Teaching Anatomy in 3D: a comparison of available digital anatomy applications

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Abstract
Selecting the most appropriate anatomical application for a university library collection presents a complex challenge, particularly when balancing pedagogical needs, technical functionality, licensing constraints, and budgetary limitations. This article presents a structured six-step methodology developed and applied at our library to support decision-making in the acquisition of an anatomical application. The process includes market exploration, functional evaluation, financial viability assessment, user trials, contract negotiation, and communication strategies. By involving both academic staff and students, and by integrating financial considerations early in the process, the methodology ensures that the selected resource aligns with curricular needs and budget constraints. The approach is designed to be adaptable and reusable, offering a practical framework for other academic libraries facing similar decisions.

Key words: *anatomy; education, medical; models, anatomic; software.*

Background

Digital anatomy applications have become integral to anatomy education. Lecturers frequently incorporate these tools into their teaching, while students rely on them as supplementary resources alongside textbooks and course materials. Three-dimensional visualisation technology has been proven to increase the factual knowledge, enhance spatial knowledge acquisition and improve the user's satisfaction and their perception of the effectiveness of the learning tools in comparison to other teaching methods (1, 2). The widespread availability of these platforms means that students quickly discover and begin using anatomy websites and apps independently (3). However, many of these applications operate on a subscription-based model, which can lead to unequal access among students. Moreover, students prioritise usability over accuracy and level of detail, which is valued more by teaching staff (3). By providing institutional licenses through the university library, all students gain equal access to high-quality anatomical resources, ensuring consistency in available educational materials.

While university libraries typically oversee contracts for journals and databases, librarians may have limited or no expertise in anatomy education, making it challenging to assess the content and pedagogical value of these tools. Conversely, teaching staff and students, who are well-versed in the educational utility of anatomy applications, are usually not involved in licensing negotiations. Their primary concerns for these applications are content quality and consistent access, especially when these resources are embedded into curricula.

When selecting or evaluating an anatomical application, several questions arise. Which platforms offer the required content and quality? What are the specific needs of educators and students? What budgetary constraints exist? And how can changes be implemented effectively, considering the interests of all stakeholders? Drawing on our experience, we present a methodology (*Figure 1*) that can be followed or adapted by other aca-

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demic libraries seeking to make informed decisions about anatomical application acquisition.

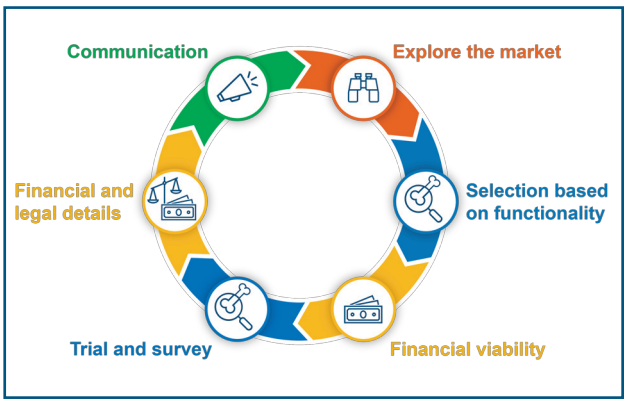

Fig. 1. *6-step methodology for decision making about anatomical applications*

Methodology

Explore the market

As a first step, we aimed to identify the available anatomical application options on the market. Zilverschoon et al. (4) suggest searching for anatomy applications in scientific literature. We expanded this approach by conducting online searches and reviewing offerings from major biomedical publishers. This broader strategy allowed us to include applications that may not yet be referenced in academic publications, such as newly launched platforms or tools not widely known within the scientific community. For example, in our case, this led to the inclusion of AnatomyTOOL, an open platform under supervision of the Dutch Association of Anatomists (Nederlandse Anatomen Vereniging) (5). We found ten applications that initially appeared to align with our requirements.

While this step did not involve formal selection, we excluded applications that clearly lacked the type of anatomical models relevant to our needs, such as tools that had no 3D visualization, contained only partial anatomy models or needed specific hardware to run.

Selection based on functionality

In the second phase, we requested trial access (where applicable) to conduct a functional evaluation of all selected applications. This initial selection was carried out by library staff. While no specific anatomical expertise was required, having a scientific or biomedical background among the testers proved beneficial to easily understand and navigate the content of the applications.

We began by applying the evaluation criteria proposed by Zilverschoon et al. (4). Unlike their comparative approach, we chose to retain only those applications that fulfilled the highest requirements for each criterion. These requirements included:

- model rotation: no limitations in rotation and usable vantage points;
- model displacement: no limitations in movement of the models;
- zooming: able to zoom in and out of models and structures without limitations;
- clickable structures: all structures are selectable;
- transparency: The transparency of structures can be adjusted;
- anatomical information: anatomical descriptions are available for all structures;
- virtual dissection: all structures can be individually removed to enable a complete virtual dissection.

To further differentiate between the applications that passed this initial screening, we introduced additional criteria tailored to the specific needs of our institution. These can be adapted by other libraries depending on their user base:

- dynamic biomechanical models: essential for physiotherapy students, these models demonstrate joint and muscle movements;
- medical imaging integration: the availability and diversity of medical imaging features accompanying the 3D models;
- model complexity: applications with overly simplified anatomical structures were excluded in favour of those offering detailed subdivisions;
- general ease of use: platforms that were unintuitive or did not run smoothly were discarded;
- app-availability: we prioritised applications that offered a mobile app with equivalent content and usability to the desktop or web version.

On the basis of these criteria, three applications were selected for further evaluation.

Financial viability

In the next step, we assessed the financial viability of the three shortlisted anatomical applications. This was not a formal negotiation process, but rather an ex-

ploratory inquiry to gain a general understanding of the pricing landscape. We contacted publishers to request indicative pricing for institutional licenses, focusing on subscription models that would cover access for all students and staff.

This preliminary cost analysis helped us identify which applications were within our budget. One of the three selected platforms, despite meeting all functional and pedagogical criteria, was excluded at this stage due to its pricing exceeding the available financial resources. This emphasises the importance of *integrating* budgetary considerations early in the selection process, as high-quality content alone does not guarantee feasibility.

While pricing structures varied – some offering tiered access models or discounts for academic institutions – this step provided valuable insight into the cost-benefit balance of each option. It also laid the groundwork for future negotiations in later stages of this methodology.

Trial and survey

With the remaining two applications shortlisted, we organized an extended trial involving professors, lecturers, and students. One of these applications was already licensed by the library, while trial access was arranged for the other, allowing participants to explore its content in depth. To gather feedback, we designed and distributed a survey (Appendix 1) tailored to each user group.

Academic staff were asked to evaluate the applications from the perspective of their subject expertise. Their feedback focused on the accuracy, completeness, and pedagogical relevance of the anatomical models. We also documented their current use of anatomical applications, both in teaching and in clinical practice, to better understand how these tools integrate into their workflows.

Students were invited to assess the usefulness of the content in relation to their studies. They were asked to reflect on what they needed or would have found useful during the past academic year. This approach allowed us to capture insights across different stages of the curriculum and to identify which anatomical features are most relevant at various points in their academic career. Additionally, we gathered data on their current usage patterns, which revealed that many students were independently purchasing licenses for applications not provided by the library. This revealed a discrepancy between the anatomical application licenses provided by the library and the students' awareness of these resources, indicating a need for improved communication and outreach.

The trial provided essential content-related input for the Campus Library Council. By combining expert evaluation with student perspectives, we ensured that the selected applications met both educational and practical needs across disciplines and study levels.

Financial and legal details

Once the preferred application was identified based on functional, pedagogical, and financial criteria, we resumed price negotiations with the publisher. At this stage, the focus shifted from general pricing to the specifics of the licensing agreement.

Special attention was given to the terms of use, particularly regarding the reuse of visual content from the application. Since anatomical images and models are often integrated into course materials, presentations, publications, and outreach activities, it was essential to clarify whether such uses were permitted under the license. Clear and permissive terms in these areas were considered crucial to ensure the resource could be fully embedded into the educational ecosystem without legal or logistical barriers.

In parallel, we finalized the financial terms, confirming the scope of access (e.g. number of users and contract duration) and any additional services included, such as training for students and staff or technical support. With this information in hand, and all stakeholder feedback considered, the final decision was made by the Campus Library Council.

Communication

The final step in the methodology involved communicating the decision to all relevant stakeholders and ensuring that the addition or replacement of the anatomical application was widely known and understood across the institution.

For academic staff, we initiated direct communication with all faculty members involved in anatomy education. We asked them to share this information within their research groups and educational teams to ensure broad dissemination. To further extend our reach, we published announcements on faculty intranet pages and included updates in departmental newsletters.

To support academic staff in adopting the new application, we organized training sessions prior to the start

of the academic year. These sessions provided hands-on guidance and addressed practical questions related to integrating the tool into teaching. For those unable to attend, a recording of the training was made available, ensuring that all staff had access to the necessary information and support.

To inform students, we presented and demonstrated the new application during anatomy courses across all relevant study programs. While we focused primarily on first-year students, we also provided presentation materials to lecturers of advanced anatomy courses. Additionally, we incorporated information about the new resource into our library sessions on information literacy. To support this outreach, we created promotional flyers that were distributed during our presentations and prominently displayed in libraries and learning centers on all campuses offering biomedical and health sciences programs.

We also utilized digital channels to reinforce the message. Slides announcing the new application were displayed on information screens in libraries and learning centers, and detailed information was added to the library's website.

These combined efforts ensured that both staff and students were aware of the new resource and could start exploring and using the application.

Lessons learned

Developing and applying this methodology for the first time allowed us to identify several key factors that contribute to a successful selection process for anatomical applications.

Internal collaboration is essential. Effective communication within the library team is crucial, especially given the involvement of multiple teams such as information specialists, the e-resources team, and legal services. Aligning expectations and responsibilities early in the process helps streamline decision-making and avoid delays.

Engaging academic staff and students requires strategy. Reaching out to teaching staff and students, and motivating them to participate in trials or surveys, can be challenging. A well-planned communication strategy is essential to ensure sufficient and meaningful feedback. Without adequate input from end users, it becomes difficult to make informed, user-centered decisions.

Time management is critical. The evaluation process, particularly the trial phase, is time-intensive. Getting to know each application, organizing access, and collecting feedback all require careful planning. Moreover, the timing of the trial must align with the academic calendar, as staff and student availability fluctuates throughout the year. Trials conducted during exam periods or holidays are unlikely to yield sufficient engagement.

The methodology should be reusable and adaptable. This selection process should not be viewed as a one-time effort. As new tools emerge and institutional needs evolve, periodic reassessment is necessary. Thorough documentation of the methodology, criteria, and outcomes ensures that future evaluations can build on past work, saving time and maintaining consistency.

Conclusion

The selection of an anatomical application for institutional use requires more than a simple comparison of features or pricing. It demands a structured, collaborative approach that brings together library staff, teaching staff, and students. The methodology we developed and applied enabled us to make a well-informed, transparent, and pedagogically sound decision. We hope that this methodology can serve as a useful model for other libraries navigating similar decisions.

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REFERENCES

1. Yammine K, Violato C. A meta-analysis of the educational effectiveness of three-dimensional visualization technologies in teaching anatomy. Anat Sci Educ. 2015;8:525-38. https://doi.org/10.1002/ASE.1510.

2. Hoyek N, Collet C, Di Rienzo F, De Almeida M, Guillot A. Effectiveness of three-dimensional digital animation in teaching human anatomy in an authentic classroom context. Anat Sci Educ. 2014;7:430-7. https://doi.org/10.1002/ASE.1446.
3. Lee JWY, Susanto J, Lai SH, Cheow PC, Low LXT, Bello F. What faculty and students value when evaluating human digital anatomy platforms: a mixed-methods study. J Med Educ Curric Dev. 2024;11. https://doi.org/10.1177/23821205241256043.
4. Zilverschoon M, Kotte EMG, van Esch B, ten Cate O, Custers EJ, Bleys RLAW. Comparing the critical features of e-applications for three-dimensional anatomy education. Annals of Anatomy. 2019;222:28-39. https://doi.org/ 10.1016/j.aanat.2018.11.001.
5. Nederlandse Anatomen Vereniging. Anatomy-TOOL n.d. https://anatomytool.org/ (accessed October 13, 2025).

Appendix 1: Questionnaire

Use of anatomical applications (questions for lecturers)

- Which course(s) do you teach or support where anatomical applications may be relevant? Please provide the course code(s) and official title(s).
- How important is it for you to have access to anatomical applications for your teaching and/or course materials?
- Did you use anatomical applications in your teaching and/or course materials prior to this trial?
- In what ways do you use anatomical applications in your teaching and/or course materials?
- Which anatomical applications do you currently use for your courses?
- To what extent do you expect students to use an anatomical application for your courses?
- How does the use of an anatomical application compare to other supplementary learning resources, such as textbooks, anatomical atlases, or plastinated specimens?
- In what ways would you like to use an anatomical application in your teaching and/or course materials?
- Do you use anatomical applications outside of your teaching activities?
- Which anatomical applications do you use outside of your teaching activities?
- For what purposes do you use anatomical applications outside of your teaching activities?

Use of anatomical applications (questions for students)

- Which degree program are you currently enrolled in or have you completed?
- How important is it for you to have access to anatomical applications for your studies?
- Did you use anatomical applications in your studies prior to this trial?
- Which anatomical applications have you used for your courses up to the last academic year?
- To what extent were you expected to use an anatomical application for your courses?
- For which courses (name and course code) did you use anatomical applications during the past academic year?
- How did the use of an anatomical application in these courses compare to other supplementary learning resources, such as textbooks, anatomical atlases, or plastinated specimens?

Content evaluation of each anatomical application

- Did you test the anatomical application?
- How well does the anatomical model cover the structures and systems relevant to your courses?
- How appropriate is the level of detail in the model for your courses?
- How well do the available functionalities align with your course requirements?
- Are there any inaccuracies or gaps in the model for your courses? If so, which ones did you notice? Are there any desired functionalities that are missing?

User experience of each anatomical application

- How user-friendly is the web version overall?
- How easy is it to access the web version?
- How easy is it to navigate and explore the web version?
- How efficient is the use of the web version?
- How easy is it to integrate material into your own course materials or the LMS?
- Did you test the associated app?
- How user-friendly is the app for the anatomical models?
- How easy is it to navigate and explore the anatomical application in the app?
- Do you have any additional comments about the user experience?
- What overall rating would you give to the anatomical application?

Additional comments

- Do you have any further comments about the tested anatomical applications?