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How Science Teacher Educators Reconceptualize Writing Within Their Curriculum: A Self-Study

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ABSTRACT

In this self-study, faculty in a UTeach model teacher preparation program engaged in the process of purposefully designing writing assignments and experiences for preservice teachers majoring in science disciplines. Following an iterative curriculum design process, we designed, tested, and redesigned curricular interventions to improve AUTeach students' experiences so that writing is used effectively to learn, reflect, and develop stronger identities as teachers and scientists. This study involved self-reflection as well as scaffolding writing assignments across all program courses. Authors are in the process of implementing the new writing curricula and anticipate building a robust dataset through an analysis of student writing artifacts to demonstrate the impact of writing across the curriculum in STEM teacher preparation.

Keywords: self-study, teacher preparation, writing across the curriculum

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INTRODUCTION

In the spring of 2023, faculty from the College of Education and the College of Sciences and Mathematics at Auburn University collaborated to design and create a new science teacher education program - AUTeach. Building a new academic program that joined seemingly disparate academic disciplines across two colleges created challenges and opportunities in developing our program identity. The AUTeach faculty members felt that it was critical to intentionally design a curriculum that helped students form a community across their different science disciplines, develop shared values, and forge a sense of belonging as both scientists and future science teachers. In addition to community-building activities and an intentional focus on putting students at the center of the program, the AUTeach faculty chose to emphasize writing in existing and newly developed classes.

The new program, AUTeach, was funded by the Alabama Commission on Higher Education and is modeled after the popular UTeach program, which was created by the University of Texas, Austin, over 25 years ago and has since been replicated at over 50 universities across the U.S. AUTeach gives students who are majoring in a science discipline such as physics, chemistry, or biomedical sciences the opportunity to take education classes, practice teaching in local schools, and graduate with a bachelor's degree in their chosen science field as well as a double major in science teaching, certified to teach secondary science.

Writing is a means of learning and creating new knowledge and a means of sharing that knowledge with others (Adler-Kassner & Wardle, 2022) and is recognized as a high-impact educational practice. High-impact educational practices (HIPs) are a collection of activities and teaching methods that are known to increase learning outcomes such as skills, knowledge, ethics, and civic engagement (Kuh, 2008). Therefore, the authors, faculty in the AUTeach program and the director of Auburn University Writing, embarked upon a semester-long collaboration to cocreate a unified approach to Writing Across the Curriculum (WAC) for the new teacher preparation program at Auburn University, AUTeach, with the goal of improving learning outcomes for students. University Writing is a comprehensive writing center and WAC program located in Auburn University's Office of the Provost and is directed by coauthor Basgier. Established in 2010, University Writing's mission is to support students as thinkers and communicators by helping them become better writers (by writing center and graduate support programs) and to extend their reach by partnering with faculty who teach high-impact, discipline specific, writing-enriched courses and curricula.

LITERATURE REVIEW

Writing Across the Curriculum

WAC is an educational reform movement (Russell, 2002) devoted to the idea that 1) writing can be a means of learning (Emig, 1977), 2) effective writing assignments are a high-impact practice that can lead to student success (Anderson et al., 2016), and 3) writing instruction is a shared responsibility for faculty across all disciplines (Anson, 2015). A robust body of scholarship spanning some 50 years undergirds the field (see Palmquist et al., 2020; see also Russell, 2002, for a comprehensive history of writing in the disciplines). A robust set of peer reviewed journals and a professional organization (the Association for Writing Across the Curriculum) provide homes for scholarly exchange and professional development.

At the institutional level, most WAC programs offer some form of professional development (i.e., workshops) for faculty who wish to teach writing as a mode of learning, engagement, and/or communication (Palmquist, 2020). A recent set of scholarship maintains that WAC professional development opportunities work best when they extend over time (as opposed to one-off events) and when they focus on helping disciplinary teams of faculty make explicit their often-implicit expertise about the purposes and forms of writing in the field (Adler-Kassner & Wardle, 2022; Flash, 2016; Flash, 2021; Glotfelter et al., 2020; Glotfelter et al., 2022). University Writing has adapted this approach to faculty professional development in its WAC Academy workshop series.

Self-Studies in Teacher Education

In the field of teacher education, it is critical to study how and why we develop and implement a new curriculum as well as the impact of implementing the new curriculum. Self-studies are a common approach for gaining insight and validating these efforts. The characteristics of self-studies are that they are self-initiated, interactive, and qualitative, with the goal of improving something (LaBoskey, 2004). Self-studies that focus on teacher education have great potential not only for reforming teaching practices but also for entire program reform (Korthagen & Lunenberg, 2024), with numerous studies detailing struggles and successes (e.g., Smith & Krumsvik, 2007; Freese, 2006; Koster & van den Berg, 2017.) Self-studies focus on thinking critically about existing educational practices and using the learners, the students in the program, as a “mirror” to show the investigators how their studies and subsequent reforms have resulted in change (Hauge, 2021).

RESEARCH METHOD

The authors embarked on a self-study in the spring of 2024 with the goal of improving outcomes for Auburn University students through a focus on writing across the curriculum. They attended five two-hour, face-to-face sessions in which they named the contexts, purposes, and genres of writing in the field of science teaching; identified salient, field-specific expectations for writing (lesson plans, teaching reflections, portfolios); composed writing-focused student learning outcomes; mapped outcomes and assignments across the degree program; learned the elements of successful writing assignment prompt design (Anderson et al., 2016; Winkelmes, 2013; Bean & Melzer, 2021); and planned for the redesign of rubrics and other assessments of student work products.

Positionality

The participants in this self-study were three faculty members who attended the WAC Academy workshop series with the University Writing director and coauthor Basgier. Stephanie Shepherd, one of the two founding codirectors of AUTeach, is an associate professor in the Department of Geosciences whose research focuses on improving postsecondary STEM education. Shepherd has been actively involved in faculty professional development at Auburn, with a focus on active and inclusive learning. Christine Schnittka, also one of the two codirectors of AUTeach, is the Emily R. and Gerald S. Leischuck Professor for Critical Needs in Education, Emerita, and Professor in the Department of Curriculum and Teaching. Her research focuses on the impact of making traditional crafts and engaging in engineering design on science learning for middle school youth. Schnittka is dedicated to quality teacher preparation, and after a decade of middle school teaching, she devoted her career in academia to high-quality programming for preservice science teachers. Matthew McVay is a graduate at Auburn University with BS and MS degrees in Marine Biology. After an alternative route to teacher licensure, McVay taught biology at the high school and community college levels for five years before returning to Auburn as a clinical faculty member in the AUTeach program.

Study Context

AUTeach at Auburn University is targeted to COSAM students in biology, biomedical sciences, chemistry, geoscience, and physics. Students who complete the program receive a double major in their science discipline and science teaching with certification to teach secondary biology, chemistry, physics, or general science. Auburn University is a

Carnegie Research 1 land grant institution and the second largest university in the state of Alabama.

AUTeach is one of seven UTeach programs across the state of Alabama, funded by the Alabama Commission on Higher Education as a strategy to address the lack of qualified STEM teachers in public schools throughout the state (Alabama STEM Council, 2024). STEM secondary and high school teachers play a crucial role in enhancing science literacy and preparing students for STEM careers. Moreover, perceptions of teaching professionally have declined in recent years (Peetz, 2022). Therefore, the AUTeach program is responsible for helping university students who love science and choose science as a major, seeing teaching as a valuable and rewarding career, and developing the knowledge and skills necessary to become excellent science teachers.

Research Questions

In the first few WAC Academy meetings, we discussed our understanding of writing and explored the different genres of writing required within our respective disciplines. We used this exploration to draft a thick description of writing expectations with our program, leading to our first research question: What are the types of writing in which the students in our program participate? As we continued through the program, we engaged in robust conversations about the value of writing as a high-impact teaching practice and discussed how to design effective writing assignments. After the WAC Academy concluded, we were determined to apply what they learned into reimagining and revising existing and new courses in the program, prompting our second research question: How can writing be enhanced, improved, and elevated within our classes to improve learning outcomes?

Data Sources and Analysis

During the WAC Academy, we drafted a curriculum map, identifying which courses incorporated specific types of writing. We collected example writing assignments from the AUTeach course progression. These documents, combined with personal reflections on our own teaching practices, personal reflections on lessons learned at the WAC Academy, and artifacts demonstrating how change is occurring in an ongoing manner as lessons learned are applied, were utilized for analysis.

RESULTS

In what follows, we describe the AUTeach faculty's experiences in the WAC Academy in spring 2024 and describe how those experiences have been translated into changes, innovations, and new applications in the AUTeach curriculum.

Research Question 1

What are the types of writing in which the students in our program participate?

The WAC Academy helped us (the AUTeach faculty) discover that writing plays a more significant role in our courses than we previously thought. We identified all the genres of writing that our students, preservice teachers, engage in, from lesson plans to reflections to peer evaluations. We focused on lesson plans as a key professional writing act, and discussed the problems our students traditionally have with composing them. We also identified reflective writing as a key component of field placements courses and discussed how reflective writing could be more impactful, as students make sense of their teaching experiences and build their identities as science teachers.

We learned about and discussed the use of writing as a means of engagement and deeper learning for our students. The WAC Academy helped us understand high-impact practices, create meaningful assignments, develop a shared language about writing genres, and incorporate inclusive language, leading to new perspectives on developing assignments and enhancing student understanding and confidence. For some of us, this was our first experience with collaborative curriculum refinement, working to align and refine our curriculum and apply research-based best practices for writing. The WAC Academy fostered open discussion and mutual learning about writing practices, helping us integrate content across our courses that we now reflect upon when creating assignments and syllabi. At the end of the WAC Academy, we developed a unifying statement on writing:

> The primary goal of writing in the AUTeach program is for students to develop well-written, engaging lesson plans and to reflect on and put into action their knowledge of science and teaching. We approach writing as a creative process where our students will apply the discipline-based rules of writing within the genres of science and teaching. We believe writing should be an educative process, not merely a means of assessment or communication. Through various course assignments,

> our students will engage with writing in a way that demonstrates a broader set of values, including caring for students and building relationships with them. Thorough lesson plans, reflections of teaching, and short summaries of scientific information and data (e.g., abstracts) are the primary writing products AUTeach students will produce throughout their academic experience. These writing genres will also carry over into students' professional lives after graduation because writing provides an opportunity for our students to develop their identity as both a scientist and a teacher. Through writing assignments in our courses, all students will practice communicating scientific concepts and ideas to different audiences in ways that are consequential in the world.

Research Question 2

How can writing be enhanced, improved, and elevated within our classes to improve learning outcomes?

The AUTeach program consists of eight courses plus a semester of student teaching, and we are responsible for teaching six of these courses. Four courses existed prior to our participation in the WAC Academy, and two were taught this year for the first time. This gives us the unique opportunity to revise existing and create new course materials aligned with the principles we learned in the workshop. The primary principles we use to design/redesign our courses are as follows: the 6Rs of reflection, elements of effective assessment design, peer reviews, and examining asset-based language.

The 6Rs of Reflection

The 6Rs of Reflection, Reporting, Responding, Relating, Reasoning, Reconstructing, and Repackaging are based on the work of Bain, et al., (2002), who created the mnemonic for the first 5Rs of Reflection and authored the book Reflecting on Practice: Student Teachers' Perspectives. In their book, the authors outline practices to enhance reflective thinking and writing among student teachers. Instead of a written reflection that merely recounts or retells an experience, they propose methods to encourage preservice teachers to engage in a more nuanced type of reflection. In addition to a description of the event or experience, students are asked to write about their emotional reactions, relate the current event to their own past, explain or interrogate it, and draw a conclusion or plan a future action. The sixth R, repackaging, asks the student to condense or reframe their reflection for a different audience

without losing the depth of the emotional and analytical work. We revised assignments in several of our classes based on the 6Rs.

After you complete each module, write about any new skills you learned (Reporting), what you found challenging about the new skills (Responding), and three ways you might use what you learned with your future students (Relating).

We hope that by adding this reflective assignment, students would become better prepared for the exam but also think about how they could apply what they learned to their teaching.

Our science methods course requires students to complete a journal reflection at the end of each week spent in a school placement. In the past, the journal prompts each week were composed of an assortment of general questions, which were revised according to the 6Rs of Reflection (Table 1).

Table 1 Changes in writing prompts for journal entries

Before WAC	After WAC
What is going well?	Describe what happened this week while you were in your school placement, in enough detail so that we can visualize your being there.
What are you still struggling with?	What were your emotions like during your experience? Think about your teaching or interactions with students and teachers and write about how you plan to modify or change things for next week.
What are you still struggling with?	What help do you need to positively enact your plan for change? Do you need resources to read or someone to talk with? Write about what your needs are.
What are you still struggling with?	Think about one issue or detail from your week in your school placement and write about why it stands out for you. What would be a different way of looking at that issue or detail? If you were a fly on the wall, what would you see? If you were a scientist, what would you see? If you were a psychologist, what would you see?

What are you still struggling with?	What is your plan for next week's school placement? How has your reflection on this week helped you plan for the future?
Where have you seen your teaching improve?	Sum up your week in one sentence!

Our educational technology course requires students to complete six Google Educator modules to prepare for the Google Educator Exam. In the past, students only had to provide evidence that they had completed each module and passed the exam at the end of the semester. We added a reflective piece aligned with three of the 6Rs, which will be used this year for the first time.

Elements of Effective Assignment Design

In the WAC Workshop, we learned the importance of the following elements when assessing our students: student choice, future applications, statement of purpose, task outline, criteria for success, and examples of exemplary work.

Student assessments take place during every weekly assignment, during every lab placement in a school, and during formal exams. We modified weekly assignments so that each would include most, if not all, of the elements listed above. For example, an assignment in the educational technology class asked students to create an online test about a science topic. Previously, the instructions for this assignment were basic.

Our modified assignment prompt includes a statement of purpose, student choice, a task outline, and linked exemplary work (Table 2).

Table 2. Instructions for test assignment before and after WAC

Before WAC	After WAC
You need to create a 10 item test on a science topic of your choice. You will put your test on Google Forms and create a link to the test. Here, I want you to upload your link so I can check over it before you send it out.	*Purpose*: Later in the semester, you are going to learn how to use Excel to analyze test data. You will do much more than compute averages, you'll be able to calculate item difficulty and discrimination values. However, I want you to be able to analyze your **own** test data so that it's more interesting for you. Therefore, the

You will end up with an Excel spreadsheet full of data, and you will use that data in class for a project.	purpose of this assignment is to make a test that you can administer. *Task Outline*: Read this advice from Brame (2013) on creating test questions. Create a 10-item test on a science topic of your choice. Put your test on Google Forms and create a link to the test. Make each question on your test multiple choice with 4 options. *Examples*: Here is an example of an exemplary test.

Peer Reviews

We have initiated peer review with peer-review protocols in lesson plans that our preservice teachers write. We first modeled this for our students, taught them how to use criteria, justified the inclusion of peer review, and connected it to their future work as teachers.

Asset-based language

Finally, we are continuing to look through all our course materials for evidence of language that does not celebrate our students' assets but instead highlights their limitations. For example, the initial instructions in Module 1 of our educational technology class were "Come to class on time. Bring a laptop computer." This was revised to:

> *Class begins promptly at 6:00pm and ends at 7:50pm. Try to arrive a few minutes early to get settled. Please let the instructor know ahead of time if you will be late. The first few minutes of class are often crucial with announcements and instructions. We only get an hour and 50 minutes a week together, so let's make the most of it! Bring a laptop computer if you can. If this is not possible, let your instructor know ahead of time, as we may be able to check one out from the Learning Resources Center for you. I'm looking forward to meeting you all and working together this semester.*

We wanted this revised introduction to help all students understand that we value their presence but are willing to discuss impediments to punctuality. Additionally, we want students to know that not having a laptop computer will not be a hindrance, as we will help them find a solution.

FUTURE DIRECTIONS

The process of revising and creating course materials aligned with the principles we learned at the WAC Academy will take some time, but we have taken the first step: revising all the course materials in our educational technology class and planning to revise the materials in the remaining courses. We are excited for the shared language we can use as we work together, the shared mission that writing is an educative process, and the shared commitment to helping our students write lesson plans, reflections, and other course assignments so that these acts are not merely communication from student to teacher but rather processes that help them grow and develop as teachers.

REFERENCES

Adler-Kassner, L., & Wardle, E. A. (2022). *Writing expertise: A research-based approach to writing and learning across disciplines*. WAC Clearinghouse.

Alabama STEM Council. (2024, July). *UTeach in Alabama: Combating Alabama's STEM teacher shortage*. https://stemcouncil.alabama.gov/uteach-in-alabama/

Anderson, P., Anson, C. M., Gonyea, R. M., & Paine, C. (2016). How to create high-impact writing assignments that enhance learning and development and reinvigorate WAC/WID programs: What almost 72,000 undergraduates taught us. *Across the Disciplines, 13*(4), 13–25.

Anson, C. (2015). Crossing thresholds. In L. Adler-Kassner & E. Wardle (Eds.), *Naming what we know: Threshold concepts of writing studies* (pp. 203–219). WAC Clearinghouse.

Bain, J. D., Ballantyne, R., Mills, C., & Lester, N. C. (2002). *Reflecting on practice: Student teachers' perspectives*. https://www.researchgate.net/publication/43505901

Bean, J. C., & Melzer, D. (2021). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom* (3rd ed.). John Wiley & Sons.

Brame, C. (2013). Writing good multiple choice test questions. *Center for Teaching, Vanderbilt University*. https://cft.vanderbilt.edu/guides-sub-pages/writing-good-multiple-choice-test-questions/

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences, 2*(2), 141–178.

Collins, A. (1992). Toward a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15–22). Springer Berlin Heidelberg.

Emig, J. (1977). Writing as a mode of learning. *College Composition and Communication, 28*(2), 122128.

Flash, P. (2016). From apprised to revised. In K. Yancey (Ed.), *A rhetoric of reflection* (pp. 227–249). Utah State University Press.

Flash, P. (2021). Writing-enriched curriculum: A model for making and sustaining change. In P. Flash, M. Hall, & S. L. Robertson (Eds.), *Writing-enriched curricula: Models of faculty-driven and departmental transformation* (pp. 17–44). https://doi.org/10.37514/PER-B.2021.1299.2.01

Freese, A. R. (2006). Reframing one's teaching: Discovering our teacher selves through reflection and inquiry. *Teaching and Teacher Education, 22*(1), 100–119.

Glotfelter, A., Updike, A., & Wardle, E. (2020). Something invisible... has been made visible for me: An expertise-based WAC seminar model grounded in theory and (cross) disciplinary dialogue. In K. M. M. Lotocky & T. R. Miller (Eds.), *Diverse approaches to teaching, learning, and writing across the curriculum: IWAC at 2* (pp. 199–214). WAC Clearinghouse.

Glotfelter, A., Martin, C., Olejnik, M., Updike, A., & Wardle, E. (Eds.). (2022). *Changing conceptions, changing practices: Innovating teaching across disciplines*. University Press of Colorado.

Hauge, K. (2021). Self-study research: Challenges and opportunities in teacher education. In C. D. Dalton (Ed.), *Teacher education in the 21st century—Emerging skills for a changing world* (pp. 1–18). IntechOpen.

Korthagen, F., & Lunenberg, M. (2004). Links between self-study and teacher education reform. In J. J. Loughran, M. L. Hamilton, V. K. LaBoskey, & T. Russell (Eds.), *International handbook of self-study of teaching and teacher education practices* (Vol. 12, pp. 421–449). Springer. https://doi.org/10.1007/978-1-4020-6545-3_11

Koster, B., & van den Berg, B. (2014). Increasing professional self-understanding: Self-study research by teachers with help of biography, core reflection, and dialogue. *Studying Teacher Education, 10*(1), 86–100.

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.

LaBoskey, V. K. (2004). The methodology of self-study and its theoretical underpinnings. In J. J. Loughran, M. L. Hamilton, V.

K. LaBoskey, & T. Russell (Eds.), *International handbook of self-study of teaching and teacher education practices* (pp. 817–869). Springer.
Palmquist, M. (2020). A middle way for WAC: Writing to engage. *WAC Journal, 31*, 7–20. https://doi.org/10.37514/WAC-J.2020.31.1.01
Palmquist, M., Childers, P., Maimon, E., Mullin, J., Rice, R., Russell, A., & Russell, D. R. (2020). Fifty years of WAC: Where have we been? Where are we going? *Across the Disciplines, 17*(3–4), 5–45. https://doi.org/10.37514/ATD-J.2020.17.3.01
Peetz, C. (2022, November). The status of the teaching profession is at a 50-year low. What can we do about it? *Education Week*. https://www.edweek.org/teaching-learning/the-status-of-the-teaching-profession-is-at-a-50-year-low-what-can-we-do-about-it/2022/11
Russell, D. R. (2002). *Writing in the academic disciplines: A curricular history* (2nd ed.). Southern Illinois University Press.
Smith, K., & Krumsvik, R. (2007). Video-papers—A means for documenting practitioners' reflections on practical experiences: The story of two teacher educators. *Research in Comparative and International Education, 2*(4), 272–282.
Winkelmes, M. (2013). Transparency in teaching: Faculty share data and improve students' learning. *Liberal Education, 99*(2), Article n2.

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Note:

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