Two Views on Mathematics Education for Deaf Students: Edward Miner Gallaudet and Amos G. Draper

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Editors’ Introduction

In this article, Christopher A. N. Kurz reviews the history of a disagreement between Edward Miner Gallaudet and one of the best-known deaf teachers at the college, Amos G. Draper. The immediate issue was Draper’s desire to reform the mathematics curriculum in order to improve deaf students’ mathematics achievement. Gallaudet believed that significant mastery of English needed to precede the study of mathematics. Draper argued that the learning of English and mathematics could proceed simultaneously and that advanced English skills were not necessary to comprehending mathematics. This debate is revealing, as historians know little about pedagogical arguments during Gallaudet’s presidency. Kurz’s work suggests that there was an underlying conflict in the nineteenth century, long before the idea of bilingual education of deaf children had been articulated, between hearing and deaf approaches to higher education.

ON APRIL 25, 1876, Amos G. Draper, a deaf professor at the National Deaf-Mute College (now Gallaudet University), delivered an oration on “The Influence of Mathematical Studies upon Personal Character.” He gave the speech during the exercises of the college’s regular public anniversary in the District of Columbia. In his presentation, Draper noted that,

As children making their first rude attempts at drawing with only sticks on the sand, so men yet ignorant of science strive to develop regular forms and avoid irregularities and excrescences.

Children, with eyes and ears opened wide, are filled with admiration by regularity of outline, beauty of color, and harmony of sound. Long be- fore the sciences that mark out present civilization were known, the first children of the earth, the first men, cultivated this kind of knowledge. The intellectual life of our race began, as that of each individual begins, in the appreciation of geometric truths. The earliest Hindoos and Chinese of whom we have any records were familiar with the properties of the right-angled triangle, the discovery of which is commonly attributed to Pythagoras. And still, as civilization advances, and as children grow to manhood, the love of form, color, and harmony remains central among the passions which sway the soul with delight.1

During his oration, Draper focused on how a child would learn mathematical principles both indirectly and directly and how knowledge would propel the child’s curiosity
about the universe. In essence, he believed that each child was a mathematician and that exploration into and understanding of mathematical studies would bring a harmony of personal character and sound mind. The knowledge and understanding of mathematics could become a way of developing character and morals, he believed. The question was how should a deaf child’s mathematical studies be molded, propelled, and supported? As superintendent of the Columbia Institution for the Instruction of the Deaf and Dumb and Blind and later president of the National Deaf-Mute College (hereafter, Gallaudet College), Edward Miner Gallaudet faced the same question when he struggled with curriculum development for his institutions. However, Gallaudet and Draper had different views on mathematics education for deaf students, especially for those who planned to go to college.

Whence They Came

Gallaudet, the youngest of eight brothers and sisters, was born on February 5, 1837, to Thomas Hopkins Gallaudet and Sophia Fowler Gallaudet. The fact that he was born after his father retired from teaching at the American School for the Deaf in 1830 did not prevent him from being around deaf people. His father continued to work diligently with Yale College to promote interest among graduates to work with deaf students, and his deaf mother was well liked in the deaf community. After graduating from high school at the age of fourteen in 1851, Gallaudet chose banking for his profession, but he soon found that working in a bank was not challenging enough. He wrote that his “mind began to crave a pabulum of a higher order than the counting of bank bills and the reckoning of discounts.” He decided to study theology and teaching at Trinity College, from which he graduated at the age of nineteen. While studying, he also held a part-time teaching position at the American School for the Deaf. In 1857 Amos Kendall invited him to come to Washington, D.C., to become head of the new Columbia Institution for the Deaf and Dumb. He later became president of what became Gallaudet College and remained in the presidency for forty-six years. In addition to his administrative responsibilities, Gallaudet taught courses in moral and political science in the college, and he became acquainted with Draper when the latter was a student.

Draper was born in Shaftsbury, Vermont, on October 24, 1845, to Jonathan and Philena Draper. His father was a manufacturer of augers, hammers, and carpenter’s squares. He became deaf when he was around ten. After he attended one of the district public schools for a few years, he worked as an apprentice under his father. At fourteen his father took him to the American School, where he was admitted in March of 1860. The admission record noted: “He can read and write–can articulate distinctly–has studied arithmetic and geography somewhat.” He spent two years at the American School, where “he had learned to set type on the Gallaudet Guide,” a school newsletter. After Draper left the school in July of 1862, he went to Danville and then Aurora, Illinois, where he worked in newspaper and printing offices, respectively, before deciding to enroll at Gallaudet College in the fall of 1868. Regarding Draper’s goal for traveling to Washington, D.C., his friend, James E. Gallaher, wrote: “His object was to see
Washington, public men and public life, with the view of fitting himself for further editorial work, and his plan was to stay only one year in college.”⁹ Draper found the college both challenging and fascinating and graduated in 1872. He then began teaching Latin and mathematics at Gallaudet and remained in the profession for the next forty-five years.

**What They Said About Mathematical Studies for Deaf Students**

In his *History of the College for the Deaf*, Gallaudet reminisced about the time when he became head of the world’s first college for deaf people: “I was a youngster of twenty-seven, at the head of a little school of deaf and blind children in which no word of Latin, Greek, or any language but English had ever been taught. Arithmetic had not been completed. No higher mathematics had been touched, no science taught.”¹⁰ Learning English was the chief goal in schools for deaf children, but Gallaudet saw the importance of establishing a college for deaf scholars to pursue higher knowledge in order to provide them with the tools to gain honor-able positions in society.

Colleges at the time focused on liberal arts, and the classics were the heart of their curriculum. The course of study Gallaudet and the faculty developed for their college corresponded “in general to what is known as the Academical Course in American colleges: there have been made, however, such modifications as seemed desirable and necessary to adapt it to the peculiar wants of the deaf and dumb.”¹¹ Like some other colleges of the time, the college for deaf students included a preparatory year before students could enroll in college-level courses.¹² The curriculum Gallaudet and his colleagues first established included the following:

**Academic Department**

First Year: Analytical Grammar, Higher Arithmetic, Physical Geography, History, Latin

Second Year: Analytical Grammar, Algebra, Natural Philosophy, History, Latin

**Collegiate Department**

Junior Year: Geometry, Latin, Rhetoric, Chemistry, Mental Science

Senior Year: History of English Language and Literature, Latin, Astronomy, Geology, Political Science, Moral Science¹³

Mastery in arithmetic and algebra up to quadratic equations was crucial to enrollment in the collegiate program. The college’s admissions announcement in 1866 stated that “candidates for admission to the Freshman Class are examined in Arithmetic, English Grammar, History, Geography, Physiology, the elements of Natural Philosophy, Algebra to Quadratic Equations, and the principles of Latin Construction in their application to any Latin author.”¹⁴ Essentially, future graduates of the college would have knowledge of mathematics up to geometry, which is equivalent to the modern United States high school course for ninth- and tenth-grade levels.

By the end of the 1868 academic year, the course of study in mathematics had changed.
Students in the preparatory class studied arithmetic and algebra up to quadratic equations. Freshmen studied algebra and geometry; sophomores studied spherical and solid geometry, conic sections, and trigonometry, including mensuration. The junior and senior classes took no mathematics courses. This curriculum remained unchanged for more than eleven years, with only some modification in 1874 when the preparatory program was divided into two years: the lower preparatory class studied grammar school arithmetic and the advanced class studied algebra up to quadratic equations. There were two major changes in 1879: conic sections was added for the freshman class and surveying for the sophomore class. In 1882, calculus and mechanics were added to the course of study for the junior class. The mechanics of materials was added as an optional course for the senior class in 1907.

Gallaudet’s annual report in 1887 gave a description of each year during which a student would study mathematics at the college and concluded: “In all the studies of the mathematical course much original work is required, and it is believed that students who have mastered this course are prepared to undertake the study of the higher branches of mathematics.” Six years later, President Gallaudet provided more detailed information about the college’s mathematics courses over the previous quarter century. An introductory student would study Wentworth’s Algebra (through quadratic equations) and problems from Todhunter’s Algebra for Beginners. A freshman student would work from Wentworth’s Treatise on Algebra (from quadratics) and Wentworth’s Geometry. In the next two years, the student would study Olney’s or Loomis’s Plane and Spherical Trigonometry and Loomis’s Analytic Geometry during the sophomore year and Loomis’s Calculus and Dana’s Mechanics during the junior year. For the senior year, no mathematics courses were offered.

It is clear that graduates of the college were expected to leave with knowledge in algebra, geometry, plane and spherical trigonometry, surveying, and mechanics. If the students wished to pursue higher branches of mathematics, they would learn analytical geometry and differential calculus, which were optional.

Gallaudet also provided a glimpse of how mathematics should be taught at the college. He emphasized that two languages were consistently used: sign language and printed English. The students would dis- cuss their mathematical work using sign language and finger-spelled English. They would write their recitations in English. On November 9, 1886, he discussed the relationship between language and teaching mathematics in response to an inquiry by the Royal Commission of the United Kingdom. During the inquiry, the chairman asked him, “You would not give lectures in Mathematics or Logic by signs, would you?” to which he responded, “To a considerable extent; but in the use of the gesture language the interjection of words spelt upon the fingers is very common.” Gallaudet suggested that most lectures should be given in signs rather than in the manual alphabet, but he admitted that most technical words would be given by the manual alphabet. The mixture of the signing and the manual alphabet was the practice for most lectures at his college.

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Despite Gallaudet’s description of the central role of sign language in mathematics instruction and his belief in the importance of mathematics, he subordinated the latter to another goal. In the college’s thirtieth annual report, published in 1887, he stated that arithmetic was second in importance to learning English. He also wrote that he believed that the pupils who did not do well in mathematics had been taught by rote and were not taught the principles upon which the rules were based. He further stated that he believed mathematics was no pleasure for students, but was a great bore, trial, and terror. His explained that their problems with mathematics were “not from lack of reasoning power, but from insufficient or defective training in English during their previous instruction.” Gallaudet was concerned that English deficiency could be a barrier to mathematical learning. It is possible, he reasoned, that English should be learned first before arithmetic can be taught. In sum, he believed that the learning of English should be the chief aim of every deaf child’s education and that it was the foundation and means of knowledge.

In contrast to Gallaudet’s rather pessimistic 1887 report, some twenty years later he noted the successes of deaf college graduates in an address he made in England.

Of its practicability and advantage for those mentally capable of availing themselves of it there can be no doubt, for the College at Washington, liberally sustained by the federal government for nearly thirty years, has [had] within its walls several hundred youth, whose success in the scientific, mathematical, philosophical, linguistic, and other studies offered them, as well as in the practical struggles of life, is a matter of history. Students of this College have become intelligent managers of considerable farms, ranchmen and fruit growers; bank clerks and cashiers; postmasters and recorders of deeds; newspaper reporters, editorial writers, editors-in-chief, publishers and foremen of newspapers; merchants and manufacturers; microscopists, astronomers and practical chemists; draughtsmen and architects; clerks in private and public offices; founders, teachers, principals of schools for the deaf, and professors in the College; one is the official botanist of an important agricultural State; one is a prominent patent lawyer, admitted to practice in the highest courts; several have been ordained as ministers of the gospel and others are at work as lay missionaries.

Some occupations mentioned in his address require mastery of arithmetic. Many graduates found mathematics challenging, yet pleasurable– since they began their learning in the best mode and since they finished the curriculum and went on to hold occupations in which it is used.

In 1876, Joseph Henry of the Smithsonian Institution confirmed Gallaudet’s claim about the success of Gallaudet College students when he gave a report based on their work.

In 1874 a plan was submitted to me for examination, by the president of this institution, of a graduated course, terminating in a collegiate curriculum. In my report upon the proposition I warmly recommend its adoption, as a means of increasing the enjoyment and extending the sphere of usefulness of the class intended to be benefited. I am now happy to say that the experiment has been successful. The scientific examination papers
of last year were submitted to me for report as to their character; while they involved the solution of questions in mathematics, physics, chemistry, geology, etc., requiring accurate knowledge and profound thought, the answers were such as to do honor to the undergraduates of any college in this country.

The plan proposed of giving a collegiate course in this institution has been, as I have said, eminently successful; it has been commended in foreign journals, and while the graduates have, in several instances, been employed in scientific calculations, one has received, on account of his attainments, an honorary degree from Dartmouth College.

Whatever Gallaudet’s belief about the affinity of the college’s students for mathematics, there was no doubt that he and Draper disagreed on its importance. Draper believed that English and arithmetic were equally important. He thought that both subjects should be studied simultaneously and as early as possible. Furthermore, he believed that mastery of English was not a prerequisite for mathematical learning. Draper was very concerned about the mathematical skills of deaf students, calling in 1880 for increased opportunities and time to study arithmetic.

As to the College records, they show that, taking the whole number of students since the foundation in 1864, only 26, or twelve-and-a-half per cent., have sustained the entrance examination in arithmetic; of applicants since the standard has approached its present condition, that is during the last eight years, only 11, or seven per cent., have endured the same test; while of 23 who presented themselves at the last examination for admission, not one was able to answer satisfactorily all the questions asked them.

However, Draper pointed out that the last part of the examination might be severe, with its emphasis on mathematical problems. Applicants had to answer six problems, as follows:

1. Write the tables of long measure and of cubic measure, and state for what each is used.

2. Find the length of a field which has an area of 144 sq. yds, and is 28 ft. broad?

3. How does a decimal fraction differ from a common fraction?

4. A note of $500 was dated June 10, and bore interest at 5 per cent; Oct. 3 a payment of $140 was made. What was due on the note one year from its date?

5. If 5/8 of a ship cost $9,875, what would 7/8 of it cost? [Solve this question first by proportion and then analysis.]

6. What is the square root of the fifth power of 3?
Draper argued that deaf schools should restructure their mathematics curriculum to involve more instruction in arithmetical terms and more accuracy in handling problems, such as those on the admittance examination, stressing his belief that deaf children should be taught how to analyze arithmetical language within questions and perform the operations accordingly. He further reasoned that student’s shortcomings were caused by several deficiencies in their instruction, specifically “that they had been taught without a text book; that they had never been dwelling on a subject, but passed rapidly through; that they had long since been given higher branches; that they had never studied arithmetic at all, or at least the recollection of it had passed from them.”

Lastly, Draper advocated for intensive arithmetic education so that graduates would be well fitted to assume honorable occupations, or if they wished, to take up higher education.

Draper’s colorful oration on April 25, 1876, titled “The Influence of Mathematical Studies upon Personal Character,” expressed disappointment in the mathematical performance of the graduates of the College. He hoped to inspire schools for deaf children to revitalize their mathematics curriculum to prepare their students for advanced studies in mathematics and, in turn, mold them into well-rounded Americans. Draper described the importance of mathematics to human civilization and its contribution to technical progress.

Mathematics is distinguished among the sciences by the certainty which attends its operations and conclusions. The ideas it presents are so distinct, its reasonings so evident, that it affords the most certain knowledge with which the mind is conversant. The meaning of its definitions, the truth of its axioms, and the correctness of the results at which it arrives, are matters concerning which there cannot be the slightest doubt or difference of opinion. While observation and experiment may deceive and confuse, demonstration ends in clear and absolute knowledge.

This exactness of the science has made it a chief instrument of human activity. A noble steamship, fresh from the builder’s hands, resting lightly upon her native waters and ready to speed to other shores, is hailed as a triumph. She is but a combination of solidified mathematical theorems. We see a still greater triumph when she urges her way out upon the illimitable ocean, and pursues an undeviating course, day after day and week after week, finally to reach her destined port with unfailing precision. Mathematics again enabled her so to do.

The same instrumentality that empowered mankind to map out the highways of the sea has built those of the land—bridging chasms, tunneling mountains, and striding across rivers. It has fashioned the vehicles that course upon those highways, together with the innumerable machines by which labor is lessened, food and clothing are cheapened, buildings perfected, and conveniences of all kinds multiplied.

Clearly the utility of mathematical studies could scarcely be overrated.

In this oration, Draper also discussed the importance of mathematics in forming
personal character and claimed that by learning mathematics people could become more disciplined and use reasoning to understand themselves and their place in society and the world. “Mathematical studies,” he wrote, are peculiarly calculated to heighten decision of character. Since in them the mind advances to a final decision by a series of minor decisions, each of them unquestionable because based upon the irrefragable testimony of intuition—since, in fine, it is the very province of our science to decide, without the smallest danger of error, it would be strange indeed if a mind impressed and led by such a species of knowledge did not absorb and retain something of the consistency and firmness embodied in its principles.  

In Draper’s view, therefore, mathematics was keenly important to deaf people. He argued that mathematical studies was strongly related to personal character; that attaining and understanding mathematical knowledge led to sound character and mind; that mathematics was universal and therefore the same for deaf people and hearing people; that mathematics was a means to encourage passionate curiosity about the nature of the world; and that every child was born with mathematical power. Finally, he believed that mathematics was as much a visual language as was sign language. Mathematics, like American Sign Language and English, should be taught as early as possible to deaf children. Draper stressed the importance of arithmetic education for deaf people, equating its value with knowledge of written language. In this case, he called for mathematics in early education where literacy was primarily studied. He thought that deaf graduates possessing advanced mathematical knowledge would contribute significantly to society and to their personal development as they became full-fledged, constructive workers.

Gallaudet and Draper thus held sharply contrasting views on mathematical education. Gallaudet perceived mathematics as subordinate to English, claiming that basic English skills precluded basic mathematics learning. Draper, however, thought that mathematics and English were equal in importance and could be learned simultaneously.

Furthermore, although both men believed that rote learning, drill, and practice could lead to drudgery in learning mathematics, and both supported the use of sign language and printed English to communicate mathematics, Draper was more progressive in terms of curricular changes. He was more committed than Gallaudet to critiquing and redressing the problems he found in deaf schools and in the college. Draper stressed that appreciation for mathematics could lead to a better understanding of the natural world, and that mathematics was an avenue for moral development. He called for reconstruction of the pre-college mathematics curriculum to increase instruction in vocabulary, analysis of practical problems, automatic performance with operations, and the importance of carefully reading directions.

Whither They Went

Despite their differing views on mathematical studies, Gallaudet and Draper worked together and were close friends for more than forty-five years. Their professional
relationship had begun in 1871–72, when Draper served as Gallaudet’s private secretary in his last year as a college student. Their affection and respect for each other were mutual. Gallaudet named his youngest son Herbert Draper Gallaudet, and Draper named his son Ernest Gallaudet Draper. Gallaudet and Draper were on the stage for the Preservation of Sign Language films during the second decade of the twentieth century. Their lives ended within five weeks of each other in 1917 (Gallaudet, September 26; Draper, November 3). Upon Gallaudet’s death, Draper wrote of his dear friend:

Possessed in his younger years of a very strong and admirable physique,— handsome, stalwart, manly classic in features,—he was perfectly fitted to excel in the sign-language, whether in lecturing, teaching, or dactylogy. Nor was his pen less ready; literature overflows with evidences of his talents and industry. The best is yet to be told,

‘That fame is lost which epitaph imparts; Who for his dust a tear would claimOn living hearts must write his name.’

This did Edward Miner Gallaudet. He endeared himself to the hearts of all his graduates and students in every generation. Now, as he stands on the threshold of the life to come, clouds of witnesses arise to call him blessed—children, grandchildren, associates, friends,—all.33

Similarly, when Draper passed away a few months later, The Silent Worker’s obituary was effusive: “Dr. Draper was a deaf man and an early graduate of the Hartford School and of Gallaudet College. For forty-fours he was connected with the latter institution of learning as instructor and professor of Mathematics and Latin, and in this work achieved distinction. Dr. Draper was one of the finest men on the Faculty of

Gallaudet—able, upright, courtly and scholarly.’34 His contemporary, James E. Gallaher, described him as “highly esteemed by the faculty and the students, being diligent and always alive to the interests to the college, and . . . always succeeds in interesting his classes. As a lecturer he is entertaining and instructive, and his personal influence among the students has been elevating. He is considered a first-class professor in all respects.”35 Both scholars left behind powerful pedagogical concepts in both their printed words and signs.

Gallaudet and Draper both held high expectations for deaf students to attain mathematical skills and knowledge. The issue was twofold: 1) the order of importance of English and mathematics and 2) the use of language to support the attainment of mathematical knowledge. From a modern perspective of bilingualism, Draper was a progressive thinker in his belief that deaf students should learn English and mathematics as early as possible in their childhood years, simultaneously if possible. He supported the notion that deaf children can learn English as a second language through a natural, dialogic process, in which the focus is on communicating mathematical concepts. The focus is not the language, but the use of it as a medium to learn mathematics. Gallaudet, on the contrary, believed that deaf students needed to acquire English first before studying mathematics. Two possible rationales for his subordinate view of learning mathematics are that deaf children should build a basic foundation of

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English to enable them to succeed in mathematics effectively, including the ability to read mathematical textbooks, and that learning mathematics may delay deaf students’ acquisition of English as a second language. Both scholars, however, supported the use of sign language as a mode of communication to exchange thoughts in the mathematics classroom.

Notes


4. Columbia Institution for the Deaf and Dumb was later transformed into a two-school system, which included Kendall School and the National Deaf-Mute College. The National Deaf-Mute College was later renamed Gallaudet College and is now Gallaudet University.


6. Register of Student Admissions, American School for the Deaf Archives. In his biography of Amos G. Draper, Representative Deaf Persons of the United States of America, James E. Gallaher wrote, “He became deaf when nine years of age from severe exposure while skating.” Further investigation on symptoms of Typhus fever showed no mention of deafness.

7. Ibid.


16. The preparatory program was designed for students who desired to enter the College, but did not prepare fully elsewhere, especially at those institutions that did not offer high classes. High classes existed in few of the institutions of the country at the time.


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Issue No.4 Spring 2014
1869, received this degree in 1873. He later became a patent lawyer in Chicago.

26. Amos G. Draper, “The Discontinuance of the ‘Lower Preparatory’ Class,” *American Annals for the Deaf and Dumb* 25, no. 4 (1880): 251–54. In an article, Draper mentioned that the issue was raised of the importance of teaching arithmetic to the deaf-mutes at the Northampton Conference of Principals in May of the same year. The concern contradicted Professor Henry’s report findings.


**Selected Bibliography**


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