems approach to guide development, evaluation, and tuning of program elements (Cabrera, Colosi, & Lobdell, 2008). For each element, we considered the features that made it distinctive from other elements. We also considered the relationship between each pair of distinctive elements, the ways each element functioned from the perspective of other elements, and the ways each element related to the program as a whole. This approach has been useful both as a means of understanding the contributions of each element to the program and as a means of identifying gaps or redundancies in our curriculum. We summarize the unique program elements and the major learning outcomes addressed by each in Figure 1. Although nearly every element relates to other elements to some extent, overlapping circles indicate elements that involve substantial reciprocity. As can be seen in Figure 1, this analysis revealed that ePortfolio practice and laboratory research are central organizing elements.

ePortfolio Practice

We believe ePortfolios are uniquely situated to magnify the effects of applied learning experiences because ePortfolio practice provides students with a shared platform in which they can establish new versions of identity (Singer-Freeman & Bastone, 2018). ePortfolios help students document growth and reflect on academic achievements

(Buzzetto-More, 2010; Singer-Freeman, Bastone, & Skrivanek, 2016). The permanent nature of the ePortfolio serves as a lasting declaration of experiences. When experiences are transformative, this lasting record has the potential to strengthen and lengthen the transformative effects. When students share ePortfolios with friends and family, they evoke what Bass (2017) calls social pedagogy by engaging students in a communication-intensive task in which an authentic audience is central to the construction of knowledge. Social pedagogy encourages integrated reflection and can support considerations of personal change. In Bass's words, the ePortfolio can become a platform for "sense-making" and "learning to be." Collective reflection that takes place within a community can also provide validation of an individual's experience and support perspective taking (Rodgers, 2002). Collective reflection can provide individuals with the sense of safety needed to try out alternate ways of knowing or being. Accordingly, it is not surprising that ePortfolio practice correlates positively with student success indicators (Eynon, Gambino, & Török, 2014; Eynon & Gambino, 2018) and was recently added to the Association of American Colleges and University's list of HIPs (Watson, Kuh, Rhodes, Penny Light, & Chen, 2016).

We initially implemented ePortfolio practice to assess and document applied and collaborative learning (Singer-Freeman, et al., 2016). However, we quickly saw the power of ePortfolio practice as a means of increasing students' reflection on their past, present, and future. Our overarching goal became for ePortfolio practice to serve as a meta HIP, amplifying the positive impact of participation in research and professional development activities. Students are introduced to the curriculum by being told that ePortfolios are a type of social media in which they will establish a professional presence that will be useful to them in a number of ways: 1) They can be shown to potential employers or research sponsors because they will document the student's research skills; 2) They can be shared with family and friends because they will document the student's summer experiences and plans; and 3) They can be revisited in the future because they will provide a rich representation of who the student was during the program. Each week students contribute a journal entry, an image that documents learning, and a section of a research poster they will present during the final week of the program. Additionally, students upload a resume and respond to weekly writing prompts (see Table 2) designed to encourage the development of academic identity, future orientation, belonging to a community of

scholars, a growth mindset, and grit. Weekly ePortfolio workshops provide an opportunity to deliver intensive social pedagogy. Visual images are central to students' ePortfolios and enhance social pedagogy by creating pages that appear like social media pages (See Figure 2). To encourage integration between images and written content, students provide titles that explain how images document learning and reorganize content to curate an integrated story of their experience. We create a community of shared ePortfolios and encourage community members to provide comments, further enhancing social pedagogy.

ePortfolio practice is a distinctive element of our program because it is the only activity in which students actively reflect on and document their learning, plans, and progress. However, it is a central and overlapping element because family members, faculty, staff, and peers are an authentic audience and the ePortfolio documents and allows for reflection on the research activities, emerging community of scholars, brief psychological interventions, professional development workshops, advising, and mentoring. The ePortfolio must be valued by other program elements in order to be successful. To do ePortfolio practice well students must make a significant investment of time and effort over an extended period. From the student perspective, the ePortfolio requires substantial effort at the end of a full day of work. A key element for engaging students is moving quickly to establish social pedagogy. We address this in an initial workshop in which students see examples of pages from past summers, learn to use the platform, create an attractive page with identity-relevant information and images, and share their page with the group. It is also essential that students receive meaningful feedback in a timely fashion. Once students become interested in ePortfolio practice, engagement opportunities are maximized because the residential nature of the program supports social pedagogy. Research faculty can view the ePortfolio as a distraction from research activities. To minimize disruption to the research day, weekly workshops take place at night and are implemented by non-research faculty. Still, to fully engage faculty and students, the value of ePortfolios must be made clear. A turning point in the establishment of faculty engagement was the introduction of research posters. The inclusion of a formal summary of the research project increased student and faculty interest and provided them with an opportunity to discuss substantive parts of the ePortfolio.

We found that ePortfolios have helped students develop academic identity, future orientation and a sense of belonging to a community of scholars (Singer-Freeman, et al., 2014). In response to an anonymous exit survey, 90% of students indicated that ePortfolio practice was somewhat or very valuable, 94% reported they were somewhat or very likely to continue to contribute to their ePortfolio, and 90% reported they were somewhat or very likely to share their ePortfolio. Students also found the ePortfolio practice to be enjoyable, with 88% reporting medium or high enjoyment levels. To investigate the effects of different aspects of the ePortfolio curriculum, we examined students' identity-related descriptions in weekly journal entries and prompted writing (Singer-Freeman & Bastone, 2018). We found that in journal entries students described themselves in academic terms but descriptions of future goals and a scholarly community were rare. Many prompts instruct students to relate material to experiences that took place at other times or places or encourage them to place themselves within a knowledge community. In this way, the prompts encouraged students to bridge formal learning with informal experience and evoked references to academic identity, future planning and scholarly community. As can be seen in Table 2, responses to prompts evoked high levels of analysis and frequently involved students' experimentation with different ways of knowing or being. A review of ePortfolios from 2018 revealed that 100% of students included references to academic identity, future plans, and membership in a scholarly community. Accordingly, we believe the inclusion of carefully constructed prompts is an essential element of ePortfolio curricula that are used to support applied learning experiences.

Brief Psychological Interventions

Brief psychological interventions can improve individuals' lives long after the intervention is over by changing the way they think and feel about the world. Brief psychological interventions have been shown to improve students' grades, persistence, and well-being (Walton, 2014). Some schools incorporate brief psychological interventions as part of student orientation. Applied learning experiences are another environment in which interventions can be introduced (Boaler, 2013). We describe two brief psychological interventions and discuss their use as part of our supportive curriculum.

Values affirmation. Reflecting on core values can promote students' feelings of efficacy in the face of academic challenges. Low-achieving African American students who affirmed core values early in middle school improved academic performance and retained equivalent levels of self-efficacy throughout middle school (Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009). This contrasted with the experience of non-affirmed low-achieving African American students who showed a declining level of self-efficacy. The transition from a community college to an intensive research experience at a four-year institution is also a moment when students face increased academic demands and may experience impaired academic self-efficacy. This risk is especially strong for students from groups underrepresented in higher education and in STEM. An affirmation intervention has the potential to have a similar buffering effect for these students. In addition to supporting self-efficacy, we believe that the inclusion of this intervention helps students form linkages between the values of their family of origin and the values of the scholarly community they are forming during the program. We provided students in Bridges with a modified version of the affirmation intervention as part of our ePortfolio curriculum. After completing a Scientific Thinking and Integrative Reasoning Skills (STIRS) case study about scientific ethics (Singer-Freeman, 2015), students reflected on their core values and how these values aligned with scientific values (See Table 2).

Growth mindset and grit. Many students enter college believing that intelligence is genetically determined and unchangeable. Dweck (2006) refers to this as a fixed mindset and pioneered work in which brief lessons on brain plasticity led to shifts in students' views of intelligence. When students shift to a growth view of intelligence, they become more interested in attempting difficult tasks and more likely to persist after initial failures. The determination to achieve long-term goals and willingness to persevere in the face of obstacles has been termed grit (Duckworth & Gross, 2014). Many interventions seek to develop both grit and a growth mindset (Snipes, Fancsali, & Stoker, 2012). The positive effects of a growth mindset on grit have been replicated in many domains of learning and across many groups (Boaler, 2013). The mindset intervention we implemented is a modified version of existing interventions (See Table 2). Students watch a TEDx (2012) talk by Eduardo Briceño that describes mindsets and respond to a writing prompt. Two weeks later they watch a TED (2013) talk by Angela Duckworth

that describes grit and respond to another writing prompt. Both prompts encourage future planning by asking students to consider ways to shift their mindset and having them write a letter to their future self.

Program participants view the brief psychological interventions as part of the ePortfolio program. The interventions contribute to students' positive feelings about the ePortfolios and support the acquisition of academic identity and future orientation. Their purpose is overlapping with other planning activities that take place in professional development workshops because students share a long-term academic goal and articulate their identification with the community of scientists through shared values. However, they are distinct from these activities because they require student-generated reflections on the self. Responses to the interventions are positive. When asked to describe the most important things they learned during the summer program, over 20% of students refer to learning about mindsets or developing more grit. The values affirmation directly supports the formation of a connection between students' families and their academic identity. A review of student responses from 2018 revealed that 65% of the responses articulated an influence of culture, religion, or family on a personal value that was important to science. Reviewing student responses to the mindset intervention over several years, 52% described shifting from a fixed mindset towards a growth mindset, 62% described themselves as currently having a growth mindset, and 57% described themselves as displaying grit (Singer-Freeman & Bastone, 2017). Because increased grit has been hypothesized to be an outcome associated with a growth mindset (Boaler, 2013), we believe that increased references to grit may reflect deep processing.

Developing a Community of Scholars

Ovink and Veazey (2011) posit that programs that provide a sense of community among URM students may reduce social isolation and help students feel that they are better able to combat stereotypes. We accomplish this in Bridges by asking students to reflect on the sense of scholarly community that emerges as the summer progresses. During a one-day spring orientation, the associate director introduces the program by explaining that students will have a unique opportunity to become part of a supportive community centered around academic inquiry. She stresses that the success of the program results from its capacity to support students as they challenge themselves and support each other. She tells students (and family members) to expect moments of discomfort and instructs them to push themselves and each other

during these moments. The associate director also uses proactive instructions to shape scholarly behavior by instructing students about best practices in scholarly settings (stowing cell phones, taking notes, asking questions). Scholarly behaviors by students provide an opportunity to build a sense of community by referring to the students as colleagues and reflecting on the growing examples of support, team work, and intellectual curiosity. The development of a community of scholars has overlaps in nearly every area of the program. It emerges from the intensive scholarship that takes place in the research laboratory; is reflected upon in the ePortfolio; is discussed with the faculty advisor, faculty mentor, peers, and family; and is referenced during professional development workshops. Students' ePortfolio reflections and comments in exit surveys indicate a strong sense of community.

Professional Development Activities

According to Donahoo (2011), the successful navigation of higher education requires three types of capital. Academic capital describes knowledge of ways to succeed on academic tasks. Social capital includes the relationships that help students gain admission into and navigate the world of higher education. Economic capital describes financial resources and knowledge about how to increase or manage these resources. When we asked URM students enrolled in Biology II and Chemistry II to report up to three obstacles that could prevent them from reaching their career goals, 52% shared concerns relating to academic capital, 52% had concerns related to economic capital, and 15% expressed concerns relating to social capital. These results confirmed our belief that helping students develop skills in these areas is essential and directed the creation of our professional development curriculum.

Nearly all professional development activities are offered during a four-day orientation during the first week of the program (See Table 1 for a chronological list of activities within each area of capital). Because our students' primary focus is on their research, these sessions, like ePortfolio practice, can be viewed by faculty and students as a distraction. Therefore, it is essential to make the professional value of activities explicit. We accomplish this by beginning each activity with a discussion of the skills students will gain and highlighting skills that could be added to their resumes or discussed in ePortfolios. We discuss the skills that have been covered in the workshops with the research faculty and encourage them to provide opportunities for students to practice the skills in the research setting. These practices increase the utility value, or extent to which students perceive work to have

worth beyond the context of a requirement (Eccles & Wigfield, 2002). The information provided in the workshops becomes material that is discussed and reflected on in individual advising appointments and in the ePortfolio. When families and friends review the ePortfolio, the information and the students' reflections on the information becomes part of their shared conversations. Thus, the ePortfolio serves both as a means of encouraging reflection on the professional development experiences and as a means of inviting family and friends into dialogues about these experiences. Students recognize the value of these sessions. When asked to report the most important things they learned during the summer and the most difficult challenges they overcame, 90% described accomplishments relating to academic capital, 47% described accomplishments relating social capital, and 3% described accomplishments relating to economic capital. Responses to exit surveys indicate that students valued the content from all of the professional development workshops. As can be seen in Table 1, most students agreed the workshops addressing academic capital, social capital, and economic capital were moderately or highly enriching (over 87%, 82%, and 92% respectively) and moderately or highly enjoyable (over 87%, 78%, and 86% respectively). Taken together, we believe that these responses are evidence that students strongly value opportunities to enhance their academic, social, and economic capital.

Advising

Proactive advising practices in which the advisor actively monitors student progress improve persistence and academic success (Escobedo, 2007). We have found that Bridges students often describe a career goal without awareness of related careers that might fit their interests or skills. They also may try to hide academic struggles because they believe that sharing these struggles will negatively impact the advisor's opinion of them. It is essential to help students view their advisor as their ally. Once this is achieved, the advisor can work with students to broaden their knowledge of possible paths and increase their understanding of the steps needed to achieve their goals.

Each student has a 30-minute advising meeting with the associate director during the first two weeks of the program. Prior to the meeting students complete a survey in which they share information about challenges during their previous semester in college, concerns about the summer, and goals for the future. Allowing students to share concerns

in writing before the meeting facilitates open communication during the meeting. The advisor also reviews the student's application to the program and ePortfolio prior to the advising session. During advising the student creates an academic plan for the next 12-24 months. Students receive individualized "homework" to complete during the summer to make progress with their academic planning. The advisor discusses progress with each student during the fifth week of the program and checks in informally during weekly ePortfolio sessions. The advising session is distinctive from other program elements because it is the only private meeting which focuses exclusively on the individual student's needs and plans. It is overlapping with other elements because the student and advisor discuss content from professional development workshops, research experiences, and the student's ePortfolio. They also discuss how the student's family feels about the student's academic goals. The advising session results in content that is reflected on in the ePortfolio and can result in future conversations between the student and the research mentor. Over 95% of students report in anonymous surveys that the individual advising appointment is helpful.

Faculty Mentoring

Academic mentoring introduces students to the values, norms, and expectations of the community to which they aspire. Mentors can have a positive impact on students' early professional identity and support students' identification with an academic discipline. Ovink and Veazey (2011) found that mentoring programs that combine academic enrichment with support beyond academic training were important for URM students' success. We hypothesize that mentoring efforts have the potential to influence students' feelings of belonging in ways that might be important for their persistence and well-being. A common element of applied learning experiences is close work with a faculty member. However, not all faculty members have been trained in best practices in mentoring or perceive their role to include mentoring.

To increase the quality of mentoring in Bridges we used Campbell and Campbell's (2007) best practices for faculty mentoring to modify hiring practices and design ongoing training. Finding mentors who are productive, warm, empathetic, available, and have integrity is essential. Mentors should actively engage mentees to help them achieve program goals beyond the research experience. The associate director meets with program faculty weekly and suggests discussions they can initiate with students. She also encourages faculty to find common ground with students and share their own academic struggles.

The mentoring relationship is distinctive because it is the only close relationship the student has with a faculty member that is centered on scientific research. However, as our supportive curriculum has improved we have increased the extent to which the mentoring relationship connects to other areas including the student's ePortfolio, academic plans, and career interests. Weekly faculty meetings are used to inform the research faculty about the types of reflective writing that are taking place in the ePortfolio and to encourage discussions or research activities that might complement recent professional development workshops. Improved mentoring has resulted in close bonds between students and faculty mentors. In anonymous exit surveys, over 95% of students have rated their interactions with their research mentor as positive. The program evaluator reports that students view research mentors as helpful, patient, caring, and attentive to the needs of all of the students in the group.

Engagement of Family

Without active engagement and support of students' families, first generation, low income and ethnic minority college students can feel that the development of a strong academic identity is a betrayal of their ethnic or cultural heritage (Syed, Azmitia, & Cooper, 2011). Many of our students fill important economic functions within their families. For these reasons, gaining family support and increasing family members' awareness of what is taking place in the program is essential. Family programs establish partnerships to support student success. During the spring orientation, families attend a session that explains the purpose of program elements and includes information about ways they can support students. During the summer, students are encouraged to share ePortfolios with their families and families are invited to the final research symposium. During individual advising, family needs are part of the discussion of the student's long term goals and plans. Family engagement is a distinctive element of our program that supports students' research engagement, identity development, and ability to engage fully in the establishment of a community of scholars. The cultivation of family engagement is supported by the shared ePortfolio and the inclusion of family members in key program events. From the perspective of the family, these events provide them with a new view of the student as a developing scholar. From the perspective of the student, family engagement events provide a validation of the student's academic efforts and an ongoing source of encouragement for the pursuit of academic success.

Applications

We have described the ways in which we modified Bridges to incorporate evidence-based practices that support student success. Broadly, these modifications created a sense of academic community and identity, supported the development of a growth mindset, grit, and a future orientation, and provided students with a roadmap for academic success. We believe these supportive elements of our program are responsible for our high level of success. Refinements in our supportive curriculum have been accompanied by improved outcomes. Whereas 43% of program alumni completed bachelor's degrees during the five-year period in which we developed our supportive programming, this rose to 47% when we began to use ePortfolios as a central organizing element. Looking forward to the students who have completed the program in the past few years, 86% are currently on track to complete bachelor's degrees. Thus, we expect degree completion rates to continue to rise as we find more effective ways to support our students. We now consider ways these practices might be modified for use in other applied learning contexts.

Transforming Supervisors into Mentors

Applied learning often takes place in small groups. In these contexts, small changes can enrich the experiences of students. For supervisors to effectively mentor it is important to select supervisors who are warm and empathetic academic role models and then provide training on best practices. It is also critical to include activities that evoke reflection and nurture the mentoring relationship. Journaling and reflective writing are commonly used to document learning in applied settings. When mentors read and respond to these artifacts the mentoring relationship is strengthened.

Developing Capital

When students are struggling to meet program expectations consider whether gaps in academic, social, or economic capital may be preventing success. Once gaps are identified, create supportive programming that can provide students with the skills they need. Encourage awareness of the development of these areas of capital through reflective writing.

Developing a Growth Mindset and Promoting Grit

Applied learning often results in unexpected challenges for students. Moments of struggle are ripe for reflection and brief psychological interventions (see Snipes et al., 2012 for descriptions of many versions of

psychological interventions). It is also possible to support the development of grit and a growth mindset directly:

- 1) *Provide proactive instructions that support student success.* For every activity, include detailed instructions, indicate elements that previous students have found difficult, and provide instructions about ways to master these elements. Then, publicly comment on students' mastery of these difficult elements.
- 2) *Communicate confidence in each student's ability to improve.* Encourage students to view criticism as an invitation for growth.
- 3) *Encourage effort.* Acknowledge effort and improvement in performance even if there is still a need for more improvement.
- 4) *Provide students with realistic biographies that model academic growth and persistence.* When discussing leaders in the field or your own biography, include details that exemplify grit and scholarly growth.

Creating Engaged Learners

To produce authentic learning we must deeply engage students in a discipline. Once students are engaged, their intrinsic motivation to integrate current learning with previous knowledge will drive future progress towards mastery. Pedagogical practices that support engagement can be implemented broadly.

- 1) *Challenge students to discover the information or skills that will be useful to them.* It is essential to create activities that have a purpose beyond the assignment of credit. Once activities with purpose have been created, make explicit the skills students will gain by completing the activity.
- 2) *Infuse assignments with self-reflection to increase engagement, conceptual integration, and retention.* ePortfolio practice is well-suited to the documentation of applied learning and encourages reflection, integration, and future planning. Our curriculum can be adapted for use in study abroad programs, internships, and other applied learning contexts. The creation of an academic showcase in which the student reflects on the self, using new concepts, will support the development of academic identity.

Conclusions

Engaging in research as an undergraduate student is a transformative experience, however successful completion of STEM degrees requires sustained efforts to overcome challenges. Programs must go beyond merely providing applied learning experiences to maximize the extent to which they prepare students to persist and excel. For underrepresented students it may be especially important to provide such opportunities and ensure that students derive the most benefit from them. The intentional design of an integrated supportive curriculum, reinforced by ePortfolio practice, can help ensure that applied learning experiences benefit all and that the benefits endure.

References

- Bass, R. (2017). Social pedagogies in ePortfolio practices. In B. Eynon and L. M. Gambino (Eds.), *High-impact ePortfolio practice: A catalyst for student, faculty, and institutional learning* (pp. 65-73). Sterling, VA: Stylus Publishing.
- Boaler, J. (2013). Ability and mathematics: The mindset revolution that is reshaping education. *Forum*, 55, 143-152. Retrieved from: http://www.ncpdf.org/pdf/steering/2013-09-06/12.0%20Boaler_FORUM_55_1_web.pdf
- Buzzetto-More, N. (2010). Assessing the efficacy and effectiveness of an e-portfolio used for summative assessment. *Interdisciplinary Journal of E-Learning and Learning Objectives*, 6, 61-85. Retrieved from <http://www.ijello.org/Volume6/IJELLOv6p061-085Buzzetto691.pdf>
- Cabrera, D., Colosi, L., & Lobdell, C. (2008). Systems thinking. *Evaluation and Program Planning*, 31, pp. 299-310. doi:10.1016/j.evalprogplan.2007.12.001
- Campbell, T. A., & Campbell, D. E. (2007). Outcomes of mentoring at-risk college students: Gender and ethnic matching effects. *Mentoring and Tutoring: Partnership in Learning*, 15, 135-148. doi:10.1080/13611260601086287
- Cohen, G.L., Garcia, J., Purdie-Vaughns, V., Apfel, N., & Brzustoski, P. (2009). Recursive processes in self-affirmation: intervening to close the minority achievement gap. *Science*, 324, 400-403. doi: 10.1126/science.1170769
- Donahoo, S. (2011). *Contemporary perspectives on capital in educational contexts*. Charlotte, NC: Information Age Publishing.
- Duckworth, A. L., & Gross, J. J. (2014). Self-control and grit: Related but separable determinants of success. *Current Directions in Psychological Science*, 23, 319-325. doi: 10.1177/0963721414541462
- Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York: Ballantine Books.
- Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology*, 53, 109-132. <https://doi.org/10.1146/annurev.psych.53.100901.135153>
- Escobedo, G. (2007). A retention/persistence intervention model: Improving success across cultures. *Journal of Developmental Education*, 31(1), 12-18. Retrieved from <http://search.proquest.com/docview/228471507/>
- Eynon, B., & Gambino, L. M. (2018). *High-impact ePortfolio practice: A catalyst for student, faculty, and institutional learning*. Sterling, VA: Stylus Publishing.

- Eynon, B., Gambino, L. M., & Török, J. (2014). What difference can ePortfolio make? A field report from the connect to learning project. *International Journal of ePortfolio*, 4, 95-114. Retrieved from <http://ezproxy.purchase.edu:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eue&AN=95908169&site=eds-live>
- Ovink, S. M., & Veazey, B. D. (2011). More than “getting us through:” A case study in cultural capital enrichment of underrepresented minority undergraduates. *Research in Higher Education*, 52, 370-394.
- Rodgers, C. (2002). Defining reflections: Another look at John Dewey and reflective thinking. *Teachers College Record*, 104 (4), p. 856.
- Russell, S. H., Hancock, M. P., & McCullough, J. M. (2007). Benefits of undergraduate research experiences. *Science*, 316, 548-549.
- Singer-Freeman, K. E. (2015). MMR vaccine and autism: Scientific inquiry, ethics, and evidence-based problem solving. AAC&U Scientific Thinking and Integrative Reasoning Skills Case Study. doi: 10.13140/RG.2.1.1624.5928
- Singer-Freeman, K. E., Bastone, L., & Skrivanek, J. (2014). ePortfolios reveal an emerging community of underrepresented minority scholars. *International Journal of ePortfolio*, 4, 85-94. Retrieved from <http://www.theijep.com/pdf/IJEP131.pdf>
- Singer-Freeman, K. E., Bastone, L., & Skrivanek, J. (2016). Using eportfolios to assess applied and collaborative learning and academic identity in a summer research program for community college students. *International Journal of ePortfolio*, 6, 45-57. Retrieved from <http://www.theijep.com/current.cfm>
- Singer-Freeman, K. E., & Bastone, L. (2017). Changing their mindsets: ePortfolios encourage application of concepts to the self. *International Journal of ePortfolio*, 7(2), 151-160.
- Singer-Freeman, K., & Bastone, L. (2018). ePortfolio and declarations of academic self: A tale of two contexts. In B. Eynon and L. Gambino (Eds.), *Catalyst in Action: Case Studies of High-Impact ePortfolio Practice* (pp. 84-97). Sterling, VA: Stylus Publishing.
- Snipes, J., Fancsali, C., & Stoker, G. (2012). Student academic mindset interventions: A review of the current landscape. *Report released by the Stupski Foundation*.
- Syed, M., Azmitia, M., & Cooper, C.R. (2011). Identity and academic success among underrepresented ethnic minorities: An interdisciplinary review and integration. *Journal of Social Issues*, 67(3), pp. 442-468. Retrieved from <https://bridging-worlds.ucsc.edu/docs-pdfs/Syed,%20Azmitia,%20and%20Cooper%202011.pdf>
- TED. (2013, April). A. L. Duckworth: *Grit: The power of passion and perseverance* [Video file]. Retrieved from <https://www.youtube.com/watch?v=H14bBuluwB8>
- TEDx. (2012, November 18). Edward Briceno: *The power of belief — mindset and success* [Video file]. Retrieved from <https://www.youtube.com/watch?v=pN34FNbOKXc>
- Walton, G.M. (2014). The new science of wise psychological interventions. *Current Directions in Psychological Science*, 23, 73-82. doi:10.1177/0963721413512856
- Watson, C.E., Kuh, G.D., Rhodes, T., Penny Light, P., & Chen, H.L. (2016). Editorial: ePortfolios – the eleventh high impact practice, *International Journal of ePortfolio*, 6, 65-69. Retrieved from <http://www.theijep.com/pdf/IJEP254.pdf>

Table 1		
<i>Percentage of Students Reporting High or Moderate Enrichment and Enjoyment</i>		
Activities by Area of Capital Targeted		
<u>Academic Capital</u>	<u>Enrichment Value</u>	<u>Enjoyment</u>
Successful Transition to a 4-year college	91%	87%
Study Techniques and Note Taking	92%	87%
Oral Presentations	91%	95%
Creating Research Posters	82%	87%
Excel Skills	90%	90%
Lab Skills	91%	91%
Faculty Science Lectures	91%	91%
<u>Social Capital</u>		
Personal Branding	87%	87%
Resume Writing	100%	100%
Scientific Ethics STIRS Case Study	91%	78%
Networking and Resume Review	96%	96%
Career Exploration Panel	91%	91%
<u>Economic Capital</u>		
Applying to and Funding Higher Education	95%	86%
Applying to Research Internships	92%	100%

Table 2 <i>Writing Prompts and Sample Excerpts from Student Responses</i>	
Writing Prompt	Response Excerpt
<p>Introductions Describe yourself completing the phrase, "I am" 5 ways. Share your goals for the summer, the next few years, and the next 10 years. Describe ways in which the last week has been different from other weeks of your life.</p>	I hope to make connections with those who share my enthusiasm for nature and to inspire others
<p>Mindset Describe how those with fixed and growth mindsets approach learning. Describe your reactions to academic struggles. Assess the extent to which your reactions employ a "fixed mindset voice." Propose responses to establish a growth mindset and a plan to help students foster a growth mindset. Add an image of your mindset.</p>	I used to have a fixed mindset when it came to English class... Of course I'm still learning but now I feel if I put in more time to work on my grammar skills I'll eventually get better.
<p>My Values and the Values of Science List your personal values. Describe an experience in your life that made you proud of yourself and your values. Reflect on the reason that the experience made you proud of your values. Discuss how your values fit with the values of the scientific community.</p>	You have to use growth to learn from your mistakes when conducting experiments. You must have dependability to have trust among your peers in the science community.
<p>Grit Describe grit. Explain how mindsets relate to grit. Describe the most difficult thing you accomplished. What aspects of grittiness did you display? Write a letter to your future self: Describe a challenge you wish to accomplish and explain how you could overcome each obstacle that might prevent success.</p>	My parents do not have proficiency in English.... I had to teach myself how schools worked and how to avoid debt. I had to develop a growth mindset and grit...
<p>Meeting Goals You are half done with your summer. Examine your goals. Describe the progress you have made. Propose ways you could increase your progress.</p>	I wish to start speaking to professors and looking for research opportunities...
<p>Ideal Career Reflect on your ideal career. Describe current skills that make you well suited for this career. Describe skills you need to develop. Have your thoughts about your career changed as the summer has progressed?</p>	Working closely with my research peers and Dr. _ has made me want to pursue a more research-based career.
<p>Conclusions What do you hope a viewer of your ePortfolio will learn about you? What do you believe are the most important things you accomplished this summer? What would you like to remember about your experience this summer?</p>	We went from strangers to becoming friends ... Sifting through all the data we collected shows how much work we've put into our projects.

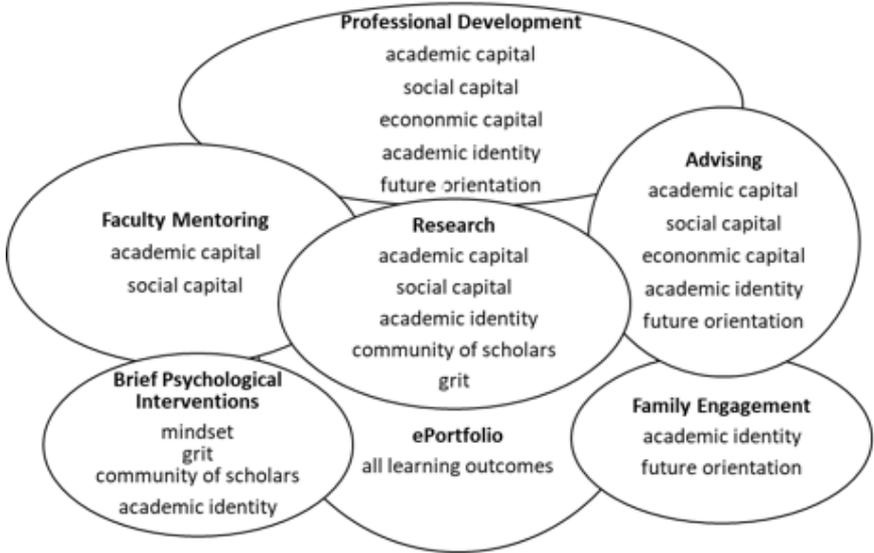


Figure 1. This figure illustrates the interrelationships between the unique program elements. Overlapping circles indicate elements with significant levels of overlap.

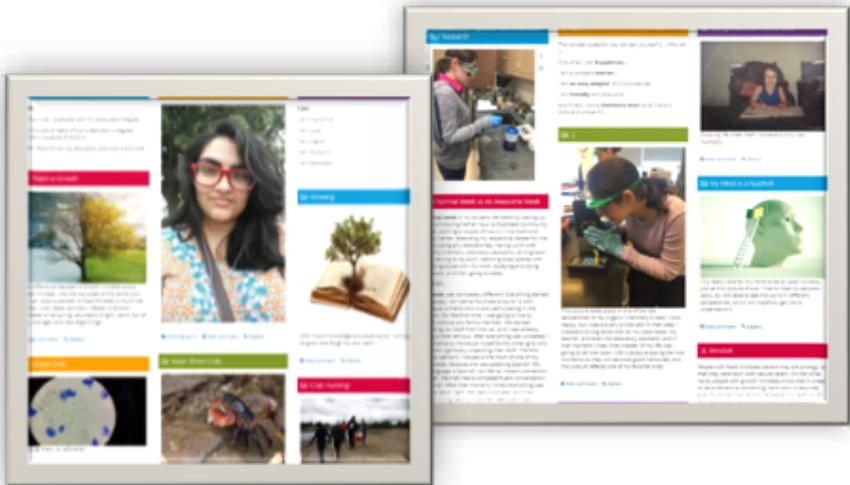


Figure 2. Sample ePortfolios