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Cover Page Footnote
We gratefully acknowledge the students who have allowed us to share their automathographies to a larger audience.

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The Automathography: A Humanistic Autobiographical Writing Assignment for Mathematics Courses

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Abstract

In this article, we discuss an autobiographical writing assignment that we call an “automathography” which can be used in different types of mathematics and mathematics education courses, and by extension, in other disciplines as well. This assignment can enhance student-instructor interactions, develop student communication skills, and provide outlets for student creativity by leveraging the lived experiences of students. We have deployed the assignment in different kinds of classes (general education [service] courses and major-only seminars) at different kinds of institutions (a private, open-admission, large university on the East Coast and a private, highly selective, small liberal arts college on the West Coast). We argue that the automathography can be used in both lower- and upper-level courses as a way of encouraging others to develop similar assignments and gain the benefits to instructors and their students associated with the use of a powerful pedagogical tool.

Keywords: automathography; mathematical autobiography; writing in STEM; creativity; humanistic classrooms; mathematical assignments.
1. Introduction

Students who take a class because it satisfies a requirement and not because of an inherent interest in the subject matter are often less engaged in the course material [1, 22]. To help increase student interest in a class, an instructor can do several things, two of which are (1) to understand what goals their students have for the course and (2) be informed about students’ background and prior experience with the course material. In this article, we discuss an example of an assignment that can be used to engage students in required mathematics courses at both entry and advanced mathematical levels. We use the term “automathography” to describe this assignment since it is both autobiographical and mathematical; the word is a portmanteau of “autobiography” and “mathematics.” We note that we are not the first in the mathematics community to use the term (see for example Halmos in [11]) and that many instructors use some kind of “getting-to-know-you” assignment in the early stages of courses.

The automathography has the ability to span both course level and major: Students need not be STEM (science, technology, engineering, and mathematics) majors to successfully complete an automathography, nor need they have a large amount of credits in mathematics courses. In fact, the automathography administered in different course levels—satisfying service and major requirements—can generate similar outcomes for student expression, communication, and creativity.

STEM majors, and in particular, mathematics majors, tend to have an inherent impression that they can succeed in mathematics, even if only through their choice of major. However, these students still might need practice in effective communication. In contrast, students who take mathematics service courses are likely to be students who are not majors in STEM. Instead, they may major in the arts, humanities, or social sciences and may not believe that they can be good at, like, or succeed in mathematics courses. The primary reason we use the automathography assignment with both student populations is because we believe it can highlight and enhance any student’s ability to communicate and be creative—abilities and activities students typically do not associate with mathematics courses. The automathography also provides humanistic insight into our students and their prior experiences engaged in learning and doing mathematics in order to help design a more inclusive and equitable learning environment.
At the time of writing, the authors were associate (Sawyer, CWS) and full (Buckmire, RB) professors of mathematics, albeit at very different kinds of institutions (a private, open-admission, large university on the East Coast and a private, highly selective, small liberal arts college on the West Coast). We note our versions of the automathography assignment were independently created and implemented for differing course levels, albeit for similar reasons. In this article, we discuss (1) the flexibility of an automathography for various courses and levels of students; (2) how different versions of the assignment can achieve multiple purposes; and (3) why the development of stronger humanistic relationships with students can benefit both the classroom environment and self-perceived success by students in the course.

2. The Premise of an Automathography

A mathematical autobiography, loosely consisting of “personally meaningful episodes, important persons, explanations, and the development of one’s beliefs of learning and teaching mathematics” [16, page 374], is not a new concept [10], nor is the use of this assignment in the classroom [4, 15, 31]. For such assignments, students are asked to reflect on their experiences with mathematics and, for some versions, what they hope or expect to get out of a course. Often, these assignments are given to pre-service teachers [16, 20], with most literature on mathematical autobiographies reflecting this population [26]. An increasing amount of literature discusses the use of a mathematical autobiography for general classroom use [5, 13, 20, 24, 26, 28]. Some authors frame the assignment as a “therapy” exercise [24] where reflections are meant to help students move beyond anxiety about mathematics to a more positive experience by the end of the course. For a summary of recent literature on the use of autobiographies in mathematics courses, see [26].

The advantages of using an automathography are threefold: It is flexible enough that it can be deployed in many different course types (e.g., service or major-specific); it requires little, if any, understanding of mathematical concepts so that it can be assigned at any point during a course but especially the beginning weeks; and the purpose of the automathography can be tailored to the needs of the instructor, students, or course. Each of these advantages will be discussed in the following sections.
2.1. Flexibility of an Automathography to Course Type

The first benefit of an automathography is its applicability to a variety of course types. These can range from pre-service teaching and service courses to mathematics major-specific classes. The following subsections discuss the authors’ experiences with developing versions of the automathography for service and major-specific courses.

2.1.1. Mathematics Major-Specific Courses

RB has often deployed the automathography assignment in classes that are primarily taken by students who are declared mathematics majors. These courses include the seminars for junior and senior majors where acculturation to math-specific practices (such as learning how to typeset mathematics papers in the $\LaTeX$ language, being exposed to expectations for oral presentations, and review of fundamental mathematical concepts) occurs. In this context, the automathography assignment provides the instructor with information not only about the prior experience of students in mathematics classes taken in college but also about even earlier formative encounters with mathematics.

For example, in the junior colloquium course, demonstrating the ability to communicate mathematical concepts in oral and written form is an explicit student learning outcome. The automathography assignment in the junior seminar course has a dual function: It is one way for students to satisfy this communication-based student learning outcome, and it can also serve as a means to meet the expectation that CWS and RB share for the automathography assignment to be an outlet for creative expression and as a medium for information exchange between instructor and student about the student’s mathematical background.

Specifically, the version of the automathography assignment in RB’s class not only asks the student to recount their “mathematical autobiography” briefly, but to also describe a mathematical concept of their choosing that they have a positive association with; see Figure 1 for a sample assignment. There are ten questions that the assignment suggests that students consider when they are writing their response to the prompt for the automathography:

1. What is your favorite mathematical topic and why?
2. What is your favorite mathematical class and why?
3. What are your best and worst experiences with math?

4. (Why) do you like math more than other subjects?

5. Why did you become a math major?

6. (How) were you influenced to become a math major?

7. How do you plan to use math in the future?
8. How has math benefited you?

9. What was your first memorable experience with mathematics?

10. In what ways do you think math is important to the world?

Note, most of these questions do not specify the level of mathematics the student should be thinking about when crafting their response. This is a specific choice made by RB in order to give the students more agency in how they write their automathography. The primary purpose of the questions is to provide students with guidance on what kinds of topics and ideas should be included in their automathography—for most students this is their first time writing a document like this in a mathematics class.

About half of the questions (numbered 4, 5, 6, 7, 8 and 10) are metacognitive and self-reflective in nature; they are aimed at encouraging the students to think about their current status as mathematics majors and to help them consider and articulate their relationship with mathematics. Although the overall goal of the mathematics major-specific version of the automathography assignment is to enhance the communication skills of the students, it also provides a way for the student to communicate their prior experience with mathematics in a creative way. For RB, the major-specific version of the automathography is graded using a rubric that emphasizes that this assignment is, at its heart, a writing assignment: The rubric includes categories for biographical content, mathematical content, sources and argument, writing mechanics, and overall written communication; see Figure 2.

2.1.2. General Education Service Courses

In contrast to RB’s focus on written communication in major-level seminar courses, CWS centered his assignment on creative expression by students taking a mathematics course to satisfy general education requirements. One of these courses, referred to here as “Math for Liberal Arts” (MLA) is a common type of service course across a variety of institutional types, where higher-level mathematics are presented to non-mathematics majors at an accessible level.

At CWS’s institution, this course is typically taken by first- or second-year students; however, it is not uncommon to see juniors and seniors who have put off satisfying their general education mathematics requirement to enroll in MLA. One commonality among students in MLA is the propensity to be
pursuing degree programs radically different from mathematics (e.g., Communications, Justice Studies, or Graphic Arts). These MLA students don’t necessarily dislike mathematics, although there tends to be a larger proportion of students who struggle with their self-confidence in mathematics in this course versus other service courses (e.g., Precalculus or Statistics). Anecdotally, MLA students seem to be more likely to express thoughts artistically, or at the very least, are interested in submitting assessments in forms other than a written assignment. To allow for this creativity in expression and to better understand any creative submissions CWS’s automathography contains two

![Figure 2: A sample rubric for an automathography assignment RB uses in his classes.](image)
distinct components differing from RB’s assignment and other versions discussed in the literature: The option to submit the assignment in any creative form (e.g., a poem, collage, or video) and a required fifteen-minute individual meeting with the instructor to discuss the student’s submission; see Figure 3 below for a version of the automathography assignment CWS uses.

Figure 3: handout describing an automathography assignment CWS uses in his classes

Note that to further understand—and have students again self-reflect on mathematical experiences—this particular assignment included a “second chapter” where students discuss (again, in any creative medium) how the
The Automathography

course influenced their impression of mathematics and aspects of their own understanding of self. This idea of the end-of-the-semester component has appeared in various versions of mathematical autobiographies as a way of summarizing and validating individual creative thinking around mathematics [5, 8, 24].

The prompts for CWS’s automathography are less prescribed than in RB’s version of the assignment:

1. Express your historical experience with and your initial reaction to mathematics;
2. Highlight key moments in your mathematical background; and
3. Discuss your hopes for the course.

The fifteen-minute meeting allows for the instructor to better understand the student’s submission, but also for a holistic understanding of the student. Invariably, a conversation about mathematics will demonstrably bring up emotions in the student—especially if they self-identify as math-adverse. By having individual meetings, the instructor can address fears, concerns, and hopes for the student in a personal environment. The second chapter, with prompts similar to those found in [5], asks students to articulate six discoveries or realizations—not necessarily related to mathematics—from the class that may have long-term personal or professional impact. The act of reflection can help students realize any change of attitude toward mathematics as well as the development of skills related to their experience [2].

All portions of the automathography assignment CWS uses are only graded on completion of the assigned components, presenting a low-stakes environment for these non-STEM students to express themselves and explore their relationship with mathematics. A sample rubric can be seen in Figure 4.

We note here the different evaluation modalities deployed by RB (a point-based rubric) and CWS (task completion) in the successful implementation of the automathography assignment is another example demonstrating its flexibility and utility as a pedagogical tool to engage students.
2.2. Developing communication abilities for math-adverse and STEM students

Communication is frequently included in almost any compilation of learning outcomes that schools, colleges, and universities ensure that all students have by the time they complete their education. This expectation applies to students who take courses in STEM disciplines. In [5] Braun makes a convincing argument in favor of using writing assignments to enhance student learning in mathematics courses. Braun believes that “writing can help students develop a sense of committed ownership of mathematics” [5].
Students with varying degrees of mathematical comfort often include expressions of emotion (positive, neutral, and/or negative) in their mathematical autobiographies [12, 13, 26]. This can lead to various degrees of self-perceptions about future success in courses [13]; however, by encouraging students to discuss their feelings toward mathematics with peers or instructors, students may feel validated in their experiences, whether positive or negative [24]. Utilization of prompts in the automathography (e.g., “discuss several key memories that have shaped your impression of mathematics”) can guide these conversations, as can individual meetings with students. Through having students elucidate their thoughts in a written or creative fashion, they can discover hidden or underlying feelings about mathematics, develop perspective on their and others’ experiences, and open themselves to new experiences in mathematics [5, 13].

2.3. Developing intuition about classroom dynamics through instructor-student relationships and encouraging metacognition by students

A tertiary purpose for the automathography is the development of humanistic relationships between the instructor and student. Recollection of memories may help in mitigating or understanding past experiences, and packaging these memories in specific formats may help the accompanying stress to be dealt with more efficiently [13]. Mathematical autobiographies have shown time and again the importance of an instructor on a student’s perception toward mathematics at all educational levels [3, 14, 20, 23] and, in particular, STEM fields [7]. Students who developed positive relationships with mathematics instructors typically displayed more positive reactions toward mathematics [20] and other STEM majors [27]. Understanding students’ various anxieties and stresses early in the term can help establish an “educational alliance” between the student and instructor [21]. Establishing such relationships can also foster greater success for the student in multiple academic settings (see [9, 19]). Students who participate in various group academic experiences where their humanity is acknowledged can also produce more meaningful bonds with other students [29].

Multiple fields outside of mathematics have discussed the “magic” of an out-of-class meeting with students [25, 30]. This rapport between instructor and student helps to build a foundation of trust for the student, and in some cases, is correlated with success in long-term goals [6]. In the mathematics classroom, the teacher-student relationship was shown to affect student self-
efficacy, the confidence an individual has in their capacity to achieve performance measures [32]. For pre-service teachers, utilization of an automathography can create humanizing spaces for the next generation of students [17].

Another rationale for using the automathography assignment, especially in the very beginning of a semester, is that it can serve “the purpose of creating a student-centered focus for the course” [5]. For this purpose, Braun [5] believes that an integral part of the assignment is having the students read very short excerpts (one or two sentences) from their automathography assignment while seated in a semicircular or circular seating arrangement facing each other because it “encourages students to view each other as peers rather than as strangers in a room listening to a lecture.” The adaptation of CWS’s assignment to have the meeting between the instructor and student allows for a similar goal, but on a more private level.

In addition to demonstrating to the students that they will be treated as humans bringing individualized experiences with mathematics into the classroom, the automathography also encourages metacognitive reflection by the students (cf. [18]). It does so by having the students think about and evaluate the highlights and lowlights of previous encounters they have had with mathematics. Recalling these experiences in other mathematics courses can prepare students for the class(es) in mathematics they are currently taking by encouraging them to remember what worked and did not work, as well as what they previously did or did not do to be successful in these courses.

3. Examples of Student Automathographies

Given the malleable nature of the automathography to both course content and level, the same general questions can be used for different student populations, as seen in the commonalities between our two versions of the assignment. In particular, prompting a student to provide examples of a mathematical experience, their impressions or understanding of mathematics, and their goals for the course are three key components in our automathography assignments. Through this metacognitive approach, students can more effectively communicate their needs so the instructor can craft a better individualized experience for the student. With these three components in mind, we highlight several examples of student automathographies in differing courses and stages of student academic careers.
In CWS’s MLA course, students often incorporate strong negative emotion words into their automathography, with words including “hate”, “failure”, and “awful”; however, other students utilize positive words, such as “enjoy”, “interesting”, and “fun”, when discussing either their experience or impressions. These are not unique emotions among literature discussing mathematical autobiographies, as several studies have noted the use of emotion words in similar assignments [3, 24]. The mathematical experience of students in MLA can combine oppositional ideas: In one visual submission, a student incorporated an image of a teacher with an A+ on a chalkboard juxtaposed with an image of a failed exam; see Figure 5.

Figure 5: A visual student automathography.
Another student with a narrative submission discussed how the memory of an enjoyable statistics lesson was dominated by a different instance of “crabby” behavior by their geometry teacher.

A poetic automathography is presented in Figure 6. Two other student automathographies can be found in Figures 7 and 8.

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**Math Autobiography**

I looked up and I saw it  
My first math problem  
Sitting there looking at me  
Sending confusion into my eyes  
It was the popular one  
2+2  
It seemed hard I was still growing  
I figured it out though just for another to appear  
2-2  
What is this? New lines? New Problems?  
I knew this wasn’t for me  
That is when I jinxed it  
More symbols appeared  
Letters entered the mix  
All blending my brain into a mush  
I couldn’t figure it all out  
I just kept going back to the basics  
Back to the simpler times  
To the problems I used the most  
I went back to my 2+2  
Just so I could escape your confusion math  
But maybe there is hope if I keep diving farther back  
In your history I could understand you  
Just like I do with the basics  
Of 2+2

Figure 6: A poetic student automathography.
Understanding the humanity and lived experiences of a student, either solely through the automathography or with the additional fifteen-minute meeting can guide an instructor about how to teach a particular topic or the adaptation of pedagogical processes. For a major-specific course, understanding the general background of students can prove invaluable. For example, if none of the students in a seminar course have had a common suggested pre/co-requisite, then this can lead to inclusion of a review of specific concepts or selection of homework problems to encourage students to review important concepts. Similarly, understanding common goals—even as simple as “I want to pass the course without hating math more”—for service courses can impact how a particularly tricky topic, such as infinite sets or fractal dimensions, should be handled. In these instances in a MLA course, the content may be taken at a much slower pace with more adaptive techniques (e.g., physical demonstrations, group discussions, and extra examples) to ease the students into such unknown concepts. The result in both cases is an improvement for the overall classroom experience by understanding the background and initial knowledge base of students.

Figure 7: Another student automathography.
An enhanced benefit of the automathography is its extension to other disciplines. The nature of the automathography is to understand students and their experience in mathematics. With a simple wording change, this can be adapted to other STEM and non-STEM fields alike: As an example, CWS’s automathography prompts and format have been adapted by the Game Programming and Design department at his institution. For majors within this department, the altered assignment is strictly for first-year courses with the purpose of promoting retention and persistence of the students in associated majors. With the refinement specific to this department, understanding student backgrounds and assumptions/expectations of the major can help faculty better aid students to stay in their declared program or, if appropriate, guide the student to other majors within the school.

4. Conclusion

In this paper we have described a specific writing assignment, a mathematical autobiography, which we called an automathography, and we have argued that it can enhance teaching and learning in mathematics classrooms.

Figure 8: Yet another student automathography. Links to more student work can be found at https://www.coltonwsawyer.com/teach/automath and https://sites.oxy.edu/ron/research/automathography.
The automathography’s three primary benefits are the flexibility of the assignment, the development of communication skills, and the enhancement of a student-instructor relationship. Other benefits of the automathography include: humanizing students, building a sense of community within the classroom, and providing an explicit opportunity for students to self-reflect on and grow from their previous mathematical experiences. Through the flexibility of the assignment, the automathography can be used at a variety of course levels, student interests, and with small modifications, other disciplines. We encourage all instructors to find modalities, such as adopting some version of the automathography assignment described above, that will allow them to interact with their students in more humanistic ways.

5. Acknowledgments

We gratefully acknowledge the students who have allowed us to share their automathographies to a larger audience.

References


