Educators’ Views on Dissection Alternatives at the Onset of the COVID-19 Pandemic

PAMELA OSENKOWSKI, IGNAS KARALIUNAS, MERARI DIORIO

ABSTRACT

When the COVID-19 pandemic struck in 2020, many schools made the decision to cancel face-to-face classes and move instruction online. To better understand how the pandemic affected science educators’ plans to conduct classroom animal dissection exercises, we conducted a nationwide survey of biology teachers (n = 2131) and asked about their experience as classes transitioned to online. Our survey revealed that 72% of biology educators had planned on having their students participate in classroom animal dissection exercises in the spring of 2020. Of those educators, 29% shifted to the use of dissection alternatives, such as web-based programs, as a result of remote learning. Our survey investigated which alternatives were most used, whether teachers were already familiar with the alternatives, how teachers identified those alternatives, and whether the educators planned to use dissection alternatives again for in-person or online learning. These survey results provide insight into biology educators’ use of dissection alternatives during the COVID-19 pandemic as well as their post-pandemic plans and may increase awareness and usage of dissection alternatives within the educational community.

Key Words: alternatives; dissection; education.

Introduction

The practice of dissecting animals for biology instruction in American classrooms has a long history, beginning in the 1920s and becoming more widely practiced with the establishment of the Biological Sciences Curriculum Study in the 1960s (Orlans, 1988; NABT, 1990). Recent surveys show that dissection remains a common practice, with ~85% of high school biology teachers offering dissection exercises to their students (Osenkowski et al., 2015; NAVS, 2020). Many animal species, including frogs, pigs, cats, and crayfish, have become regular candidates for dissection, and students often participate in multiple dissections as part of their pre-college science education (Oakley, 2013). Although statistics on the numbers and species of animals used for classroom dissection exercises in the United States are not maintained, some sources estimate that 10–12 million animals are used for this purpose annually (Rosenberger, 1998).

Interestingly, classroom dissection does not occur in countries such as Argentina, Israel, the Netherlands, the Slovak Republic, and Switzerland, and is rare and being phased out in other countries, including England, Germany, Sweden, and India (Oakley, 2013). While the practice of dissection is common in the United States, 16 states have adopted student choice policies or laws that give students the right to opt out of animal dissection exercises and participate in an alternative activity, without penalty. A handful of other states have more general policies that allow students to opt out of any classroom activities with their parents’ or guardians’ consent (NAVS, n.d.). In total, student choice laws or policies exist at the state level in 22 states, plus Washington, DC, and in many large public school districts in other states (Suiter et al., 2016).

Over the years, various methods have been developed to teach students about anatomy and physiology without the use of animal specimens. These dissection alternatives have evolved as technology continues to advance, with many web-based programs, apps, and other models now being widely available to teachers and students. Many of these virtual programs are designed to work on tablets, laptops, desktops, and interactive white boards. Several are available for free or for a nominal fee (BioLEAP, n.d.).

Dozens of studies examining the efficacy of student learning with dissection alternatives have demonstrated that students using non-animal alternatives perform as well as or better than students using animal dissection specimens, concluding that they are effective teaching tools. Thorough meta-overviews of such studies are available online (Animalearn, n.d.; Society for Humane Science, n.d.). The most recent published meta-analysis, which examined 50 studies comparing the learning outcomes of students using traditional animal specimens versus the use of alternatives for activities including dissection, found that in 90% of
studies, alternatives were as effective as or more effective than traditional animal specimens in achieving desired learning outcomes (Zemanova & Knight, 2021). Some studies have attributed the effectiveness of alternatives to the way in which they are designed, because many virtual alternatives include detailed information on the animal being studied, as well as built-in assessments, to further enhance students’ learning experiences (van der Valk et al., 1999; Oakley, 2013). In addition, with dissection alternatives, students can work at their own pace and repeat the virtual dissection, which may help them retain information better (Lalley et al., 2010).

Despite the advantages that dissection alternatives offer, biology instructors continue to hold strong feelings about their preference for using dissection specimens in the classroom. A recent survey conducted by the National Anti-Vivisection Society revealed that more than half of educators polled (56%) viewed dissection as an important tradition in biology education. The majority of educators did not believe that alternatives were as good as dissection for teaching anatomy and physiology (54%) and did not believe that technology will make dissection obsolete (59%) (Osenkowski et al., 2015). At the same time, however, our survey revealed that 59% of biology teachers felt that information about dissection alternatives is not widely disseminated (Osenkowski et al., 2015). If educators were better informed about available dissection alternatives, the effectiveness of alternatives as teaching tools, and other advantages of using these resources, they might be more open to using alternatives in the classroom.

During the second half of the 2019–2020 academic year, many educators unexpectedly had to deliver course content remotely due to the coronavirus pandemic. Educators who had planned classroom dissection exercises for their students may have been forced to change their plans and either cancel the dissection exercises or use alternatives in place of animal dissection. While our previous survey revealed that 70% of educators reported using alternatives in some capacity, only about 36% of educators reported using them in place of traditional animal dissection (Osenkowski et al., 2015).

The goal of the present study was to learn more about the change in teaching modality that biology educators faced because of the COVID-19 pandemic and to document how teachers had to pivot during remote instruction. Given that the use of dissection alternatives was a viable option for biology educators to use for remote learning, and that a minority of educators had experience using them as replacements for dissection specimens, we conducted a survey to better understand which dissection alternatives were most used by biology educators during the COVID-19 pandemic, how teachers identified those alternatives, and whether they planned to use dissection alternatives again for in-person or online learning.

Methods

Names and email addresses for 27,224 biology teachers at public and private schools were obtained through the Market Data Retrieval database, with an emphasis on high school educators. Participants were asked to respond to an online survey administered through SurveyMonkey during August 3–17, 2020, with multiple-choice and free-response questions that addressed how their delivery of course content changed during the COVID-19 pandemic, focusing on the use of dissection alternatives. A total of 2131 teachers responded to the survey, representing a response rate of 7.8%. Responses were received from educators in 50 states, plus Washington, DC. (For further details, see the Supplemental Material available with the online version of this article.) Educators reported teaching at the fifth-grade through college levels, with most, 97.7%, teaching at the high school level, grades 9–12. Two percent of educators indicated teaching at the middle school level, grades 5–8, while <1% of educators reported teaching at the college level.

Please note that this data set is subject to nonresponse bias, in that the behaviors and attitudes of participants who did not respond to the survey may be substantially different from those of the respondents.

Results

A nationwide survey of biology teachers was conducted to better understand how the coronavirus pandemic affected science educators’ plans to conduct classroom animal dissection exercises in the spring of 2020. Our research indicated that animal dissection continues to be a common practice in the United States, as 72% of educators reported planning classroom animal dissection exercises at that time (n = 2127).

Interested in learning more about how teachers had to change their methods of teaching during remote instruction, we followed up with the educators who had planned classroom dissection exercises for the spring 2020 semester and asked them if the pandemic and any related school closings changed their plans to hold dissection exercises in class. Of the 1502 educators who responded, 67% canceled their scheduled dissection exercises and chose not to pursue the use of dissection alternatives for remote learning, while 29% of educators polled used dissection alternatives for online instruction. Approximately 3% of respondents were able to hold all of their scheduled dissection exercises in class. Data from educators who used dissection alternatives for remote learning (n = 438) were further analyzed.

Educators were next asked about which dissection alternatives they selected for their students for remote learning. Forty-two percent of instructors relied on various web-based programs or dissection apps to deliver dissection-related content to their students. Some of the most-used resources were ones from FlinnPrep, Whitman College, Biology Corner, EdPuzzle, McGraw Hill, PBS, Glencoe, eMind, and Carolina. Thirty-three percent of instructors used videos of dissection that they found online, while 9% of instructors recorded themselves or others doing the dissection. A smaller percentage of instructors (2%) relied on either paper dissection exercises or worksheets (Table 1).

Table 1. Dissection alternatives commonly used for remote learning at the onset of the COVID-19 pandemic (n = 379).

| Various dissection apps/web-based programs | 42% |
|-------------------------------------------|-----|
| FlinnPREP                                 | 7%  |
| Whitman College                           | 5%  |
| Biology Corner                            | 4%  |
| EdPuzzle                                  | 3%  |
| McGraw Hill                               | 2%  |
Given that the survey we published in 2015 revealed that ~60% of educators felt that information about alternatives is not widely disseminated, we wanted to understand how familiar educators were with the alternatives that they selected for remote learning. Of 400 biology educator respondents to the 2020 survey, 60% revealed they were familiar with the dissection alternative they chose to use during the COVID-19 pandemic; 37% were not familiar with the alternative(s); and 3% responded “Not applicable.”

Next, we set out to understand how educators identified which dissection alternative(s) to use. An analysis of this free-response question revealed that most educators, 51%, reported looking online for available alternatives (Table 2). Twenty-three percent of educators selected alternatives based on their ease of use or personal preference, while 10% used available resources from past experiences. Six percent of educators reported using resources that aligned with their curriculum or textbook. (We would like to note that modern curricula, including the International Baccalaureate, the Next Generation Science Standards, and the College Board’s Advanced Placement program do not require animal dissection.) Four percent of respondents indicated that a colleague helped them with their selection.

When asked whether they would consider using dissection alternatives again if learning continues remotely, 97% of educators responded “Yes,” 2% responded “No,” and 1% responded “Not applicable” (Table 3A). The educators further elaborated on their responses, with 59% indicating their openness to using alternatives again based on their availability, price, and other factors. Fourteen percent of respondents reported good experiences with alternatives because of their ease of use and the positive experiences that their students had using them, with an additional 8% responding that they already use alternatives or make their own and would consider doing so in the future. Thirteen percent of educators indicated having some concerns with using dissection alternatives and preferred the use of dissection specimens.

Next, we examined whether educators would consider using dissection alternatives again when in-person classes resume. Most instructors (63%) responded “Yes,” 35% responded “No,” and 2% responded “Not applicable.” The educators further elaborated on their responses, with 38% indicating that they would use dissection alternatives as part of a pre-laboratory exercise, in conjunction with animal dissection, or for students who opt out of dissection exercises. Thirty-two percent of respondents indicated their preference for animal dissection specimens, while 22% indicated they would use alternatives again for reasons including cost savings and the fact that the alternatives save animal lives. Two percent of respondents said their ability to use dissection alternatives during in-person learning would depend on the school budget or the opinions of other colleagues or administrators at the school (Table 3B).

Educators who planned on using dissection alternatives again in the future were also asked how they planned on using them. Sixty-one percent of educators said they plan to use alternatives in conjunction with animal dissection specimens, 16% plan to use them in place of dissection specimens, and 15% responded “Not applicable” (Table 4). Eight percent of respondents selected “Other (please specify).” Of those respondents, 3% said they would use alternatives both in conjunction with animal dissection and in place of it, 3% planned to use alternatives only for remote learning, 1% were not sure, 1% planned to use alternatives for make-up work for students who miss class, and <1% said they do not plan on using alternatives.

| Various dissection apps/web-based programs | 42% |
|-----------------------------------------|-----|
| PBS                                     | 2%  |
| Glencoe                                 | 2%  |
| Emind                                   | 2%  |
| Carolina                                | 2%  |
| Froguts                                 | 1%  |
| Teachers Pay Teachers                   | 1%  |
| Maricopa                                | <1% |
| Project Lead the Way                    | <1% |
| Cornell University                      | <1% |
| Labster                                 | <1% |
| Exploratorium                           | <1% |
| Other various websites                  | 8%  |
| Videos of dissection found online        | 33% |
| Recorded themselves or others doing the dissection | 9% |
| Not applicable                          | 9%  |
| Other (not specified)                   | 3%  |
| Paper dissection                        | 2%  |
| Worksheets                              | 2%  |

Table 2. Identification of dissection alternatives by biology educators during the COVID-19 pandemic (n = 382).

| 51% looked online for available alternatives | 23% selected alternatives based on ease of use or personal preference | 10% used available resources from past experiences | 6% responded “Not applicable” |
|---------------------------------------------|---------------------------------------------------------------|---------------------------------|-------------------------------|
| 6% used resources that aligned with their curriculum or textbook | 4% indicated that a colleague helped make the selection |

Discussion

While the COVID-19 pandemic and the related move to online learning for teachers and students provided educators with a unique opportunity to use dissection alternatives as a replacement for animal dissection specimens in the spring of 2020, our survey revealed that most educators who were planning to conduct classroom dissection exercises did not choose to work with dissection alternatives when classroom instruction shifted online. Seventy-two percent of biology educators polled had planned on conducting classroom dissection exercises in the spring of 2020, and 67% of those educators...
chose not to pursue the use of dissection alternatives during remote instruction and instead canceled dissection-related activities. Additionally, of the educators who plan on using dissection alternatives in the future, most (61%) intend to use them in conjunction with animal dissection, while 16% plan to use them as replacements for dissection specimens. Although we did not explore the explanations behind their decisions, our previous survey findings suggest that they may be due to the strong opinions teachers hold about the benefits of dissection or concerns they have about the effectiveness of alternatives. A previous survey conducted by the National Anti-Vivisection Society revealed that 70% of biology educators feel that dissection is the best way to teach anatomy and physiology, and only 21% of educators feel that dissection alternatives are as good as dissection for teaching anatomy and physiology (Osenkowski et al., 2015).

Alternatively, teachers may not have relied heavily on dissection alternatives during the pandemic, in part, due to the stance that teaching organizations, such as the National Association of Biology Teachers (NABT), have about dissection and alternatives. The most recent NABT position statement regarding the use of animals in biology education indicated that “utilizing a software-only approach may constitute a disservice to many students and
does not acknowledge the well-documented educational benefits of hands-on dissection” (NABT, 2019). This statement does not consider the well-documented educational benefits of using dissection alternatives (Zemanova & Knight, 2021; Animalearn, n.d.; Society for Humane Science, n.d.). The National Science Teaching Association (NSTA) policy on dissection, last updated in 2008 and currently under revision, reflects greater support for the use of alternatives, acknowledging the development and improvement of alternatives and enabling teachers to decide for themselves whether animal dissection or the use of alternatives is most appropriate for their students (NSTA, 2008). A further conversation with biology educators about their use of dissection alternatives during the COVID-19 pandemic could highlight the value alternatives provided in enabling educators to continue delivering course content to their students in the absence of dissection specimens and may encourage teaching organizations to be more supportive of dissection alternatives.

We must also consider an alternative explanation. The fact that only 29% of educators chose to use dissection alternatives for remote learning and that a minority of educators plan to use dissection alternatives as a replacement for traditional animal dissection in the future may be attributed to another finding from our previous survey – that the majority of educators (59%) feel that information about dissection alternatives is not widely disseminated (Osenkowski et al., 2015). Educators may have felt that they did not have the time or resources to effectively make the switch from in-person learning to an online format using dissection alternatives. Nearly 38% of respondents who used dissection alternatives during the pandemic indicated that they were not familiar with the dissection alternatives they chose to work with. This suggests that teachers may benefit from having more information about available dissection alternatives, the strengths and weaknesses of specific alternatives, and the results of studies that have been conducted that compared the learning outcomes of students who have used alternatives versus traditional animal dissection. Greater availability of this information may result in increased use of dissection alternatives for remote or in-person instruction.

To that end, more should be done to inform educators about studies that have examined the effectiveness of dissection alternatives as learning tools. The outcomes of student learning when using traditional animal dissection compared to dissection alternatives have been examined in numerous studies. In general, students using non-animal alternatives have been found to perform as well as or better than students using animal models, and studies have demonstrated that alternatives can be used to meet most learning objectives (van der Valk et al., 1999; Oakley, 2013; Zemanova & Knight, 2021; Animalearn, n.d.; Society for Humane Science, n.d.). One review of >30 published studies comparing how well students from pre-college to medical school levels learned with alternatives versus animal specimens concluded that there was “solid support for the replacement of traditional learning methods” involving animals with alternative approaches (Balcombe, 2003). The most recent published meta-analysis comparing learning outcomes of students using traditional animal specimens versus alternatives from 50 publications reached a similar conclusion, stating “there is no valid educational reason for continued harmful animal use in education and training” (Zemanova & Knight, 2021).

Additionally, although teachers hold strong feelings about their preference for using dissection specimens in the classroom, educators must consider that use of dissection alternatives in place of traditional animal dissection specimens is an effective way to incorporate Russell and Burch’s “3 R’s principle” – reduction, refinement, and replacement of animal use – in education (Russell & Burch, 1959). The 3 R’s principle is widely discussed and implemented in the scientific research community; however, more can be done to apply the 3 R’s in science education. Many of the animals used for dissection are harvested and killed specifically for biological study. Given that alternatives to the use of animal specimens exist and have been shown to be effective teaching tools, information about dissection alternatives should be widely disseminated to biology educators and their use should be encouraged.

Conclusions

While teaching during the COVID-19 pandemic posed challenges for many educators, it also gave science teachers who had not previously worked with dissection alternatives an opportunity to do so. This push to have educators think outside of the box with respect to traditional animal dissection may help transform science education and may reduce educators’ reliance on animal dissection specimens in the future, particularly when in-person classes resume. In addition to gaining insight into how biology educators changed their teaching modalities because of the COVID-19 pandemic and documenting how teachers had to pivot during remote instruction, our survey findings have identified dissection alternatives that biology educators used for remote learning during the pandemic and may provide a starting point for educators looking to use dissection alternatives in their remote and in-person science classes in the future.

Acknowledgments

We thank members of the NAVS staff for helpful comments on survey question design and feedback on the manuscript, as well as survey participants for their time and feedback. Disclosure: The authors are affiliated with the National Anti-Vivisection Society, a nonprofit organization aimed at ending the use of animals in science.

References

Animalearn (n.d.). Analysis of studies comparing the use of animals in science education to the use of humane educational methods. http://www.animalearn.org/img/pdf/comparativestudies.pdf.

Balcombe, J. (2003). From guinea pig to computer mouse. Assessment of alternatives in education. Leicester, England: InterNICHE.

BioLEAP (n.d.). Dissection alternative resources. [online]. Available at https://www.navs.org/additional-information/bioleap-dissection-alternatives/resources/.

Lalley, J.P., Piotrowski, P.S., Battaglia, B., Brophy, K. & Chugh, K. (2010). A comparison of V-Frog to physical frog dissection. International Journal of Environmental and Science Education, 5, 189–200.

NABT (1990). The responsible use of animal in biology classrooms: Including alternatives to dissection. Monograph IV. Warrenton, VA: National Association of Biology Teachers.

NABT (2019). The use of animals in biology education. https://nabt.org/Position-Statements-The-Use-Of-Animals-In-Biology-Education.
NAVS (n.d.). Student choice laws and policies. http://www.navs.org/education/states-with-student-choice-laws.

NAVS (2020). 2020 Animal Dissection and Alternatives Survey. Unpublished data.

NSTA (2008). Responsible use of live animals and dissection in the science classroom. http://www.nsta.org/about/positions/animals.aspx.

Oakley, J. (2013). Animal dissection in schools: life lessons, alternatives, and humane education. Ann Arbor, MI: Animals and Society Institute.

Orlans, F.B. (1988). Debating dissection. Science Teacher, 55, 36–40.

Orlans, F.B. (1993). In the Name of Science: Issues and Responsible Animal Experimentation. New York, NY: Oxford University Press.

Osenkowski, P., Green, C., Tjaden, A., & Cunniff, P. (2015). Evaluation of educator and student use of and attitudes toward dissection and dissection alternatives. American Biology Teacher, 77, 340–346.

Rosenberger, J. (1998). Harvest of shame: dissection’s deadly toll hits frogs hardest. E Magazine, 9(4), 26–27.

Russell, W.M.S. & Burch, R.L. (1959). The Principles of Humane Experimental Technique. London, UK: Methuen.

Society for Humane Science (n.d.). Comparative studies of animal and non-animal methods in teaching. https://www.forhumanescience.org/what_we_do/research/literature-review/.

Suiter, S., Oakley, J. & Goodman, J. (2016). Prevalence of student dissection-choice policies in U.S. schools. American Biology Teacher, 78, 560–567.

van der Valk, J., Dewhurst, D., Hughes, I., Atkinson, J., Balcombe, J., Braun, H., et al. (1999). Alternatives to the use of animals in higher education. ATLA, 27, 39–52.

Zemanova, M. & Knight, A. (2021). The educational efficacy of humane teaching methods: a systematic review of the evidence. Animals, 11, 114.

PAMELA OSENKOWSKI is a Science Advisor at the National Anti-Vivisection Society and a Senior Lecturer at Loyola University Chicago, Chicago, IL 60660; e-mail: posenkowski@navs.org. IGNAS KARALIUNAS is an intern at the National Anti-Vivisection Society, Chicago, IL 60654; e-mail: ikaraliunas@navs.org. MERARI DIORIO is an intern at the National Anti-Vivisection Society; e-mail: xenia.diorio@gmail.com.