



PURM

Perspectives on Undergraduate
Research & Mentoring

What is creativity? Undergraduate research student reflections on creativity as an essential research skill

Andrée Leighton, Ph.D., Mount Saint Mary's University (aleighton@msmu.edu)
Stephen Inrig, Mount Saint Mary's University

Introduction

Undergraduate research (UR) is widely regarded as one of the most effective high-impact practices in higher education (Kuh, 2008; Lopatto, 2007). It offers students the chance to engage deeply with topics they care about, work closely with faculty mentors, and build skills that serve them well beyond the classroom. UR provides meaningful preparation for both careers and graduate study, making it an especially powerful and equitable form of preparation for students from underrepresented backgrounds (Kuh, 2008). Through this process, students not only gain academic enrichment but also grow personally and professionally, developing confidence, persistence, and a stronger sense of purpose (Ishiyama, 2002; Kistner et al., 2021; Toven-Lindsey et al., 2023).

As undergraduate research programs have expanded across disciplines, scholars have sought to identify the core skills students develop through these experiences and the benefits they produce in students' lives (Hunter et al., 2007; Seymour et al., 2004). While critical thinking and problem-solving are well-documented outcomes, creativity – though equally fundamental – is less frequently studied (Beghetto & Kaufman, 2007; Crawford et al., 2014; Kistner et al., 2021). Creativity helps students frame research questions, explore new ideas, and generate new knowledge (Osborn & Karukstis, 2009; Sawyer & Henriksen, 2024; Summers et al., 2024). Creativity often grows not just by developing research skills, but through reflection, collaboration, and refining ideas over time (Beghetto & Kaufman, 2014; Sawyer & DeZutter, 2009; Toven-Lindsey et al., 2023). Creativity is pivotal to students making the leap from technical proficiency to original contribution (Brew, 2013; Kaufman & Beghetto, 2009; Osborn & Karukstis, 2009).

Recent scholarship documents creativity as one of several research-related skills that develop through undergraduate research and contribute to students' academic and personal growth (Kistner et al., 2021; Summers et al., 2024; Toven-Lindsey et al., 2023). Showman et al. (2013) describe creativity in undergraduate research as a developmental process made up of four sub-categories. The first, developing a topic or plan for exploring a problem, includes the form of creativity students need to “get started.” Showman et al. (2013) argue that “all researchers, not just undergraduates, require creative thinking and process development to build upon today's knowledge. ... The first step in research is developing a topic or a plan for exploring a problem, and creativity is fundamental to this effort” (p. 16).

The second sub-category, making new connections, is the form of creativity that links ideas, fields, or concepts together in ways that bring fresh insight to existing scholarship (Madore et al., 2015). This

form of creativity allows students to move beyond linear research processes, opening space for originality and discovery as they explore different angles of their projects.

The third sub-category, reaching beyond the mentor's discipline or the student's prior experience, asks students to take ownership of their projects and contributions unique to them and distinct from their mentors, personal experience, fellow students, or even mainstream ideas. To grow as researchers, undergraduates benefit by moving beyond received knowledge and wisdom.

The fourth sub-category, transcending mainstream ideas toward an original offering, describes creativity as the ability to move past conventional thinking to produce work that contributes something original to a discipline. Table 1 summarizes each sub-category with a definition and illustrative language from Showman et al. (2013), representing a developmental, rather than a sequential, process.

Table 1: Adapted from Showman et al.'s (2013) Four Sub-Categories of Creativity in Undergraduate Research

#	Creativity Sub-Category	Definition	Illustrative Language from Showman et al. (2013)
1	Developing a topic or plan for exploring a problem or question	A generative sub-category of creativity where students identify, frame, and shape a research focus	"The first step in research is developing a topic or a plan for exploring a problem, and creativity is fundamental to this effort."
2	Making new connections	An integrative sub-category of creativity linking ideas, fields, or concepts in ways that bring fresh insights to existing scholarship	"Budding researchers can use the creative process to make new connections, pushing the envelope of what is possible in discovery."
3	Reaching beyond mentor's discipline/student's prior experience	A sub-category of creativity where students explore unfamiliar disciplines and their ideas, methods, or perspectives	"Students should not limit themselves to the expertise of their faculty mentors ... undergraduates should strive to reach beyond their own disciplines ... for possible ideas."
4	Moving toward transcending mainstream ideas and making an original offering	A sub-category of creativity where students produce work that contributes something original to a discipline	"Creativity is the ability to transcend mainstream ideas ... [students make] an original, intellectual, or creative contribution to the discipline."

To our knowledge, no empirical studies have tested how real-world student reflections align with proposed conceptual frameworks like that of Showman et al. (2013), representing an important gap in the literature. The present study addresses this gap through a qualitative analysis of weekly

reflections written by students during a six-week structured summer research program. Our research question was, *“Using Showman et al.’s (2013) definition of creativity as a framework, how do students perceive the development of creativity, a core research skill, through weekly written reflections on their research experience during a structured summer research program?”* The students read Showman et al.’s (2013) article and wrote weekly reflections about their development as researchers. We analyzed all written reflections that discussed creativity, using the Showman et al. (2013) creative sub-categories to guide our coding, while remaining open to student-generated descriptions that might extend, revise, or complicate the existing dimensions. By doing so, we aimed both to understand better how students experience creativity in practice and to assess whether the Showman et al. (2013) definitions accurately capture those experiences.

Methods

Study Design

Our research question guided the structure and focus of our analysis. The students read Showman et al.’s (2013) article “Five essential skills for every undergraduate researcher” (creativity, organization, communication, judgment, and persistence) and were introduced to the four creative sub-categories in their reading. Beyond that reading, we did not provide any additional instruction on the definition of creativity, and we did not ask students to discuss creativity directly. We made this choice deliberately, to avoid pre-conditioning student responses.

We asked students to submit weekly written reflections on their experience and development with all five undergraduate research skills. In the weekly prompts, we asked students to reflect on their growth across all five essential skills broadly, including creativity, though we did not name the four creativity sub-categories individually in the prompts (see Appendix B for the weekly report template, specifically item #3, ‘Self-Assessment of Progress.’). We analyze student responses with respect to all five undergraduate research skills in a forthcoming paper.¹

In light of the purpose of this study and the gap in current UR literature, we focused specifically on student responses related to creativity. We used Showman et al.’s (2013) four-part definition of creativity as a guiding lens to code student responses. We also paid attention to where students’ reflections extended beyond Showman et al.’s (2013) existing framework. Our aim was to understand how students experience and describe creativity in the context of undergraduate research and consider the extent to which their reflections align with Showman et al.’s (2013) creativity framework and/or reveal nuances that expand or complicate its existing definitions.

Participants

Our qualitative study examined the UR experiences of nine undergraduates in humanities and social sciences programs at a small liberal arts and sciences institution in the western United States. All of the students identified as women or non-binary. Table 2 includes student profiles by year, major, and minor where applicable, illustrating the range of disciplines represented in the research projects (see Appendix B for brief descriptions of the projects). The program was designed and facilitated by one of the authors, a faculty member and the academic director of the institution’s center for innovation and creativity in teaching and learning. Ten students were initially included in the program; one student did not participate due to life circumstances.

¹ cf. Leighton and Inrig, “Framing research readiness: A student-centered look at core research competencies” (forthcoming).

Table 2: Student Researcher Demographics

Student Researcher	Year	Major	Minor
R1	Y1	Psychology, Healthcare Policy	Child Development
R2	Y2	Healthcare Policy	Business Administration
R3	Y2	Psychology	Business Administration
R4	Y4	Nursing, Healthcare Policy	N/A
R5	Y2	Music	N/A
R6	Y2	Journalism and New Media	N/A
R7	Y2	Business	Emphasis: Management
R8	Y2	Nursing, Healthcare Policy	Sociology
R9	Y1	Political Science	Pre-Law

Procedure

We implemented a qualitative content analysis, using NVivo software (QSR International (2023) *NVivo (Version 14)*), to examine the weekly reflections students gave related to the category of creativity. We anonymized all reports and coded for each student researcher (R1, R2, R3, etc.) and week of the report (e.g., R1-W1, etc.) to the category of creativity. We started with Showman et al.'s (2013) four creativity dimensions as our first set of codes and added new codes when the data indicated them.

Each member of the research team coded the reflections independently, reading all reflections and building a short codebook (definitions, what to include/exclude, examples), testing these on about 20% of the reflections (beginning with the first two students) across all five weeks. After comparing findings, resolving discrepancies, and refining the coding scheme, we reached consensus on how to apply the codes in ways that aligned with Showman et al.'s (2013) framework.

Ethics

Our study received approval from our university's Institutional Review Board (IRB #1-2025/2026). We submitted the study protocol, including the semi-structured weekly reflections, and the data confidentiality provisions to ensure compliance with ethical standards for research involving human subjects.

Results

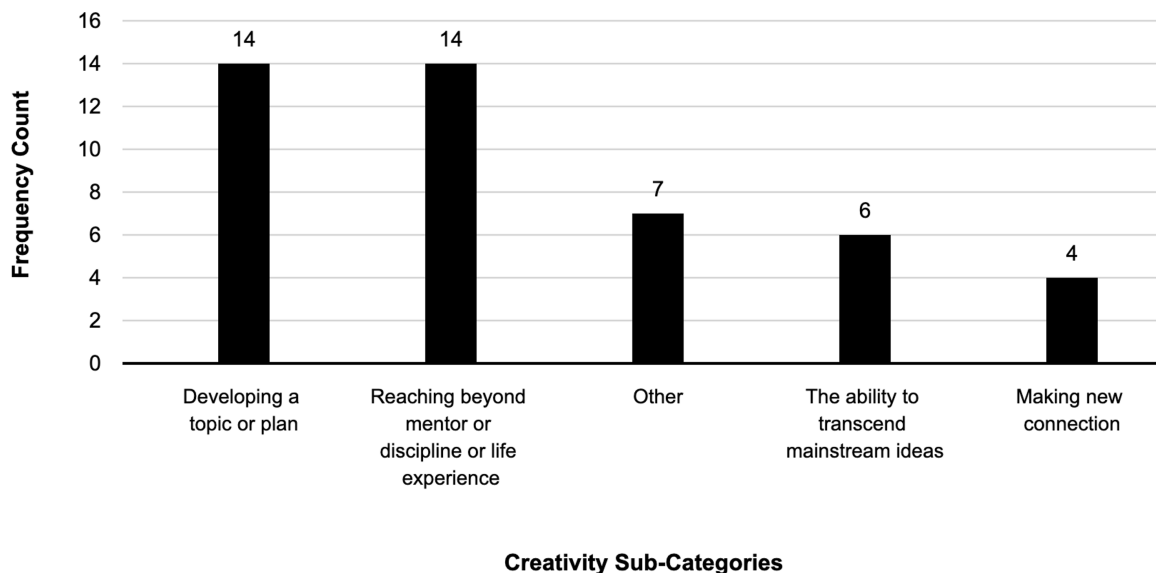
Introduction of Overarching Categories and Subordinate Categories

Our analysis of student reflections revealed an evolving understanding of creativity in the research process. In what follows, we outline general patterns in how students described creative engagement, including the kinds of tasks that felt accessible and the areas where creativity felt more challenging or unfamiliar. From there, we map the student reports onto Showman et al.'s (2013) four sub-categories of creativity. We close by highlighting several cross-cutting observations, including the role of mentors, shifts in how students viewed their own creativity, and the challenges and ambiguities students raised about whether Showman et al.'s (2013) criteria fully captured their experiences.

General Patterns

The student reports revealed several broad patterns regarding creativity in undergraduate research. According to our coding (Figure 1), students most frequently described creative engagement in the context of ‘developing a topic or plan,’ and ‘reaching beyond mentor or discipline or life experience.’ This suggests that structured forms of creativity, such as outlining projects or organizing research components, felt accessible and familiar, while engagement in the research process itself allowed students to reach beyond their own life experience. In contrast, the least reported dimension was ‘making an original offering,’ indicating that producing wholly novel contributions remained challenging for many students. Interestingly, ‘making new connections’ and ‘going beyond mentor/discipline/prior life experience’ appeared at similar rates, six times and four times respectively, suggesting that students were beginning to stretch their thinking beyond traditional boundaries, but not always in ways that led to integrative or cross-disciplinary insights.

Figure 1. Frequency of creativity sub-category codes across student reflections. Note: We omitted ‘Making an original offering’ due to low frequency



Sub-Category 1: Creativity as developing a topic or plan for exploring a problem/question

Students most often described this sub-category through the everyday work of getting a project off the ground. One student wrote, “Throughout planning my outline, I have had to be creative and think about what I want to add to my literature review. I have also had to be creative when it comes to researching and picking articles.” (R7, W1).

Others described specific moments where creativity emerged in the planning stages, such as the student who said, “I am showing my Creative side by planning and outlining my film format.” [R1, W1]. Creativity also appeared in problem-solving, such as when a student used alternative social media channels to locate difficult-to-find contact information:

“When researching, I had to be creative when I struggled to find certain contact information for people. I thought of other means for reaching them and looked at different social media outlets when searching for an email. I think this week I was able to see how creative I can be in regard to researching as it was challenging to find up to date information.” (R9, W4).

The process was not always intuitive; some students reported struggling to see themselves as creative, only discovering their capacities in collaborative environments or with the guidance of a mentor:

“I believe that creativity is my weakest essential skill. I find that I am not a traditionally creative person and struggle to come up with ideas by myself. However, this week I learned that working in a group and bouncing ideas off of classmates encourages me to embrace my creativity.” (R8, W1).

Another student explained the importance of the mentor’s collaboration:

“After all the music was recorded, we had to focus on the visual element of Circle Atsia. [My mentor] would play my recording of a certain part, and I would play over my recording while visually recording my movements on my phone. We did this for each percussion element in Circle Atsia. I then downloaded all the video elements to the computer. [Mentor] then helped me put both the video and audio together in perfect sync.” (R5, W3).

Across these examples, students engaged in the creative work of process development, whether by structuring outlines, choosing literature, troubleshooting communication barriers, or working through technological challenges. Importantly, many students recognized that this creativity was often sparked in collaboration with peers or supported by mentors. This hands-on engagement with the research process appeared to be a key driver of creative growth, with students citing activities such as refining themes, categorizing data, and learning new tools like SparkMaps as pushing them to think in new ways. Students also described how mentorship and structured tools such as annotated outlines supported creative problem-solving.

Sub-Category 2: Creativity as making connections

Students most often described this sub-category through moments of stepping back and seeing their project from a different angle. Several students described this kind of expansive thinking in their reflections.

One student reflected on how traveling through Europe inspired new perspectives on local parks (their research project): “I took time to sit down and write observations I noticed about the people around me ... This was really inspiring to me because it was one of my ideas and it is something I want to bring to (student’s park) ... I’ve been able to observe what green spaces look like in new places.” (R9, W2). Another student discussed the creative connections they made when exploring community-based organizations, writing, “I found certain nonprofits that work in this area and started a document about the nonprofits and what they do to help the community. I also did thinking myself on the topics I researched and thought of the pros and cons, and situations about this data.” (R4, W3). A third student demonstrated divergent thinking by questioning patterns in the data itself, wondering “about other aspects within that specific topic. For example, when analyzing data based on ‘young people who do not work or go to school,’ I noticed a difference based on gender. Why was there a noticeable difference between boys and girls? What other factors contributed to this statistic?” (R8, W4).

Finally, one student had the opportunity to explore the influence personal history and unique culture can have on traditional music, writing “This week my mentor arranged a meeting to interview an Ewe descendant so that I could better understand the music, culture and Ewe people. In this fantastic interview, I was able to freely ask ... questions like ‘What is your knowledge of your family history?’, ‘What were your parents’ reasons for beginning their teaching career in the U.S.?’, ‘What is it like growing up in a culturally rich family and holding their history?’” (R5, W4). These reflections illustrate

how divergent thinking helps students stretch beyond surface-level inquiry, allowing them to identify new connections, refine their questions, and expand the scope of their research or examine it in a larger context (Madore et al., 2015).

Sub-Category 3: Creativity as reaching beyond mentor/discipline/life experience

Students most often described this sub-category through moments when they pushed past what their mentor, their prior experience, or their discipline had taught them to expect. One student described how their project helped them “cultivate a sense of exploration” and develop new ways of thinking about spirituality. (R3, W1). Another explained how generational perspective played a role, noting that as a Generation Z student, they could bring fresh insights into financial literacy gaps and “look at it from different perspectives.” (R7, W3). Several students described moments when creativity felt like a breakthrough experience, such as the student who compared the process to “arriving at the studio prepared to release music in my head for weeks to come together in just a few hours and sound whole.” (R5, W3). Others spoke of the ways creativity expanded their capacity for problem-solving, whether in brainstorming ideas tied to community need (“I want my project to make a difference in the lives of [people] ... so it has to be unique and special to the community. I am thinking of more creative aspects to include to my project as I brainstorm ideas.” [R9, W3]) or in finding new ways to access hard-to-reach contacts (“This week I was able to see how creative I can be in regard to researching as it was challenging to find up to date information.” [R9, W4].)

Sub-Category 4: Creativity as transcending mainstream ideas and offering something original

When thinking about creativity as the ability to transcend mainstream ideas, the most common and explicit theme students employed was to “think outside the box.” As one student put it, “Creativity helps push my boundaries and limits and come up with new theories. Creativity can also lead to findings that I may not have had in mind or thought of.” (R7, W2). Another student captured the feeling more personally: “This week, my creativity felt like it was presented to me in a beautifully wrapped pink box ... ” (R5, W3). Several students emphasized that thinking beyond conventional ideas was not just about novelty but was also about purposefully tailoring ideas to specific community needs or real-world situations. One student working on a project related to park design wrote, “With creativity, I have learned how to think outside the box and form ideas that are unique to my park that will benefit the community. I had to think of ways to better the park by coming up with new, innovative ideas that align the people’s needs, demands, and concerns.” (R9, W1).

Others reflected on the role of creativity in shaping their broader intellectual growth. One student noted, “In terms of growth, there has been growth in my creativity and how I am able to cultivate a sense of explorations within myself in order to bring new ideas to answer the overarching question of spirituality.” (R3, W1). Another described how creativity in research carried over into everyday life, saying, “My creativity has flourished throughout this project. I have noticed my increased sense of creativity in all aspects of my life. I have a more analyzed approach to problem solving and I have found myself begin to think outside of the box.” (R8, W5).

Discussion

General Discussion of Results and Their Implications

Increasingly, studies indicate the value of involving students in research early and often (Chaplin et al., 1998). This pilot study explored how nine undergraduates, engaged in humanities and social science research, experienced the development of creativity (a core research skill) during a six-week summer research program. Two students worked in humanities fields (Music and Journalism), while the remaining seven participated in social science research projects, including a group project on healthcare policy (Researchers 2, 4, and 8). As Table 2 illustrated, these students were high achievers preparing for post-graduation careers.

Our analysis indicates that the four dimensions of creativity identified by Showman et al. (2013) were indeed recognizable in student reflections. More importantly, we observed a developmental arc that unfolded gradually over the course of the project, as students grew in their understanding of creativity, described themselves as flourishing, and found that this growth carried into other areas of their lives. This growth was also reported in their relational learning, through collaboration with mentors and other student researchers. Students evolved from viewing creativity as a fixed trait to recognizing it as a skill they could practice and cultivate.

Cross-Cutting Observations

One clear pattern that emerged across student reflections was that creativity often felt most challenging at the outset of the program, when students had not yet begun to see themselves as creative people and felt the most pressure to produce original ideas. Additionally, some students noted that certain weeks felt less favorable to creativity due to the nature of the work conducted that week; this suggests students have internal conceptions of some activities as creative and others not, rather than creativity as something that can be brought to any task or situation.

Throughout these challenges, mentorship played a pivotal role, though often from the background. Students credited mentors with providing the scaffolding that helped them navigate and expand their creative capacities, and peer-mentor interactions with expanding beyond their personal “shells.” Students credited collaborative engagement with generating new confidence, and at the same time frequently used individualized language to describe the changes they experienced. This suggests students viewed creativity as a personal skill that they were learning to claim for themselves, and that this skill development could be supported in a context of social learning through collaboration.

Challenges and Ambiguities

One challenge we found with interpreting the data was that students did not consistently frame their reflections using the four dimensions of creativity from Showman et al (2013). This raises questions about the extent to which students had Showman et al.’s (2013) framework in mind as they wrote. For instance, some students described creative work in presentation design or media production that involve creative communication rather than research design or analysis and one student described community-specific ideas of creativity, such as designing public park improvements that were specific to a community.

Students also described attributes adjacent to creativity, including enthusiasm (R2 W5), empathy (R4 W1), confidence (R5 W2, R6 W2), patience (R7 W4), critical thinking (R3 W3, R4 W2, R6 W4), and interdisciplinary collaboration (R8 W3). These qualities may support or overlap with creativity but were not fully captured by the Showman et al. (2013) taxonomy. This points to a need for a broader or more flexible framework that reflects how students naturally experience and express creative growth.

Limitations

We should acknowledge a number of limitations. First, the study’s small sample size (N=9) limits its generalizability. More significantly, the issue of construct validity emerged: are we measuring what we think we are measuring? Students did not always articulate creativity in ways that clearly align with the dimensions proposed by Showman et al. (2013), possibly because they were not explicitly guided to use or reflect on that framework. This ambiguity is not surprising, as researchers continue to grapple with defining creativity and identifying its dimensions.

Another limitation involved variation in mentor engagement and reinforcement. While mentors were provided with the Showman et al. (2013) article on the “Five Essential Skills,” it is unclear how many read or integrated its concepts into their guidance. Without a unified and repeated conversation with

students about skills like creativity, students responded according to pre-existing understandings rather than Showman et al's (2013) conceptualizations. However, this also allowed students to explore creativity and have their own discoveries. A more structured conversation around creativity throughout the program may have helped students narrate these experiences more clearly by the end.

A related limitation involved variation in the opportunity for creative engagement itself. Opportunities for creative engagement may have varied by discipline and project design. Some students had more latitude in shaping their research topic or approach from the outset, while others worked within methods or team structures set by their mentor or project, which may have constrained the space available for creative exploration.

Program length was also a constraint. It takes time for momentum to build with creativity and research and many students and mentors reported building that momentum just as the program concluded. This constraint involved external factors including the university calendar and students' busy schedules.

An additional issue was researcher roles and reflexivity. Both authors were directly involved in the program. The faculty UR director designed and ran it, mentored a student, and served as a primary coder. The other co-investigator mentored four students and served as a primary coder. These overlapping roles can shape how researchers read the data, the authors included, so we recognize that as a source of possible bias. To lessen (but not eliminate) that bias, we de-identified all student reflections before analysis. Each author coded the full set on their own, then we met to compare results and agree on the final codes by consensus; no external analyst was involved. We did not keep reflexive journals or run a formal search for disconfirming evidence, and we note this as a limitation. Our findings are grounded in the written reflections and a negotiated-agreement process, and we are explicit about our insider positions. Adding those bias reducing steps in the future and adding external reviewers can assist the research going forward.

Next Steps

For the 2025 summer program, the faculty UR director extended the time student researchers and their faculty mentors had to conduct their research from six to eight weeks. Preliminary results suggest this was a welcome change from the six weeks in 2024. Additional changes included: adding an orientation session for students and faculty, respectively; providing students with clearer guidance for the weekly skills section using an anonymous student sample; and specifically asking faculty to discuss students' skill development and discoveries in weekly meetings.

Looking ahead to 2026, we plan to implement more changes, including: collecting more demographic information from students and faculty and offering additional support to help students find their unique entry point for creativity and how it applies to research. While not all students are going to go on to be researchers, they can find meaningful ways to value and enjoy it.

Future Research

We need to test the congruence of the Showman et al. (2013) framework among our students more extensively. Including the 2025 and 2026 student cohorts will expand our sample size and evidence base as a first step. Additionally, we will use our data set to explore the four remaining framework skills Showman et al. (2013) describe (organization, communication, judgment and persistence). Our longer term goal is to assess the strengths and limitations of the framework and explore possible refinements to it.

Conclusions

The value of Undergraduate Research (UR) programs is well established and their impact can be far-reaching for emerging student researchers. In this paper we sought to explore how undergraduate students perceived the development of creativity, specifically in relation to four dimensions of the concept provided by Showman et al. (2013) that are discrete, synergistic and developmental.

We found that students perceive the development of creativity in undergraduate research as a gradual and relational process. At first, many students felt unsure of themselves and saw creativity mainly in simple tasks like outlining projects or solving practical problems. Over time, however, students began to see creativity as a skill they could grow or develop with help from mentors, peers, and self-reflection. By the end of the program, several students saw creativity as transferable, shaping not only their research, but also how they tackled problems and grew personally. Students came to see creativity not as a fixed trait but as a skill that they could intentionally learn and develop through research.

Our study found that undergraduate students do, in fact, experience creativity in ways that resonate with Showman et al.'s (2013) framework. That said, their reflections also reveal both developmental nuances and conceptual gaps in that framework. Students often linked creativity with qualities like empathy, patience, and confidence, showing that creativity's boundaries are less clear-cut than the Showman et. al (2013) framework suggests. Their reflections also highlighted community- and context-based dimensions (such as designing parks or interventions with local needs in mind) that go beyond individual originality. By centering student voices, our study moves past theory to show how creativity actually takes shape in practice.

Our findings suggest that undergraduate research initiatives should introduce creativity to students as a skill they can develop, rather than as a fixed trait. Program features like reflection, mentorship, and sufficient program time play a key role in helping students build this capacity. Future studies should also test Showman et al.'s (2013) framework with larger and more diverse groups and they should also explore how culture, discipline, and environment influence creativity in research. Our broader goal is to develop a model of research skills that sees creativity as relational and context-driven, tied both to personal growth and community impact. Centering creativity in undergraduate research can make inquiry more equitable and prepare students for meaningful contributions beyond the university.

References

- Beghetto, R. A., & Kaufman, J. C. (2007). Toward a broader conception of creativity: A case for mini-c creativity. *Psychology of Aesthetics, Creativity, and the Arts*, 1(2), 73-79. <https://doi.org/10.1037/1931-3896.1.2.73>
- Beghetto, R. A., & Kaufman, J. C. (2014). Classroom contexts for creativity. *High Ability Studies*, 25(1), 53-69. <https://doi.org/10.1080/13598139.2014.905247>
- Brew, A. (2013). Understanding the scope of undergraduate research: A framework for curricular and pedagogical decision-making. *Higher Education*, 66(5), 603-618. <https://doi.org/10.1007/s10734-013-9624-x>
- Camacho, T. C., Vasquez-Salgado, Y., Chavira, G., Boyns, D., Appelrouth, S., Saetermoe, C., & Khachikian, C. (2021). Science identity among Latinx students in the biomedical sciences: The role of a critical race theory-informed undergraduate research experience. *CBE – Life Sciences Education*, 20(2), Article 23. <https://doi.org/10.1187/cbe.19-06-0124>
- Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187-1218. <https://doi.org/10.1002/tea.20237>
- Carpi, A., Ronan, D. M., Falconer, H. M., & Lents, N. H. (2017). Cultivating minority scientists: Undergraduate research increases self-efficacy and career ambitions for underrepresented students in STEM. *Journal of Research in Science Teaching*, 54(2), 169-194. <https://doi.org/10.1002/tea.21341>
- Chaplin, S. B., Manske, J. M., & Cruise, J. L. (1998). Introducing freshmen to investigative research – A course for biology majors at Minnesota’s University of St. Thomas. *Journal of College Science Teaching* 27(5), 347-350.
- Corazza, G. E. & Lubart, T. (2021). Intelligence and creativity: Mapping constructs on the space-time continuum. *Journal of Intelligence* 9(1), 1-27. <https://doi.org/10.3390/jintelligence9010001>
- Crawford, I., Orel, S., & Shanahan, J. O. (Eds.). (2014). How to get started in arts and humanities research with undergraduates. Council on Undergraduate Research.
- Cuevas, S. (2024). “I tell them generics, but not the specifics”: Exploring tensions underlying familial support for first-generation Latinx undergraduate students. *Education Sciences*, 14(6), Article 622. <https://doi.org/10.3390/educsci14060622>
- Hernandez, P. R., Schultz, P. W., Estrada, M., Woodcock, A., & Chance, R. C. (2013). Sustaining optimal motivation: A longitudinal analysis of interventions to broaden participation of underrepresented students in STEM. *Journal of Educational Psychology*, 105(1), 89-107. <https://doi.org/10.1037/a0029691>
- Hunter, A-B., Laursen, S. L., & Seymour, E. (2007). Becoming a scientist: The role of undergraduate research in students’ cognitive, personal, and professional development. *Science Education*, 91(1), 36-74. <https://doi.org/10.1002/sce.20173>

Hurtado, S., Cabrera, N. L., Lin, M. H., Arellano, L., & Espinosa, L. L. (2009). Diversifying science: Underrepresented student experiences in structured research programs. *Research in Higher Education*, 50(2), 189-214. <https://doi.org/10.1007/s11162-008-9114-7>

Ishiyama, J. (2002). Does early participation in undergraduate research benefit social science and humanities students? *College Student Journal*, 36(3), 380-386.

Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The four C model of creativity. *Review of General Psychology*, 13(1), 1-12. <https://doi.org/10.1037/a0013688>

Kistner, K., Sparck, E. M., Liu, A., Whang Sayson, H., Levis-Fitzgerald, M., & Arnold, W. (2021). Academic and professional preparedness: Outcomes of undergraduate research in the humanities, arts, and social sciences. *Scholarship and Practice of Undergraduate Research*, 4(4), 3-9. <https://doi.org/10.18833/spur/4/4/1>

Kuh, G. D. (2008). High-impact educational practices: What they are, who has access to them, and why they matter. Association of American Colleges and Universities.

Lopatto, D. (2007). Undergraduate research experiences support science career decisions and active learning. *CBE—Life Sciences Education*, 6(4), 297–306. <https://doi.org/10.1187/cbe.07-06-0039>

Madore, K. P., Addis, D. R., & Schacter, D. L. (2015). Creativity and memory: Effects of an episodic-specificity induction on divergent thinking. *Psychological Science*, 26(9), 1461-1468. <https://doi.org/10.1177/0956797615591863>

Osborn, Jeffrey M. & Kerry K. Karukstis. (2009). The benefits of undergraduate research, scholarship, and creative activity. In M. Boyd and J. Wesemann (Eds.), *Broadening participation in undergraduate research: Fostering excellence and enhancing the impact* (pp. 41-53). Council on Undergraduate Research.

Park, J. H., Niu, W., Cheng, L., & Allen, H. (2021). Fostering creativity and critical thinking in college: A cross-cultural investigation. *Frontiers in Psychology*, 12, Article 760351. <https://doi.org/10.3389/fpsyg.2021.760351>

Sawyer, R. K., & DeZutter, S. (2009). Distributed creativity: How collective creations emerge from collaboration. *Psychology of Aesthetics, Creativity, and the Arts*, 3(2), 81-92. <https://doi.org/10.1037/a0013282>

Sawyer, R. K., & Henriksen, D. (2024). *Explaining creativity: The science of human innovation* (3rd ed.). Oxford University Press.

Seymour, E., Hunter, A.-B., Laursen, S. L., & DeAntoni, T. (2004). Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science Education*, 88(4), 493-534. <https://doi.org/10.1002/sce.10131>

Showman, A., Cat, L.A., Cook, J., Hollway, N., Wittman, T. (2013). Five essential skills for every undergraduate researcher. *Council for Undergraduate Research (CUR): Focus*, 33(3), 16-20.

Summers, M., Fernandez, J., Handy-Hart, C. J., Kulle, S., & Flanagan, K. (2024). Undergraduate students develop questioning, creativity, and collaboration skills by using the question formulation

technique. *Canadian Journal for the Scholarship of Teaching and Learning*, 15(2), Article 7.
<https://doi.org/10.5206/cjsotlrcacea.2024.2.15519>

Su-Russell, C., Hendricks, M., & Arellanes, J. A. (2024). Latinx college students in a PWI: Perceptions of inclusion, diversity, equity, and access (IDEA), basic psychological needs satisfaction, and access to mentorship. *Journal of Underrepresented & Minority Progress*, 8(SI2), 26-49. <https://ojed.org/jump/article/view/6213>

Toven-Lindsey, B., Sparck, E. M., Kistner, K., Ardam, J., & Arnold, W. (2023). Undergraduate research in humanities, arts, and social sciences: Helping students navigate uncertainty and build community through a structured cohort-based program. *Scholarship and Practice of Undergraduate Research*, 7(2), 15-24. <https://doi.org/10.18833/spur/7/2/2>

APPENDIX A: STUDENT RESEARCHER WEEKLY REPORT TEMPLATE

Please be thoughtful and specific in your responses. The report is **for you** — it is an opportunity to claim your progress and growth and identify your next steps.

1. Mentor-Researcher Interactions: How did you interact with your faculty mentor this week? How did you meet, communicate; how often? Discuss how your interaction supported you and how it could support you better. It is OK to note anything that is not working well, and celebrate what is working wonderfully.
2. Summary of Activity: What did you work on this week? Note the kinds of things you did, and anything that was new. Think about the activity you did that was your own as well as discussed by you and your mentor. Be specific to fully claim and anchor your learning.
3. Self-Assessment of Progress: Reflect on and briefly discuss your learning (elevate as if in a hot air balloon). Also discuss how you are demonstrating growing mastery with the five essential skills for undergraduate researchers. What additional skill(s) do you also see yourself developing or expanding? Share about 3 sentences addressing each skill, including the additional skill(s) you see.
4. Next Steps: Looking to the next week, what are your next steps? These are the ones you discuss with your mentor, as well as the things you see as important for yourself.
5. Issues: Note anything that came up as a challenge for you this week and your ideas about how to address the challenge. This is a time when you can ask questions and/or request support as well.

APPENDIX B: STUDENT RESEARCH PROJECTS

Student Researcher 1 created a short historical film designed to honor the founders of the university.

Student Researcher 2, Researcher 4 and Researcher 8 participated in a community-based healthcare policy group project. The team conducted a population and health resources survey of the downtown area surrounding the university campus using SparkMaps.

Student Researcher 3 created a website with spirituality-in-the-workplace resources for human resource and other professionals.

Student Researcher 5 worked on a project learning a complex polyrhythmic African piece, Circle Atsia.

Student Researcher 6 explored comparative surrogacy and the different laws and cultural understandings that govern the relationships between hopeful parents and surrogates.

Student Researcher 7 created and administered a survey of undergraduate Generation Z students to assess financial literacy, specifically retirement planning skills for first-generation students of color.

Student Researcher 9 focused on a community-based project to serve an under-resourced urban public park in her community.