"To give light where He made all dark": Educating the Blind about the Natural World and God in Nineteenth-Century North America

Joanna L. Pearce

Nineteenth-century educators worried that blind children were particularly susceptible to moral apathy, religious decay, and atheism because they could not see the beauty of nature. These educators used instruction in biology, zoology, and natural history to teach blind children about the beauty of the natural world and the breadth of God's creation. Instruction techniques included innovative but expensive apparatuses and tactile models. Despite cost challenges, educators of the blind devoted time and ingenuity to expand the science curriculum, particularly nature study programs, to help their students become successful, productive, and pious citizens equal to their sighted peers. Teaching blind students about nature ensured the blind would not become burdens on society but could be brought into the proper, civilized, religious sphere of the sighted.

Keywords: Nature studies, science education, blind students, Christian education

At the beginning of the twentieth century, three blind boys at the Perkins Institute and Massachusetts School for the Blind near Boston, gave a short demonstration to the public about the botany and zoology they had been learning in school. Despite being unable to see the plants or animals they were describing or the models they were using for their demonstration, the boys explained the various skeletal parts of an owl and the stages of growth in a bean plant. They were followed by three blind girls who described the "nature of the human nervous system" with wooden tablets that had parts of

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the body molded in clay.[1] These were not famous blind children, like Helen Keller or Laura Bridgman, or blind people who went on to careers in the sciences, such as pulmonary doctor Robert H. Babcock, bee expert Francis Huber, or mathematician Nicholas Saunderson. The reports of the event did not even list their names. Rather, these children represented a movement within residential schools for the blind across North America to include a nature-based curriculum for their pupils. These children were a few of the hundreds of students who, despite being unable to see, were taught physics, geography, geometry, zoology, botany, and other sciences—just like their sighted counterparts in public schools.

It is difficult to estimate how successful this expanded curriculum was in teaching blind children basic facts about the natural world that surrounded them. Much of the work that examines the history of blindness in education in the nineteenth century focuses on the aims and goals of superintendents and educators of the blind, examining the overall curriculum of the various residential schools built for blind children or the funding models that schools developed over time.[2] The earliest work on the education of blind children is dominated by biographies of leaders in the field, such as Samuel Gridley Howe (superintendent of the Perkins Institute for the Blind), or individuals such as Bridgman or Keller, both of whom obtained fame in part for being deaf-blind girls.[3] This focus on individuals makes it difficult to see larger trends in the education of blind children, more representative results of that education, or broader attitudes toward the blind that educators sought to overcome. Other works have been histories of individual organizations, whether schools (including Perkins and the

[1] E. B. F. Robinson, *The True Sphere of the Blind* (Toronto: William Briggs, 1896), 10-11.

[2] Examples of the history of blindness include Harold Schwartz, *Samuel Gridley Howe: Social Reformer, 1801-1876* (Cambridge, MA: Harvard University Press, 1956); Ishbel Ross, *Journey into Light: The Story of the Education of the Blind* (New York: Appleton-Century-Crofts, 1951); and Richard Slayton French, *From Homer to Helen Keller: A Social and Educational Study of the Blind* (New York: American Foundation for the Blind, 1932). For a discussion on funding for schools for the blind, see Joanna Pearce, "'Not for Alms but Help': Fund-raising and Free Education for the Blind," *Journal of the Canadian Historical Association* 23, no. 1 (2012), 131-55.

[3] Examples of biographies include James W. Trent Jr., *The Manliest Man: Samuel G. Howe and the Contours of Nineteenth-Century American Reform* (Amherst: University of Massachusetts Press, 2012); Ernest Freeburg, *The Education of Laura Bridgman: First Deaf and Blind Person to Learn Language* (Cambridge, MA: Harvard University Press, 2001); Elisabeth Gitter, *The Imprisoned Guest: Samuel Howe and Laura Bridgman, the Original Deaf-Blind Girl* (New York: Farrar, Straus and Groux, 2001); and Kim E. Nielsen, *The Radical Lives of Helen Keller* (New York: New York University Press, 2009).

Ontario Institution for the Education of the Blind in Brantford) or organizations that advocated on behalf of the blind as a class in Canada or the United States.[4] Many of these works are hagiographies of sighted male educators and superintendents that may describe the coursework set in schools but that do not examine the purpose of the coursework in the greater goals of the institutions.[5]

This article examines how broader concerns about idleness and degeneracy in blind children and adults was addressed by developing a curriculum that included nature and object studies as well as learning the contours of the natural world. As outlined in works such as *No Right to Be Idle* and *A Disability History of the United States*, various disabled children, including the blind, were enrolled in institutions across North America to address the social problems they were believed to present to both their communities and to their parents.[6] While blind and deaf children were deemed educable and were sent to special-built residential schools, it was rare for graduating pupils to become self-sufficient.[7] In some cases, students returned to their families and were integrated into the household economy; however, many pupils were forced to rely on charitable aid despite their years of education. It was less likely that students would be self-sufficient after graduation, with many

[4]For Canadian organizations, see Margaret Ross Chandler, *A Century of Challenge: The History of the Ontario School for the Blind* (Belleville, ON: Mika Publishing, 1980); Shirley J. Trites, *Reading Hands: The Halifax School for the Blind* (Halifax, NS: Vision Press, 2003); and Euclid Herie, *Journey to Independence: Blindness – The Canadian Story* (Toronto: Dundurn Group, 2005). For examples from the United states, see Mary Klages, *Woeful Afflictions: Disability and Sentimentality in Victorian America* (Philadelphia: University of Pennsylvania Press, 1999).

[5]See, for example, Kimberly French, *Perkins School for the Blind* (Charleston, SC: Arcadia Publishing, 2004).

[6]Kim E. Nielsen, *Disability History of the United States* (Boston: Beacon Press, 2012); Sarah F. Rose, *No Right to Be Idle: The Invention of Disability, 1840s-1930s* (Chapel Hill: University of North Carolina Press, 2017). Parents often resisted this characterization of their blind or otherwise disabled children, with some refusing outright to send their children to institutions or only sending them for a limited amount of time due to their being needed at home. For a discussion of how this applied to children labeled as imbeciles, see Rose, *No Right to Be Idle*, 14-48. Superintendents of schools for the blind noted similar parental concerns and viewed these parents with disdain. One example of this can be found in "Report of the Principal of the Institution for the Blind," in *Fifth Annual Report of the Inspector of Asylums, Prisons, &c for the Province of Ontario, 1871-72* (Toronto: Hunter, Rose, 1873), 181. However, this was far from unique, with similar sentiments expressed in American schools as well.

[7]Although modern convention is to use *deaf* to describe the medical condition, and *Deaf* to refer to those who are culturally Deaf and primarily use signed language to communicate, I have chosen to use *deaf* throughout this article, as I am referring entirely to the medical condition.

students ending up in sheltered workshops that institutions created to provide work for the adult blind. This raised questions about the efficacy of schools in addressing the problem they were built to alleviate.

This paper is part of a larger project that explores the development of the education system for blind children and adults and the outcomes of this process in North America. Examining how and why nature studies and other scientific concepts were taught to these children demonstrates both how educators viewed a nature-based curriculum as part of a broader civilizing process for the blind and how the curriculum was adapted to accommodate disability during this period. While some—perhaps even most—graduates of residential schools for the blind ended up in sheltered workshops or supporting themselves at subsistence-level jobs, schools not only provided these courses but expanded the curriculum available at the end of the nineteenth century. This mirrored the expansion in science education for sighted children but not for the same reasons. While American scientists and educational reformers in Canada and the United States promoted the teaching of science to build a "literate and numerate citizenry," educators of the blind were particularly concerned about their charges falling into atheism.[8] Developing a science curriculum for blind children that was similar to the one for sighted children was to teach them the grandeur of God's creation, necessary for making them good Christians and in turn good citizens.

Both the history of education and the history of childhood in Canada have been expanding to include the experiences of children in the nineteenth and twentieth centuries who were labeled *disabled* and *defective*. Answering Catherine J. Kudlick's call for history to include "another 'other'" as a "useful category of historical analysis," historians have begun to examine the ways that the treatment of these children reflects the attitudes of the Canadian state toward other allegedly "defective" groups.[9] *Untold Stories: A Canadian Disability History Reader* includes articles that describe the educational experiences of blind and deaf children in Canada, examining why and how these children were educated in separate residential schools established for them in Ontario and Manitoba. These articles address the perceived defectiveness of these children and the need to make them productive citizens under the growing Canadian state.[10]

[8]Sally Gregory Kohlstedt, "Nature, Not Books: Scientists and the Origins of the Nature-Study Movement in the 1890s," *Isis* 96, no. 3 (Sept. 2005), 326.

[9]Catherine J. Kudlick, "Disability History: Why We Need Another 'Other,'" *American Historical Review* 108, no. 3 (June 2003), 763-93.

[10]Vanessa Warne, "'Blindness Clears the Way': E. B. F. Robinson's *The True Sphere of the Blind* (1896)," in *Untold Stories: A Canadian Disability History Reader*, ed.

Madeline C. Burghardt also explores the desire to remove other "defective" children from the population due to the perceived burden on both their families and society. Burghardt examines the establishment of institutions for the feeble-minded in the nineteenth century as a means of social control, as the state became more concerned with the productivity of its citizens.[11] Jason Ellis continued this examination of the education of "defective" children, including those who required sight-saving and speech and hearing classes, into the twentieth century. The policies and outcomes affecting so-called "backward" children that Ellis outlines clearly built upon decisions made in the nineteenth century.[12] These studies demonstrate how children labeled as disabled were segregated from their nondisabled counterparts in part because of their perceived threat to society as well as their additional educational needs around morality and proper behavior.

This paper begins by briefly outlining the formation of common schools for nondisabled children to establish what was considered educational standards.[13] This includes a discussion of reform movements within the common schools at the end of the nineteenth century, as these had some influence in the debates among educators of the blind during this period. It then addresses the perception of blind children as being in particular need of moral and religious education due to their blindness. Sighted children were admonished to count their blessings, as they were lucky to not be blind themselves; blind children were directed to be grateful for the opportunities given to them through their education and to not rely too much on charity.

This paper then describes the debates about educational reform among educators of the blind. These debates took place across North America, and thus this section examines schools in both Canada and the United States. As with sighted children, educators of the blind across North America questioned how to most effectively

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Nancy Hansen, Roy Hanes, and Diane Driedger (Toronto: Canadian Scholars, 2018), 53-65; Alessandra Iozzo-Duval, "The Education of 'Good' and 'Useful' Citizens: Work, Disability, and d/Deaf Citizenship at the Ontario Institution for the Education of the Deaf, 1892-1902," in Hansen, Hanes, and Driedger, *Untold Stories*, 66-90; and Sandy R. Barron, "'An Excuse for Being So Bold': D. W. McDermid and the Early Development of the Manitoba Institute for the Deaf and Dumb, 1888-1900," in Hansen, Hanes, and Driedger, *Untold Stories*, 91-109.

[11] Madeline C. Burghardt, *Broken: Institutions, Families, and the Construction of Intellectual Disability* (Montreal: McGill-Queen's University Press, 2018).

[12] Jason Ellis, *A Class By Themselves?: The Origins of Special Education in Toronto and Beyond* (Toronto: University of Toronto Press, 2019).

[13] The earliest school for the deaf was established in the United States in 1817 and in Canada in 1831; the earliest schools for the blind were established in the 1829 and 1871, respectively.

ensure their pupils would graduate as productive citizens and Christians. Should they be educated the same as sighted children, or should the curriculum instead focus on correcting the moral and physical defects blind children were perceived to have? The final section addresses the reaction of the blind themselves to these debates. Far from being the passive recipients of education, blind adults responded to the debates among educators of the blind and used their own experiences to address the questions raised.

Compulsory Education and Curriculum Development in Common Schools

Compulsory education for children in nineteenth-century Canada arose in part out of a need to form a stable country built on common Christian values that could be taught in schools. Through education, citizens could be taught proper respect for government authority as well as morality, piousness, and strength of character.[14] Egerton Ryerson, who became chief superintendent of education for the British colony of Upper Canada (now the Canadian province of Ontario) in 1844, argued that a system of education that was both free and compulsory would ensure that citizens would learn their "proper duties" within the community.[15] Ryerson and other school promoters in Upper Canada feared that lack of education would lead to a life of crime and vice for the poor, with the *Journal of Education for Upper Canada* claiming a direct correlation between lack of educational achievement and time in Toronto's jails.[16]

For both education reformers and the broader public, compulsory education would achieve three key goals: (1) it would legitimize the common school system broadly, as more children and families would make use of it, (2) it would make education as compulsory as property tax, and (3) and it would keep urchins off the city streets, particularly in Toronto.[17] Paul Axelrod also points out that farming families in Upper Canada realized the economic benefits of an education for their children. While previously these farming families had enough land to ensure their children would be taken care of after their parents'

[14] Paul Axelrod, *The Promise of Schooling: Education in Canada, 1800-1914* (Toronto: University of Toronto Press, 1997), 30.

[15] Axelrod, *Promise of Schooling*, 24-25.

[16] "Free Schools in the City of Toronto," *Journal of Education for Upper Canada*, II, no 6, (June 1848), 96.

[17] Susan E. Houston, "Social Reform and Education: The Issue of Compulsory Schooling, Toronto, 1851-71," in *Egerton Ryerson and His Times*, ed. Alf Chaiton and Neil Gerard McDonald (Toronto: Macmillan of Canada, 1978), 255.

death, larger families meant there were economic benefits to sending children to school to learn enough to get jobs in the city.[18] It also began the process of defining what a neglected child might look like—a child who was not in school when he should be.[19]

Ryerson argued that schooling for nondisabled children needed to prepare them for their roles in society as Christians.[20] As a Methodist minister, Ryerson believed that religious instruction was the path to moral improvement.[21] Denominational disputes about how to educate children to become proper God-fearing citizens led to the compromise under Ryerson of nondenominational Protestant common schools.[22] Ryerson argued that a Christian-based education that included biblical scriptures would ensure that boys would grow into good men who understood their purpose within Upper Canadian society.[23] Basic Christian morality taught in every school, through the use of the Lord's Prayer and the Ten Commandments, ensured a common spiritual basis to education that would help ease some of the sectarian tensions between Protestant and Catholic people of the period, as all children would have been educated with a "common spiritual message."[24] As well, common schools would raise the poor and teach them their proper roles in society by educating them in how to behave like their more civilized betters.[25] Children, even the poorest, would become more respectable if they learned "refined manners and taste, respectable religions, proper speech and . . . the ability to read and write English."[26] Schools for disabled children would also reflect this concern for a religiously based education.

School attendance became normalized for nondisabled children before the 1871 Education Act made all schools in Ontario free and compulsory; in turn, education reformers attempted various improvements to the curriculum. Neil Sutherland outlines the debates between two groups of educators about how to best ensure the success of education across Canada during the late nineteenth century. These groups followed similar discussions in the United States, as both countries grappled with how to best address educational outcomes. Sutherland

[18] Axelrod, *Promise of Schooling*, 28.

[19] Houston, "Social Reform and Education," 256.

[20] Axelrod, *Promise of Schooling*, 25.

[21] Goldwin S. French, "Egerton Ryerson and the Methodist Model for Upper Canada," in Chaiton and McDonald, *Egerton Ryerson and His Times*, 50.

[22] Prentice, *School Promoters*, 60.

[23] Albert F. Fiorino, "The Moral Education of Egerton Ryerson's Idea of Education," in Chaiton and McDonald, *Egerton Ryerson and His Times*, 66.

[24] Axelrod, *Promise of Schooling*, 30.

[25] Prentice, *School Promoters,* 67.

[26] Prentice, *School Promoters,* 68.

describes how one side argued for a more child-centered education focused on helping children develop skills that mirrored their physical development. This included "object teaching," which became popular in North America after Edward Austin Sheldon introduced it at the Oswego Primary Teachers' Training School in New York.[27] These educators argued that education should move away from recitation and rote memorization and instead encourage children to develop their observational skills and to "educate the hand."[28] These reforms were meant to move education away from creating "untrained" minds filled with repeatable knowledge and instead train children to think clearly, with the specific knowledge being incidental.[29] The Canadian school system introduced these principles by the 1890s, with the youngest children making objects out of clay, then drawing the objects, and then describing the objects through writing.[30] By developing these skills, children would cultivate their senses rather than learn to merely communicate information.[31]

On the opposing side were educators who wanted education to focus on teaching students the necessary vocational skills to be successful in life. This was seen as a more practical form of education, with classes including agricultural skills, manual training, and the establishment of industrial schools where delinquent boys could learn trades.[32] Ideally, these educational opportunities would inculcate in students an "increasing respect for honest labour," ensuring that they would become productive members of society regardless of their experiences in the family home.[33] Only some of these reforms remained in place long term in schools across North America. Middle-class parents rejected the idea of vocational training in schools, instead feeling that these types of classes were only meant for poor and

[27]Neil Sutherland, *Children in English Canadian Society: Framing the Twentieth-Century Consensus* (Waterloo, ON: Wilfred Laurier University Press, 2000), 160.

[28]Mary W. Boyle, "Edward Austin Sheldon and the Oswego Movement: A Model of Innovative Administration" (master's thesis, Loyola University, 1972), 65, https://ecommons.luc.edu/luc_theses/2557/.

[29]Robert M. Stamp, *The Schools of Ontario 1876-1976; A Project of the Board of Trustees of the Ontario Historical Series for the Government of Ontario* (Toronto: University of Toronto Press, 1982), 51.

[30]Sutherland, *Children in English Canadian Society*, 161.

[31]A discussion about the development of the senses in education is beyond the scope of this paper. For more on how sensory input, including touch, has been studied in the history of education, see Ian Grosvenor, "Back to the Future or Towards a Sensory History of Schooling," *History of Education* 41, no. 5 (2012), 675-87.

[32]Sutherland, *Children in English Canadian Society,* 178-79.

[33]Stamp, *Schools of Ontario,* 58.

delinquent children.[34] However, many of these changes were also attempted in schools for the blind.

Schools of Thought on Educating the Blind

The establishment of schools for the blind in North America was in part to address the perception that these children were part of a dependent class that would ultimately rely on charitable support rather than being productive members of society. Sarah F. Rose describes the industrialization of North America throughout the nineteenth century as contributing to this concern—those deemed disabled were increasingly unable to participate in waged work due to the need for interchangeable workers on the factory floor and the decreased ability of families to support "partially productive" members.[35] Blind children were unable to attend the common schools to learn even basic skills; however, educators such as Howe in Boston, Ryerson in Toronto, and Sir Charles Frederick Fraser in Halifax argued that providing instruction to blind children would keep them out of poverty and sin and provide productive work and a moral life. A large part of their education would include Christian beliefs, as they deemed blind children more susceptible to moral degeneracy due to their disability.

Sighted people believed that the blind were ignorant to the beauty of the world around them. Morality tales admonished sighted children to think of the suffering blind as they enjoyed "the bright flowers and fair skies of summer," and poets described the blind as longing to see the light.[36] In another story, "Truman Foster: The Blind Sunday School Scholar," Foster is presented as a model pupil who memorizes Bible verses and clearly understands their meaning. It ends with "O what a blessing is our sight! How good is God to you, that you are not blind."[37] On seeing blind children at a fund-raising event for the Perkins Institution for the Blind, one journalist described the grief he felt that they could not see (and thus enjoy) the flowers they carried or garlands they wore as they passed each day "in total darkness!"[38] Learned men also expressed this sentiment: in his *Lettre sur les aveugles*, Denis Diderot argued that the blind were incapable of feeling pity in

[34] Stamp, *Schools of Ontario,* 60-61.

[35] Rose, *No Right to Be Idle,* 2.

[36] Justin T. Clark, *City of Second Sight: Nineteenth-Century Boston and the Making of American Visual Culture* (Chapel Hill: University of North Carolina Press, 2018), 145.

[37] "Truman Foster, The Blind Sunday-School Scholar", *Sunday School Advocate*, 51, no 2, (Nov. 1851), 20.

[38] Clark, *City of Second Sight,* 146; and "The Boston May Fair", *North American Magazine*, 8, no. 2 (June 1833), 94-98.

the way their sighted counterparts did since they were unable to see the visible signs of suffering, such as facial expressions or body language.[39] Even educators of the blind focused on the overwhelming darkness that left blind people unable to engage with the world as the sighted: when seeking funds to support the Halifax Asylum for the Blind, Fraser (himself blind) described the uneducated blind as living in a physical, mental, and moral darkness that left them discontented and depressed.[40] This pitiable experience of the world could only be lifted by the light of education.[41]

The purpose of educating blind children was the subject of much contention throughout the period, both among the blind and their educators (which included both blind and sighted teachers and administrators). Debates with no clear victor were held at conferences for educators, within the annual reports of institutions that assisted the blind (including schools, libraries, and work homes), and at alumni gatherings for residential schools, from the establishment of the earliest schools into the twentieth century. Educators argued for and developed different ideas at different times in their career, which makes a clear chronology of the growth of these ideas difficult.[42] These discussions included if and how the blind should be taught to read, if it was necessary to include musical education in the curriculum, and if those who became blind as adults should be admitted to schools for blind children.

While some argued that the purpose of educating blind children, in particular, was to teach them to be moral, clean, and practicing members of a (likely Protestant) church, others felt the goal was to prepare them for self-sufficiency. In the words of one educator, "To lift them above the pauper class, and place them in the industrious class."[43] Those in this latter category tended to fall into three groups,

[39] Denis Diderot, "Letter on the Blind for the use of Those Who See," *Diderot's Early Philosophical Works*, ed. and trans. Margaret Jourdain (Chicago: Open Court Publishing, 1916), 81-82.

[40] Charles Frederick Fraser, *Fighting in the Dark* (Halifax, NS: C. F. Fraser, 1879).

[41] Unsurprisingly, the ability to raise the blind out of their moral darkness through education was a common theme in annual reports of schools for the blind. See J. Laurence Cohen, "Shining Inward: The Blind Seer, Fanny Crosby, and Education for the Blind in the Nineteenth Century," *Journal of Literary & Cultural Disability Studies* 11, no. 1 (2017), 55-68; Klages, *Woeful Afflictions*; Clark, *City of Second Sight;* and Pearce, "Not for Alms but Help."

[42] At one point, these debates were so contentious that certain subjects were banned from further discussion.

[43] *Forty-Second Annual Report of the Trustees of the Perkins Institution and Massachusetts Asylum for the Blind, October 1873* (Boston: Wright & Potter, State Printers, 1874), 11.

although they differed on how to best ensure the success of their graduates as well as what success looked like for the blind.

The first group argued that it was best to educate blind children in the same way, or as nearly as possible, as sighted children. Howe, one of the strongest early advocates for this system, was considered the leading educator of the blind in the United States. Canadian educators consulted him prior to founding schools in Ontario and Nova Scotia, arguing that Perkins graduates were better equipped to "earn their own livelihood" than, for example, their British counterparts.[44] While the British prepared their students primarily for a trade, graduates from schools that followed the Perkins example were "educated up to a level with [their] fellow [sighted] men."[45] This, according to Howe and his allies, allowed them to either build their own businesses from the ground up, or fall back on whatever trade they had learned if necessary.[46] The British method, Howe argued, created a dependent class that relied primarily on workhouses and other charitable means for support, while graduates from schools with a broader curriculum were far more independent and self-reliant.[47] Schools that employed Howe's model often gave public demonstrations of their students' work, such as the Perkins Institution demonstration about bean plants and human physiology. The message was clear—their schools were not warehouses for the blind but true educational institutions on par with the best schools for the sighted in their city.

The second school of thought, championed by Warring Wilkinson of the California State Asylum for the Deaf, Dumb and Blind, argued instead that giving students a curriculum similar to that of sighted children, rather than an apprenticeship that prepared them for manual labor, was a mistake. Blindness was often acquired in childhood due to unsanitary conditions, accidents, or untreated illnesses, and children who attended the residential schools came mostly from poorer families—families that administrators often looked down on for either coddling their blind children or not prioritizing their education.[48] Wilkinson and his allies worried that these children would

[44] *Forty-First Annual Report of the Trustees of the Perkins Institution, October 1872* (Boston: Wright & Potter, State Printers, 1873), 11.

[45] *Forty-First Annual Report of the Trustees of the Perkins Institution*, 11.

[46] *Forty-First Annual Report of the Trustees of the Perkins Institution*, 11.

[47] *Forty-First Annual Report of the Trustees of the Perkins Institution*, 11.

[48] Examples of this disdain toward parents appear in annual reports from all schools for the blind during the nineteenth century. In Ontario, mothers were blamed for their children "fast falling into idiocy," while Missouri's Institution for the Education of the Blind prayed that blind children should be preserved from "a mother who does everything for it." *Fifth Annual Report of the Inspector of Asylums*, 181; and *Second Biennial Report of the Trustees Missouri Institution for the Education of the Blind to the*

grow into dependent adults, and they focused much of their attention on making these children self-sufficient at a working-class job such as broom-making or cane-chair seating. By not preparing students to be strong workers, Wilkinson argued, educators of the blind were letting their students down. As Wilkinson pointed out, few graduates of schools for the blind became fully self-sufficient in a trade and struggled to find any paying work. Far too many relied on selling pamphlets or songs—what one educator called "a polite way of begging"—the very lifestyle education for the blind was supposed to prevent.[49] Students whose education prepared them for anything other than the working-class jobs Wilkinson believed they were more likely to get were just made more aware of their failure to find work. "If they are going to graduate from the class-room to street corners and the alms-house," Wilkinson asserted, "do not bring them into the institutions, do not teach them the intellectual instruments by which they will measure their own inferiority. Let them go to the street-corners and alms-house without education."[50]

Wilkinson and his supporters contended that residential schools expected too much of their blind pupils. Not only were students supposed to learn how to dress, clean, feed, and otherwise care for themselves over the course of ten years, they were also required to learn to read using one of (or even all of) half a dozen tangible prints in use in North America, some music, the rudiments of a job in the workshop or the crafts room, and a full curriculum.[51] Rather than expanding the curriculum beyond these student's abilities, they argued, it would be far better to focus their education on what would be best for their future. These men maintained that students should learn the basics of a trade and the ability to run their own business rather than all that was taught in common schools.[52] Ensuring graduates could work immediately after leaving the institution, or even before they

Twenty-First General Assembly (Saint Louis: Missouri Institution for the Education of the Blind, 1860).

[49]Comments by H. L. Hall in *Proceedings of the First Meeting of the American Association of Instructors of the Blind, Held at the Perkins Institution for the Blind, Boston, August 20, 21 and 22, 1872* (Boston: Rand, Avery, 1873), 89.

[50]Comments by W. H. Wilkinson, *Proceedings of the First Meeting of the American Association of Instructors of the Blind*, 87.

[51]Missouri Institution for the Education of the Blind, *Fourth Annual Report of the Trustees of the Missouri Institution for the Education of the Blind* (Saint Louis: Geo. Knapp & Co, 1855), 11.

[52]*Proceedings of the Second Convention of American Instructors of the Blind Held at the Indiana Institute for the Education of the Blind, Indianapolis, August 8th, 9th, and 10th, 1871,* (Indianapolis: Indianapolis Printing and Publishing House, 1871), 126.

left, was the way to lift them out the poverty.[53] In the annual reports from these institutions, administers would list jobs that successful graduates had found, whether in factories, tuning pianos, selling books, making brooms and mattresses, or repairing cane-seated chairs.

A third school of thought rejected the focus on industrial-class jobs outright, instead asserting that all education of the blind should focus on the mind rather than on manual labor. E. B. F. Robinson, a blind Canadian who attended the Ontario Institution for the Education of the Blind and graduated with a degree in philosophy from Trinity University, claimed that it was the types of jobs the blind were taught at school that set them up for failure. Cane-chair seating, broom-making, and even piano tuning could be done much faster and at a better profit by sighted men. Robinson instead wanted education for the blind to focus far more on science and literature, for the true sphere of the blind—the title of his book on the subject—was in "mental activities."[54] Blind people, he argued, were not as easily distracted as the sighted, as "from the nature of their limitation they are peculiarly adapted to follow the intricate windings of a mental labyrinth. The blind are undistracted, undisturbed in the midst of the varying petty details of the visible world."[55] Teaching blind children the sciences opened the possibility of them attending university, just as Robinson had. Through this extension of their education, Robinson believed that more blind people could become journalists, pharmacists, teachers, lawyers, or clergy members, and even enter general medicine, veterinary medicine, or dentistry.[56] Other supporters of expanding the curriculum insisted that the blind were excellent teachers to the sighted, and by ensuring their pupils understood the sciences they were ensuring further career options for them in schools or as tutors.[57]

The Grandeur of God's Creation

Underlying each of these arguments was the expectation that the uneducated blind were particularly prone to falling into moral decay or atheism. As early as 1833, the New York Institution for the Blind

[53] *Proceedings of the Second Convention, Indianapolis*, 91-93.

[54] Robinson, *True Sphere of the Blind*, 20.

[55] Robinson, *True Sphere of the Blind*, v, 21-22.

[56] Robinson, *True Sphere of the Blind*, 195.

[57] The blind themselves also discussed this as a possible career path. See, for example, New York Institution for the Blind, *An Account of the New-York Institution for the Blind; Together with a Brief Statement of the Origin, Progress, and Present Condition, of the Institutions for the Blind in This and Other Countries* (New York: Press of G. P. Scott, 1833), 33.

released a report that described the uneducated blind as sitting in "listless vacancy at home, a prey to never-ceasing regret." Due to this pitiable lifestyle, the blind were "charged with atheism and infidelity . . . [as] a natural result of their ignorance."[58] Here, their ignorance was of the works of nature, for "to [the sighted], each tree, each plant, each flower contains a god."[59] Howe also reported on this concern in his 1843 annual report, describing the "ingenious objections of blind Saunderson to the truths of religion."[60]

Educators of the blind continued to discuss this concern for the next several decades, with Alfred L. Elwyn of the Pennsylvania Institution for the Education of the Blind describing the life of the blind in 1876 as being in such darkness that "the whole majesty of eternal power be an idea impossible to him, and all God's work as nothing." For Elwyn, the lack of sight that prevented the blind from seeing Niagara Falls, the flash of lightning, or the source of birdsong made it impossible for the blind to even conceive of a creator without the intervention of education through residential schools.[61] By introducing nature study programs supplemented with Christian religious instruction, blind children would be exposed to the true grandeur of creation and thus be saved from the tragedy of rejecting the dominant faith.[62] Other educators of the blind expanded further on Elwyn's arguments. Henry Snyder, superintendent of the Ohio Institution for the Education of the Blind, believed that science cultivated in the blind both greater knowledge of the world and a keener intellect. This in turn would encourage the blind toward "higher and holier ambitions."[63] In response to this, Mr. Couden of the Ohio Institution further claimed that only by fully unfolding the capacity of the minds of blind

[58]New York Institution for the Blind, *Account of the New-York Institution for the Blind*, 32.

[59]New York Institution for the Blind, *Account of the New-York Institution for the Blind*, 32.

[60]Richard Fowler, S. G. Howe, Perkins Institution, and Massachusetts Asylum for the Blind, *Eleventh Annual Report of the Trustees of the Perkins Institution and Massachusetts Asylum for the Blind, to the Corporation* (Boston: John H. Eastburn, Printer, 1843), 11.

[61]American Association of Instructors of the Blind, *Proceedings of the Convention of the American Association of Instructors of the Blind held in the Hall of the Pennsylvania Institution for the Instruction of the Blind, Philadelphia, PA, August 15, 16, and 17, 1876* (Philadelphia: Culbertson & Bache, Printers, 1877), 7.

[62]I have yet to come across a school for the blind that acknowledges students from non-Christian backgrounds, instead focusing on their acceptance of different Christian denominations.

[63]James W. Welch, *Achievements and Abilities of the Blind* (Columbus, OH: F. J. Heer, 1905), 230.

children would the powers of their soul be developed "to their fullest capacity."[64]

The most commonly cited reason for believing in the atheism of the blind was related to Nicholas Saunderson's rejection of religious faith in the eighteenth century. Howe, in an 1833 *North American Review* essay on the education of the blind, also described Saunderson's rejection of faith. Howe related Saunderson's rejection of the comfort of a clergyman while dying, explaining that Saunderson found the clergy's awe of Saunderson's abilities as a blind man absurd. Howe quoted Saunderson as replying to the clergy, "How often have I heard you express your wonder at my performing things which are to me perfectly simple; how then do I know that your wonder is more reasonable in the one case, than in the other."[65] In his 1867 book, *Blind People: Their Works and Ways*, Rev. B. G. Johns also describes Saunderson's atheism as related to his blindness. He explains part of Saunderson's rejection of Christian faith as asking why he had no eyes: "What had either you or I done to God, that one of us should have that organ, and the other be without it?" Johns describes Saunderson as haunted by this question his whole life.[66] With this concern expressed in the annual reports of various schools, in addition to debates held at various conventions of educators of the blind, it is clear this fear of atheism preoccupied superintendents and teachers alike.

These concerns often directly contradicted what the blind themselves had to say about the lives and experiences, including those who did not receive the benefit of an education. Maurice de la Sizeranne, a blind Frenchman, expressed how "sight is not indispensable for us to feel ourselves in contact and communion with creation," indicating in detail the joy he and other blind people felt when being able to fully immerse themselves in nature.[67] Fanny Crosby, who became known as the "Queen of Gospel Song Writers," described how her blindness did not prevent her from experiencing natural beauty or perceiving the inner meaning of things.[68] Abram Courtney, who published the earliest autobiography of a blind man in North America, reminded the reader that the sighted seem "to forget, or not to reflect, that the extinction of one faculty does not injure the others. If you prick a blind man,

[64] Welch, *Achievements and Abilities of the Blind,* 235.

[65] S. G. Howe, "Review: Education of the Blind," *North American Review* 37, no. 80 (July 1833), 20-58, 50.

[66] B. G. Johns, *Blind People: Their Works and Ways* (London: John Murray, 1867), 52.

[67] Maurice de la Sizeranne, *The Blind Sisters of Saint Paul*, trans. L. M. Leggatt (New York: Benziger Brothers, 1907), 3.

[68] Cohen Jr., "Shining Inward," 56.

does he not bleed?"[69] Despite this testimony from the blind themselves that they were not as troubled about losing faith or missing out on the glories of the sighted world, educators and the public were still uneasy and argued that this must be addressed directly through education.

Nature Study and Faith

Louis Agassiz, a nineteenth-century Swiss naturalist, introduced nature study programs into Boston schools for the sighted in the 1850s, although they did not take root until the 1890s.[70] Agassiz and other nature study advocates argued that teaching sighted children the "fundamentals of scientific investigation"—meaning direct observation of the natural world—would ensure that they would continue to observe "the subjective, the ethical and the magical that can be found in [nature]."[71] He was not trying to advance scientific investigation, in fact, European-based researchers often dismissed his work. Instead, his goal was to train teachers how to best present the natural world to students.[72] He established a field school in 1873 and invited forty-four teachers from across the United States to join him in developing new pedagogical approaches, with the aim of incorporating studies of nature into the sighted classroom and encouraging more natural science into the overall curriculum.[73] Agassiz rejected the use of textbook recitation as a teaching tool, as this did not allow students to experience the natural world as it really existed. His followers argued that his pedagogical approach to nature studies ensured that both the spirituality and moral lessons of the natural world were available to children despite the growing industrialization of the United States.[74]

These lessons, where students would carefully examine objects to better understand them, were an obvious way to include nature studies in the America classroom. Henry H. Straight, a former pupil of Agassiz's and the chair of natural sciences at the Oswego Normal School, alleged that nature study helped students to understand their role in creation.[75] Straight and his fellow educators at Oswego believed that a close study of the natural world instilled in students

[69] Abram V. Courtney, *Anecdotes of the Blind: With a Memoir of the Author* (Boston: Abram V. Courtney, 1835), 4.

[70] Kohlstedt, "Nature, Not Books," 324-25.

[71] Kevin Armitage, "Knowing Nature: Nature Study and American Life, 1873-1923" (PhD diss., University of Kansas, 2004), 5-6.

[72] Armitage, "Knowing Nature," 10.

[73] Kohlstedt, "Nature, Not Books," 327.

[74] Armitage, "Knowing Nature," 11, 19.

[75] Armitage, "Knowing Nature," 22.

a clearer understanding of "natural piety." Historian Kevin Armitage asserts that proponents of the nature study movement emphasized the connections between science and the spiritual, describing the use of nature in the classroom as "baptism of spirit" and connected to the soul of the pupil.[76] The natural world was viewed as a gift from God that needed to be appreciated, and nature study programs within schools would ensure a moral connection to the spiritual world.

These programs were introduced into school systems across North America just as progressive educators were exploring new ways of focusing education on building a child's "natural curiosity [and] . . . basic observational skills" and including a heightened piousness.[77] Like Robinson's goals for blind children, part of what drove educators to include more science in the curriculum was the hope that it would allow more sighted children to go on to higher education and become better Christians.[78] Programs designed to help elementary school teachers develop nature study in the classroom were established in New York, Massachusetts, Missouri, Illinois, and elsewhere.[79] Following on Agassiz's work, William T. Harris (head of St. Louis Public Schools and later US Commissioner of Education) wrote a widely read treatise on the subject, originally published in 1871. Harris argued that the oral method of teaching sighted children encouraged them toward "self-activity" and discouraged learning by rote instead of true understanding.[80] Textbook learning, on the other hand, encouraged students to learn by themselves how to overcome difficulties rather than having the teacher solve all the problems for them.[81] Despite a lengthy list of required texts, Harris encouraged teachers to bring in real objects that illustrated what was being taught (similar, one would expect, to the models used in schools for the blind) and to urge students to describe what they had seen or heard in their own lives.[82]

Harris outlined a method of study that began in the first grade with plants, moved on to comparing animals to humans the second year, and concluded with the elements of earth (including gravity),

[76] Armitage, "Knowing Nature," 29.

[77] Kohlstedt, "Nature, Not Books," 330.

[78] A subgroup of the Committee of Ten on Secondary Schools debated the best way to approach standardizing education in the sciences in 1892. The National Education Association created the Committee of Ten to standardize education overall across the United States with similar pedagogical goals.

[79] Kohlstedt, "Nature, Not Books," 335-36.

[80] William Torrey Harris, *How to Teach Natural Science in Public Schools* (Syracuse, NY: C. W. Bardeen, 1895), 24.

[81] Harris, *How to Teach Natural Science*, 24.

[82] Harris, *How to Teach Natural Science,* 41.

air (including weather), fire, and water in year three.[83] As sighted pupils typically spent less time in school than blind children, it was vital that this early education focus entirely on "what the pupil is not likely to pick up from intercourse with the family circle."[84] Sighted students completing three years of education would acquire at least enough to understand the industrializing world in which they would enter the workforce.[85] Those who completed more years of schooling would go on to more specialized looks at plants, animals, geology, and physics, including examining plants used in medicine, clothing, and the arts (year four); the circulation and other systems within the bodies of animals (year five); astronomy, microscope work, electricity, and barometric pressure (also year five); the structure of land, water, and meteorology (year six); and "the outlines of natural philosophy (or physics), as illustrated in familiar objects" (year seven).[86] It was the goal of these educators for this to become a universal curriculum for sighted children across the United States. Similar nature studies programs that used science to celebrate God's creation and encourage students to be devout Christians were introduced for sighted children in Canada. Educators were encouraged to conduct field studies on local plants, animals, and minerals, with some classes taught in classroom gardens.[87]

Methods of Instruction

Despite lengthy discussions over several years among North American educators of the blind, residential schools never developed a universal curriculum. However, schools that included the sciences often shared techniques, apparatuses, and textbooks across state and country lines. While discussions about how to develop a science curriculum for sighted children did not explicitly include educating blind children—most of whom were not expected to go on to postsecondary education—educators of the blind were clearly aware of them. The arguments and suggestions on how to teach the blind science drew mainly on Harris. Looking at how the blind were taught geography, physics, chemistry, biology, and zoology shows the creativity educators used to produce apparatuses and tactile models, how these tools could vary in cost and

[83] Harris, *How to Teach Natural Science,* 29-30.

[84] Harris, *How to Teach Natural Science,* 17. Harris claimed an average time in school of five years for children in the city and only three years for those in the country, while blind children usually spent ten or more years at residential schools.

[85] Harris, *How to Teach Natural Science*, 38.

[86] Harris, *How to Teach Natural Science,* 28-35.

[87] Stamp, *Schools of Ontario 1876-1976,* 187.

sophistication, and how the ongoing struggle to settle on one tactile print for use in blind schools limited advancement for students. Financial difficulties often factored into how much schools could do, and the annual reports of these schools would often feature discussions of how effectively students were learning under difficult circumstances, followed by a plea for more money. Superintendents would also reference how they were adapting science within the classroom, sharing their knowledge with other schools for the blind and with a public fascinated by the image of blind children learning.[88]

Teaching the sciences often involved creating physical models with which the blind could interact, whether by running their fingers over them or by taking them apart and putting them back together. These could be simple handmade replicas, ones that could be easily re-created through the use of molds and etchings, or more expensive ones specially built for individual schools that were used for decades. The widest variety of models were used in teaching geography. Whether giving students a clear idea of the layout of the school and city they lived in so they would be more confident in navigation, showing how their city or state fit into the overall map of North America, or demonstrating that the Earth was round, many educators considered geography essential learning for blind children. Howe argued that the blind needed to be aware of political geography in order to function in the modern world of the late nineteenth century.[89] Blind students also needed to be fully comfortable with the geographic space they lived in, and models with which students could interact in the safety of their schoolroom would ensure that blind students learned about their surroundings and how to navigate through them.

Mock-ups were made of various materials, depending on their purpose and the financial resources available. Some reproductions of the school and surrounding neighborhood, built by the students as they became more familiar with the space, were made of pins and string stuck into a cushion. As teachers tried to make these maps more tangible, they used clay.[90] These maps gave students, who had often traveled far distances to attend the only residential school in their area, a stronger sense of place and more confidence in navigating the world on their own. For larger maps of the state, province, or country, schools had a few different options, depending on cost. Again, some relied on

[88] For further discussion of the public's fascination with demonstrations of blind children reading, doing science, or creating handicrafts for sale, see Klages, *Woeful Afflictions*.

[89] B. L. McGinnity, J. Seymour-Ford, and K. J. Andries, "Geography," Perkins School for the Blind, http://www.perkins.org/history/curriculum/geography.

[90] Robinson, *True Sphere of the Blind*, 153.

string, pins, and a cushion to give students an idea of the larger map, while other low-cost methods included pinpricks tracing the edges of the state boundaries and geographic features on a paper map, or using a machine to sew a map onto thick fabric.[91] Schools with more money would commission wooden maps, with states or countries carved like puzzle pieces that could be fit together and geographical features laid out with tacks or carved into the wood.[92] Howe decided that a globe was necessary, partly for world geography and partly to explain the rotation of the round earth, and commissioned the first tactile globe made in North America. The final product, finished in 1837, was thirteen feet in circumference and made out of seven hundred pieces of wood carefully glued together, while the landmasses were made out of papier-mâché and emery cloth.[93] While no other institution appears to have requested something of quite that size and sophistication, many schools did seek out smaller tactical globes, which Howe was happy to sell for between $40 and $75.[94]

As techniques in creating touchable maps improved, schools began purchasing more easily reproducible maps for each student in a class. These maps were created using a carved block of wood that showed the map in relief and were printed with the edges raised in a similar manner to books with raised tangible print. While these maps were not for longtime use—one educator complained about how quickly they wore out—they were inexpensive and allowed each student in a class to interact with a map in front of them during a lesson.[95] For educators, this was similar to placing a map at the front of the classroom for sighted students, since blind pupils could feel along the map to get a clearer idea of the layout of the area they were discussing. In response to those who doubted the financial cost of what were, essentially, disposable maps, S. A. Knapp of the Iowa Institution for the Education of the Blind pointed out that by having the maps in front of them his pupils "have made more progress in the study of geography . . . than was made before in quadruple the time." [96] Without this constant reminder that students could consult throughout the day, they would lose track of the physical spaces they were learning about and quickly become lost in the lesson.

[91] Robinson, *True Sphere of the Blind*, 153; and *Report of the Trustees and Principal of the Missouri Institution for the Education of the Blind to the Twenty-Second General Assembly*, (Jefferson City, MO: W. A. Curry, 1863), 1.

[92] Robinson, *True Sphere of the Blind*, 154.

[93] McGinnity, Seymour-Ford, and Andries, "Geography," paragraph 9.

[94] *Report of the Trustees and Principal of the Missouri Institution,* 14.

[95] *Proceedings of the First Meeting, Boston,* 60.

[96] *Proceedings of the First Meeting, Boston,* 60.

Teachers of the blind also had heated discussions about the best ways to provide something palpable that students could consult, such as textbooks with embossed figures or print. Throughout the nineteenth century and into the twentieth, administrators and educators debated at length the best form of tangible print to use for their students, arguing about dot-based texts like Braille versus raised-print texts like Boston Line.[97] With limited funds split between three or four different publishing houses, translating texts into tangible print slowed to only the most important of books, which were usually religious in nature.[98] As a result, most education for the blind was done orally—in some schools teachers dictated textbooks while their students recorded them in Braille or another dot-based print.[99] Other schools continued to reject the idea of textbooks, arguing that students would rely on them too much rather than developing their own thoughts.[100] Without an agreed-upon tangible print, it was difficult for teachers to bring textbooks into the classroom. Again, teachers needed to rely on various forms of interactive models, even outside of geography—one that could be explained orally while students played with them.

Thus educators relied on interactive counting boards and movable slates to teach basic mathematical skills, rather than the more common textbooks used in schools for the sighted. Students in Missouri, for example, learned on a metallic slate "divided into small squares in which [movable] figures [were] placed" that allowed students to perform all common mathematical operations. Once they mastered the basics of addition and subtraction, however, students preferred to do math in their heads.[101] This technique was used throughout the nineteenth century to teach the youngest pupils the basics.[102] Other educators looked backward to Saunderson's "counting board" for working out more complicated math and keeping track of more numbers. This board used squares with one hole in the center

[97] For a brief overview of this debate, see Robert B. Irwin, *The War of the Dots* (New York: American Foundation for the Blind, 1970); Joanna L. Pearce, "The Tactile Babble Under Which the Blind Have Hitherto Groaned: Dots, Lines and Literacy for the Blind in Nineteenth-Century North America," in *Edinburgh History of Reading: Subversive Readers*, ed. Jonathan Rose (Edinburgh, UK: Edinburgh University Press, 2020), 97-115.

[98] With much reluctance, I must admit that a discussion of this debate is outside the scope of this paper.

[99] *Proceedings of the First Meeting, Boston,* 59.

[100] *Proceedings of the Convention, Philadelphia*, 77-78.

[101] *Fifth Biennial Report of the Missouri Institution for the Education of the Blind to the Twenty-Fourth General Assembly* (Jefferson City, MO: W. A. Curry, 1867), 10.

[102] Robinson, *True Sphere of the Blind*, 151.

surrounded by eight other holes. The numbers from zero to ten were represented by various pins that could be placed and moved around easily as the numbers were manipulated in equations.[103] While it is unclear how widely North American schools used this board, students who learned with it or similar slates relied on them, and alumni at the Ohio Institution for the Education of the Blind protested when the institution decided to stop using them.[104]

Educators of the blind felt that geometry was particularly useful to their students, as it gave them a firmer grasp on the physical world. When addressing the Convention of the American Association of Instructors of the Blind in 1876, W. H. Churchman, superintendent of the Indiana Institute for the Education of the Blind, described "how limited the horizon of the blind person is; he has no greater radius than the length of his arm." Churchman argued that classes such as geometry and geography heightened the conceptive power of the blind and allowed them to "infer a great deal with regard to external objects," particularly mountains and planetary systems.[105] Mrs. T. H. Little, the superintendent of the Wisconsin Institute for the Blind, agreed, stating that "geometry is perhaps the most beneficial study for blind scholars . . . because it teaches them a conception of outside objects; they can more easily get a correct conception of physical objects from a description after studying geometry."[106] In order to ensure that students understood shapes and movement in space, George Lindsey, a teacher at the Ohio Institution for the Education of the Blind, argued that it was important they have access to textbooks with "numerous and well-chosen examples. . . . Definitions and principles might also be introduced, but the demand for examples is special and urgent. Every scholar . . . should likewise have an example book for that study."[107] The Virginia Institution for the Deaf and Dumb and Blindrose to Lindsey's challenge by designing and printing tactile books with raised diagrams made with the same embossed printing techniques used for maps. They made enough of these to share with other institutions, although they were likely both expensive and quickly wore out from repeated use.[108] However, students could

[103] J. J. Tattersall, "Nicholas Saunderson: The Blind Lucasian Professor," *Historical Mathematica* 19, no. 4 (Nov. 1992), 358.

[104] Welch, *Achievements and Abilities of the Blind*, 123.

[105] *Proceedings of the Convention, Philadelphia,* 78.

[106] *Proceedings of the Convention, Philadelphia,* 77.

[107] *Proceedings of the Second Convention, Indianapolis,* 11.

[108] *Report of the Trustees and Principal of the Missouri Institution for the Education of the Blind to the Nineteenth General Assembly,* (Jefferson City, MO: James Lusk, Public Printer, 1857), 11.

study the figures outside of the classroom, something the blind could rarely do—much to the chagrin of their teachers at the end of each summer break.

However, most schools, unable to afford these specially printed textbooks, relied on handmade models. Students again used pins and string on cushions or pegboards to explore shapes, lines, and angles, or used their fingers to read diagrams that had been made on cloth using a sewing machine.[109] Some schools used something called "Vitali's ink," a glutinous ink which, after drying, "would give relief enough to be felt by the finger of the blind man" although these needed to be made with care.[110] The ink became smooth after hardening and was used to "give the blind an idea of the form of the letters" if they had not had the chance to learn to write before becoming blind.[111]Unlike textbooks for the sighted, handmade diagrams were rarely labeled, as the tangible prints in use were either of a problematic size or did not take to the material. Regardless, the students could interact in some way with the models and diagrams, and thus were able to gain insight into how the shapes worked. As a result, as Little and Churchman described, students could get a clear idea of how various objects and shapes felt and had a better understanding of objects they had never interacted with but that had only been described to them. "The more that [conceptive] power is cultivated," Churchman argued, "the better the pupil will be able to understand."[112]

By teaching blind children geography and geometry, educators believed they were giving their pupils a clearer idea of the physical space they inhabited as well as the divine glory of the Earth. With this increased awareness of the space around them, blind children would feel more confident while they moved around in the world, appearing less like lost savages and more like their sighted, civilized counterparts. This conceptive power that Churchman discussed was also important in ensuring students understood the beauty of God's creation. Elwyn described the blind as living in a meaningless darkness:

> He may hear the rush of the storm, the singing of the birds—all the poetry of the world may speak in rich and beautiful language, and the effect be as nothing, from the source not being seen. . . . How can the existence of a God be introduced in the mind of one who sees no evidence of his power?[113]

[109] Robinson, *True Sphere of the Blind*, 160.

[110] Arthur Good, "Writing-Machines for the Blind," *Popular Science Monthly* 33 (Sept. 1888), 650.

[111] Robinson, *True Sphere of the Blind*, 150.

[112] *Proceedings of the Convention, Philadelphia*, 78.

[113] *Proceedings of the Convention, Philadelphia*, 5.

This was by no means an uncommon sentiment. Educators of both the deaf and the blind discussed which disability was more of a burden to a child's development, particularly which left children the most debilitated in their ability to be truly Christian. For the deaf, the fear was that they could not learn religious practices or understand the scriptures, but at least they could see the majesty of the world.[114] Educators of the blind, however, needed to find ways to bring that majesty to their pupils by bringing it to their fingertips.

Work that relied on simple observation, such as zoology, biology, and physiology, was relatively easy to teach to blind students. While, as Robinson explained, the "microscopic work must be taken on trust," most of the work was done by bringing in specimens—live ones, in some cases—for the students to interact with.[115] Della Bennett, a sighted teacher at the Perkins School for the Blind, discussed how having students observe the months-long metamorphosis of a caterpillar into a moth taught "faith in the stillest and darkest hour." She encouraged her fellow teachers to "put your pupils in direct communication with nature" in order to bring out the best in their minds.[116] Mostly, though, these were either models made of clay, wood, or other material, or stuffed and mounted animals. To best explain the finer differentiations between various species, models would be made larger for tiny fingers to explore. Students were expected to remember the details and associate them with the models, as the three boys did in the Perkins presentation on owls and bean plants.[117]

Educators would often share anecdotes of the wonder students felt at interacting with models, and their sudden understanding of the greatness of the world they could not see. Henry Snyder of the Ohio Institution for the Education of the Blind discussed one of his students interacting with a model of a duck:

> One especially diligent and intelligent girl seemed very much pleased with the plump body and fine plumage of a wood duck. Soon after, her first impressions gave way to more sober thoughts. Then her face was wreathed with astonishment. She declared, "Well, what a duck! It has but two legs, and I always thought that all kinds of birds have four legs." This single incident may bear testimony as to the value of

[114] Alessandra Iozzo, "'Silent Citizens': Citizenship Education, Disability, and d/Deafness at the Ontario Institution for the Education of the Deaf, 1870-1914" (PhD diss., University of Ottawa, 2015), 101.

[115] Robinson, *True Sphere of the Blind*, 163.

[116] Della Bennett, "Science for Our Schools," *The Mentor* 1, no. 5 (May 1891), 146-47.

[117] Robinson, "True Sphere of the Blind", 165.

> systematic collections of animals, and, in fact, all of the most common things about us.[118]

Other sciences, particularly physics and chemistry, relied on students performing experiments in order to gain a fuller understanding. Students used various electrical appliances designed to explain the laws of heat, sound, and light. Educators who supported students doing their own experiments in class argued that they were done with "comparatively as few accidents as in schools for the sighted," although details on these accidents were not forthcoming in their reports to donors or other educators.[119]

How effective these methods were at educating the blind is unclear. The annual reports of schools focused on their successes, in part due to their continuing need for funds.[120] The principal of the Ontario Institution for the Education of the Blind described the effectiveness of tactile maps in teaching children the geography of Ontario and Canada, explaining that students could easily trace the railway routes around the province, while the object lessons (recently improved by adding such things as seals, ducks, and kangaroos to the curriculum) were described as showing "a very correct idea of the size, shape, etc of the various animals about which they read . . . too high praise cannot be bestowed on the pains taken to the instruction of this class."[121] Mary Redick of the Ohio Institution described how including clay models in her classroom had a "transforming effect on the pupils . . . dispelling . . . the misty shadows which hang over the dark pathway through which they must feel their way to a knowledge of the things around them."[122] Snyder elaborated by describing the tears of "joy and thankfulness" of a girl whose study of a model of

[118]Henry Snyder, "A Chip from an Ohio Workshop," *Proceedings of the Eighth Biennial Convention of the American Association of Instructors of the Blind Held at the Missouri School for the Blind at St. Louis, Missouri, August 19, 20, and 21, 1884* (St. Louis: Commercial Printing Company, 1885), 44.

[119]Robinson, True Sphere of the Blind," 163]

[120]For further discussion of institutions needing to show that their disabled pupils were being effectively educated in order to maintain government and public funding, see Rose, *No Right to Be Idle*, 2-48; and Pearce, "Not for Alms but Help."

[121] *Ontario Institution for the Education of the Blind—Brantford, Ontario, Canada Report of Principal Dymon, Dr. L. Secord, Acting-Physician, and the Examiners for the Year Ending September 30th, 1888* (Brantford, ON: Watt and Sherston, 1889), 12, 22-23, 24.

[122]Mary S. Redick, "The New Education, or Kindergarten for the Blind," in *Proceedings of the Sixth Biennial Convention of the American Association of Instructors of the Blind held at the Kentucky Institution for the Blind at Louisville, KY, August 17, 18, and 19, 1880* (Louisville: John P Morton, 1880), 43.

the ear "has taught me the sweet lesson that I can do something for myself. I never felt until now that I could study anything for myself."[123]

However, outsider reports did not always support educators' reports of success. Ian Grosvenor and Natasha Macnab describe how museum curators in New York created handling sessions for blind students in 1909 and found students lacked real knowledge of the appearance of domesticated animals beyond cats and dogs; students often struggled to truly comprehend the size of the actual animals they were examining via models and stuffed version.[124] While these models may have been effective in giving students insight into the breadth of God's creation, the details may have been lost due to the techniques in use.

Responses of the Blind

Discussions about the proper use of science in schools were not limited to educators of the blind. The blind themselves also debated how to best achieve an effective education that would set graduates up for success after leaving school. While some, like Robinson, argued that the blind needed higher education in order to be truly successful, others claimed it was a distraction. At the 1885 meeting of the Ohio Institution for the Education of the Blind's alumni association, several blind graduates spoke against science education in their school. Albert Bohrer, echoing sentiments expressed by Wilkinson and other educators, contended that while his scientific education prepared him to identify all the parts of a cow at the butcher, it did not give him the ability to afford to buy beef.[125] A Mr. Henderson further expanded on Bohrer's argument, pointing out that the true purpose of educating the blind must be to set them up for independence. "But, if so much of their time is taken up by studies [of literature and science, including nature study programs], which only discipline and develop the blind, it is impossible for them to perfect themselves in those branches where are necessary for the accomplishment of the great object" he claimed.[126] His speech, which engendered much debate at the alumni association gathering, described how graduates were still being set up for failure, as the knowledge acquired would not "help a man to make a

[123] Snyder, "A Chip from an Ohio Workshop," 43.

[124] Ian Grosvenor and Natasha Macnab, "'Seeing Through Touch': The Material World of Visually Impaired Children," *Educar em Revista* 49 (July/Sept. 2013), 46, 53. A further exploration of museums and tactile exhibitions for the blind in North America is a fruitful avenue of inquiry but is outside the scope of this paper.

[125] Welch, *Achievements and Abilities of the Blind*, 190.

[126] Welch, *Achievements and Abilities of the Blind*, 183.

broom or a girl to sew a hem."[127] Educators held debates at their various conventions on whether educating the blind in the natural sciences was a waste of time—time that could be better spent on subjects that ensured the success of blind graduates.[128]

However, these were not the only sentiments Ohio Institution alumni expressed at the meeting. A Mr. Bodle pointed out that a scientific education prepared the blind for the changing world outside the institution, particularly for the wonders of the telephone and telegraph. While Bohrer and Henderson maintained that a scientific education was a distraction, Bodle asserted that it enhanced the education the blind were already receiving. He believed that as "the old methods were giving place to the new the institution had drawn a newer life from the old."[129] Others agreed, arguing that having an education similar to that of the sighted further proved that the blind could be independent and were as intelligent as their sighted counterparts. Without a complete education that included the natural world and literature, "how can we be men and women among men and women?" asked one graduate.[130] Notably, blind people did not discuss how a scientific education could affect one's religious faith, instead focusing entirely on the practicalities of the education they received.

Teaching blind children biology, zoology, and natural history was meant to ensure the blind were aware of the beauty of the world and the breadth of God's creation, despite being unable to see any of it. This reflected the fear that the blind were particularly prone to falling into moral apathy and atheism. When describing why educating the blind through nature study was so important, Elwyn ended his speech by praising the men

> who are striving as far as is possible to make up for the loss of one of the chief sources of man's intercourse with the world, to give direction to, and make active minds, that else under such loss would be dormant; to place on a level with their fellows, those who cannot feel all the beauty of the world in which they live; to carry out the design of the Creator by perfecting that which is imperfect, and to give light where He made all dark.[131]

Variations on the techniques educators developed in the nineteenth century are used to educate the blind today. The Perkins School for the Blind e-learning site describes the use of tactile models,

[127] Welch, *Achievements and Abilities of the Blind*, 183.
[128] Welch, *Achievements and Abilities of the Blind*, 184.
[129] Welch, *Achievements and Abilities of the Blind*, 187.
[130] Welch, *Achievements and Abilities of the Blind*, 188.
[131] *Proceedings of the Convention, Philadelphia*, 8.

including maps and other hands-on materials. These are supplemented with "multi-sensory lessons" that include audio descriptions alongside larger print for students with partial vision. Educators are encouraged to be creative in adapting lessons for students with multiple disabilities, including trips to museums or farms.[132] Raised black line drawings are used in classrooms alongside talking data collection devices, adapted periodic tables, and models of atoms and molecules that students can take apart.[133] Three-dimensional printing technologies allow innovative educators to make their own classroom models.[134] Just as their nineteenth-century counterparts, educators of the blind continue to use carefully designed models to show the complexity of the natural world, encouraging discussions not about God's grandeur but instead about biodiversity and the importance of preserving healthy ecosystems.[135]

Despite the challenges educators of the blind have faced, every year they used time and ingenuity to expand the science curriculum, particularly the nature study programs, for blind students. This ingenuity showed the strong commitment that many teachers of the blind had toward ensuring their students would be as successful as possible, despite mounting evidence that the educated blind struggled to find financially supportive work. However, by demonstrating their students' ability to learn, as much as possible, in similar ways to sighted children, these educators were calling on the public to view their students as nearly equal, rather than inferior. Demonstrations of student's successful nature study in schools for the blind became more common in the late nineteenth and early twentieth centuries, showing both how students were learning and that they could be integrated into sighted society. These classes prioritized teaching students about the natural world they could not see, which was meant to make them more independent and give them more confidence in interacting with people

[132]Perkins School for the Blind, "Accessible Science: General Tips," Perkins School for the Blind eLearning, https://www.perkinselearning.org/accessible-science/getting-started.

[133]Kate Fraser, "Simple Adaptions to Increase Accessibility in Science Instruction," Perkins School for the Blind eLearning, Dec. 7, 2015, https://www.perkinselearning.org/accessible-science/blog/simple-adaptations-increase-accessibility-science-instruction.

[134]Nonscriptum, "3D Printed Teaching Models," Perkins School for the Blind eLearning, Sept. 9, 2019, https://www.perkinselearning.org/technology/blog/3d-printed-teaching-models.

[135]Olivia Kate Cerrone, "Sight Unseen: This Teacher Brings Science to Life for Blind Students," *Christian Science Monitor*, Dec. 2, 2019, https://www.csmonitor.com/World/Making-a-difference/2019/1202/Sight-unseen-This-teacher-brings-science-to-life-for-blind-students.

outside of the residential school system in addition to giving them the understanding of the grandeur of God's creation that they could not see. These were also ways of showing that education could ensure the blind would not become burdens on society but could be brought into the proper, civilized, pious sphere of the sighted.