IJCMBS

Original Article

doi.org/ 10.5281/zenodo.15738755 JCMBS 2025; 5(2):83-92

3D Digital Models and Cadaver Use in Anatomy Education: An Altmetric Evaluation of Publications from 2020 to 2024

Anatomi Eğitiminde 3D Dijital Modeller ve Kadavra Kullanımı: 2020–2024 Yayınlarının Altmetrik Değerlendirmesi

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Abstract

Background: This study evaluates the academic and digital visibility of publications on 3D digital and cadaveric models in anatomy education (2020–2024) using altmetric indicators. It was hypothesized that 3D model-related studies receive higher engagement.

Materials and Methods: A descriptive literature review was conducted through the Springer Nature database, identifying 68 eligible articles based on predefined criteria. Altmetric data—including Altmetric Attention Score (AAS), Twitter/Facebook mentions, Mendeley readership—and citation counts were collected. Pearson correlation analysis assessed relationships between altmetric indicators and citations ($p < 0.05$).

Results: The keyword group "3D model AND anatomy AND teaching" yielded the most publications and highest metrics (AAS = 53, Twitter = 42, Facebook = 3, Mendeley = 1423, citations = 206). In total, 132 AAS points, 80 Twitter mentions, 9 Facebook mentions, 3365 Mendeley readers, and 712 citations were recorded. Strong positive correlations were found between AAS and Mendeley ($r = 0.999$), Twitter ($r = 0.917$), and Facebook ($r = 0.998$). AAS ($r = 0.728$) and Mendeley readership ($r = 0.748$) also showed notable correlations with citation counts.

Conclusions: 3D digital models demonstrate higher academic and digital visibility than cadaveric models. Mendeley readership appears to be a more stable predictor of scholarly impact compared to AAS. Areas such as pediatric anatomy, pathology, and real-time clinical modeling remain underexplored. Altmetric analysis provides valuable insights into the evolving tools used in anatomy education.

Keywords: 3D digital models; anatomy education; altmetric analysis; cadaver models; medical education

ÖZ

Amaç: Bu çalışma, 2020–2024 yılları arasında anatomi eğitiminde 3D dijital ve kadaverik modellerin kullanımına yönelik yayınların akademik ve dijital görünürlüğünü altmetrik göstergeler kullanarak değerlendirmeyi amaçlamaktadır. 3D model odaklı çalışmaların daha yüksek etkileşim aldığı hipoteziyle yola çıkılmıştır.

Gereç ve Yöntem: Springer Nature veritabanı kullanılarak tanımlayıcı bir literatür taraması yapılmış ve önceden belirlenmiş kriterlere göre 68 uygun makale belirlenmiştir. Altmetric Attention Score (AAS), Twitter/Facebook paylaşımları, Mendeley okuyucu sayısı ve atıf sayıları toplanmıştır. Altmetrik göstergeler ile atıf sayıları arasındaki ilişki Pearson korelasyon analizi ile değerlendirilmiştir ($p < 0.05$).

Bulgular: "3D model AND anatomy AND teaching" anahtar kelime grubu en fazla yayını ve en yüksek metrikleri üretmiştir (AAS = 53, Twitter = 42, Facebook = 3, Mendeley = 1423, atıf = 206). Tüm gruplarda toplamda 132 AAS puanı, 80 Twitter, 9 Facebook paylaşımı, 3365 Mendeley okuyucusu ve 712 atıf kaydedilmiştir. AAS ile Mendeley ($r = 0.999$), Twitter ($r = 0.917$) ve Facebook ($r = 0.998$) arasında çok güçlü pozitif korelasyonlar bulunmuştur. AAS ($r = 0.728$) ve Mendeley okuyucu sayısı ($r = 0.748$) atıf sayılarıyla da anlamlı ilişkiler göstermiştir.

Sonuç: 3D dijital modeller, kadaverik modellere kıyasla daha yüksek akademik ve dijital görünürlüğe sahiptir. Mendeley okuyuculuğu, AAS'tan daha tutarlı bir akademik etki göstergesi olarak öne çıkmıştır. Pediatrik anatomi, patoloji modellemeleri ve gerçek zamanlı klinik uygulamalar gibi alanlar daha fazla araştırmaya ihtiyaç duymaktadır. Altmetrik analiz, anatomi eğitiminde kullanılan araçların değişen yapısını anlamada önemli bilgiler sunmaktadır.

Anahtar kelimeler: 3D dijital modeller; anatomi eğitimi; altmetrik analiz; kadaver modelleri; tıp eğitimi

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E-mail: akabakci@cu.edu.tr **Received:** 15 May 2025 **Accepted:** 25 July 2025

***Cite as*:** Kabakcı. AG 3D Digital Models and Cadaver Use in Anatomy Education: An Altmetric Evaluation of Publications from 2020 to 2024. JCMBS 2025; 5(2):83-92 doi.org/ 10.5281/zenodo.15738755

Highlights Toplam 3 satır

- Anatomy education
- Altmetric evaluation
- 3D digital models

Introduction

In recent years, the measurement of scholarly impact has evolved beyond traditional citation counts. Altmetric analysis, which evaluates the online attention of scientific publications across platforms such as social media, news outlets, blogs, and reference managers like Mendeley, offers a broader view of how research disseminates and influences both academic and non-academic audiences (1). Unlike conventional bibliometrics, altmetrics provide near real-time feedback and can capture public engagement, policy influence, and interdisciplinary interest in scientific work (2).

Despite its growing use in various medical fields, the integration of altmetric analysis into anatomical education research remains limited. Most altmetric studies in medical literature focus on fields such as oncology, cardiology, or general surgery, with relatively fewer publications assessing anatomy-specific educational tools or technologies (3).

Anatomical education has traditionally relied on cadaveric dissection, which is widely regarded as a foundational and irreplaceable component in the training of health professionals. Cadaver-based education provides unique tactile, spatial, and contextual learning experiences that are difficult to replicate (4). However, increasing ethical considerations, costs, and the global shortage of cadavers have posed significant challenges for anatomy departments worldwide (5).

To address these limitations, educators and researchers have turned to innovative solutions such as three-dimensional (3D) digital modeling. These technologies offer customizable, cost-effective, and reusable models that can enhance the teaching of complex anatomical structures and procedures (6,7). Particularly in recent years, the use of 3D-printed models in anatomy education has expanded rapidly, with increasing publication output and academic interest.

Given this background, this study aims to evaluate the visibility and impact of scientific literature focusing on the use of 3D digital models and cadaveric models in anatomical education over the past five years. By analyzing Altmetric Attention Scores (AAS), citation counts, and social media mentions, we aim to map current trends and highlight the most influential contributions in this interdisciplinary and rapidly evolving domain. The primary aim of this study is to assess the online impact and scholarly visibility of publications related to 3D digital models and cadaveric models in anatomy education over the past five years through altmetric analysis. It is hypothesized that research focusing on 3D digital models in anatomical education will exhibit higher Altmetric Attention Scores and social media engagement compared to studies based on traditional cadaveric models, reflecting the increasing interest in innovative educational technologies within this field.

Material and Methods

Study Design

This study is a descriptive literature review aimed at analyzing the altmetric attention of scientific publications on three-dimensional (3D) anatomical modeling and digital models, including cadaver-based anatomical education materials. The review focuses on these publications' visibility and social impact across digital platforms, including social media, news outlets, and academic databases. The research covers publications published between January 2020 and December 2024. This study did not need to be approved by an ethics committee, because it only conducted altmetric analyses on classical studies that have been published.

Database and Search Strategy

Database selection in this study, only the Springer Nature database was utilized. The primary rationale for limiting the search to a single database was to ensure methodological consistency and data integrity. Using multiple databases can introduce heterogeneity due to variations in indexing policies, classification systems, and content coverage, which may compromise the comparability and reliability of the results. Springer Nature is a well-established platform known for its comprehensive and up-to-date scientific content, hosting high-impact journals across various disciplines. Notably, for the present study focusing on anatomical education, Springer offers a

specific filtering option under the "Anatomy" category. This feature enabled a highly specific and sensitive literature search, minimizing irrelevant results and enhancing the precision of the selection process. Therefore, the decision to rely on a single, but thematically relevant and high-quality database was made to preserve data quality and maintain methodological coherence throughout the study. To ensure methodological rigor and transparency in the selection of publications, a systematic search strategy was employed. Records were initially identified through the Springer database (n = 8369). After removing duplicates (n = 92), 8277 records remained. Subsequently, specific filtering criteria were applied, including publication date (2020–2024), article type (original, research, or review), language (English), open access status, and relevance to the selected subject areas and disciplines (e.g., 3D imaging, anatomy, education, biomechanical analysis and modeling within medicine and education). These filters reduced the pool to 68 articles. All 68 articles were screened by title and abstract, and then assessed in full-text for eligibility. Ultimately, 68 studies met all inclusion criteria and were incorporated into the final analysis (Table 1). The search strategy used Boolean operators (AND, OR) to combine relevant terms effectively. A total of 68 articles were identified across four search strategies combining 3D digital models, anatomy, education, and cadaver usage. Quantitative analysis was conducted based on Altmetric Attention Scores (AAS), social media engagement (Twitter and Facebook mentions), Mendeley readership, and citation counts. The search was limited to English-language publications, and the following keywords were employed:

- "3D digital models" AND anatomy AND cadaver
- "3D anatomical model" AND education AND cadaver
- "3D model" AND anatomy AND teaching
- "cadaver study" AND 3D digital models AND anatomy

The articles retrieved were initially screened based on their titles and abstracts to determine relevance. Studies were included if they directly involved 3D anatomical modeling in human anatomy, including cadaver studies. Only full-text articles with a valid Digital Object Identifier (DOI) and accessible through SpringerLink were **considered.**

Article Selection and Inclusion Criteria

Inclusion Criteria:

- The study directly involved 3D anatomical modeling or 3D digital models.
- The topic was clearly related to human anatomy and included cadaver studies.
- The full text was accessible via SpringerLink.
- The article had a valid Digital Object Identifier (DOI).

Exclusion Criteria:

- Studies that did not discuss 3D anatomical modeling or digital models or cadaver.
- Studies focusing on areas outside human anatomy (e.g., animal studies or material science).
- Articles not available as full text.

A total of 68 articles meeting the inclusion criteria were selected for further analysis.

Altmetric Data Collection

The Altmetric Attention Score (AAS) is a quantitative measure of the online attention an academic publication receives across various digital platforms. It is calculated based on mentions and engagement from sources such as Twitter, Facebook, news outlets, blogs, Wikipedia, YouTube, Reddit, policy documents, and Mendeley. Each source contributes differently to the score, depending on its reach and credibility; for example, a news article mention contributes more than a tweet. The AAS allows for the assessment of scholarly impact not only through traditional citations but also through public and digital engagement, making it a valuable metric particularly for studies focusing on online visibility and influence (8).

The following indicators were collected:

- **Altmetric Attention Score (AAS**): A composite score representing the online attention the article has received across various platforms.
- **Mentions on platforms:** The number of mentions on Twitter, Facebook, news outlets, and blogs.
- **Mendeley readership:** The number of readers on Mendeley, a reference manager and social network for researchers.
- **Open Access Status:** Whether the article is open access or behind a paywall.
- **Journal Name:** The journal in which the article was published.

Inclusion of Cadaver Studies

Cadaver-based anatomical education materials, particularly those integrating 3D digital model technologies, were also included in the analysis. These studies focus on digital modeling real human tissues for anatomical education.

Statistical analysis

To determine the relationships between the number of citations of the selected T100 anatomy education articles

and AAS and between IF and AAS, descriptive statistics was revealed and evaluated with SPSS 22 package software. Moreover, data were analyzed using Pearson correlation coefficient to assess the strength and direction of linear relationships between continuous variables, including Altmetric Attention Score (AAS), Twitter mentions, Facebook mentions, Mendeley readership, and citation counts. Prior to analysis, the normality of the data distributions was confirmed using the Shapiro-Wilk test. A p-value of less than 0.05 was considered statistically significant.

Ethical Approval

This study did not need to be approved by an ethics committee, because it only conducted altmetric analyses on classical studies that have been published.

Results

A total of 8369 records were initially identified through a systematic search of the Springer Nature database. Following the removal of 92 duplicate entries, 8277 unique records remained for initial evaluation. A series of filters were then applied to refine the dataset, including publication date (2020–2024), article type (original articles, research papers, or reviews), language (English), open access availability, and relevance to specific subjects (3D imaging, anatomy, education, biomechanical analysis and modeling), disciplines (medicine and education), and subdisciplines (medical education and anatomy). As a result of this filtering process, the number of records was reduced to 68 articles. These 68 records were screened by title and abstract, after which all were assessed in full-text form for eligibility. Ultimately, all 68 studies met the inclusion criteria and were included in the final analysis. The detailed selection process is illustrated in the flow diagram **(Table 1)**.

Table 1. Flow diagram of the study selection process conducted using keywords and filters

Records identified through Springer database searching
(n = 8369)
↓
Duplicates removed
(n = 92)
↓
Records after duplicates removed
(n = 8277)
↓
Records after applying filters:
- Date (2020–2024)
- Article type (Original, Research, Review)
- Open Access
- English
- Subjects: 3D imaging, anatomy, education, biomechanical analysis and modeling
- Disciplines: Medicine, Education
- Subdisciplines: Medical Education, Anatomy
- SDG: Quality Education
(n = 68)
↓
Records screened (title and abstract)
(n = 68)
↓
Full-text articles assessed for eligibility
(n = 68)
↓
Studies included in the final analysis
(n = 68)

In addition, the 68 publications included in the final analysis were categorized according to predefined keyword combinations and filtering criteria. The distribution revealed that the keyword group “3D model” AND anatomy AND teaching yielded the highest number of relevant publications (n = 37), followed by “3D anatomical model”

AND education AND cadaver (n = 15), "3D digital models" AND anatomy AND cadaver (n = 8), and "cadaver study" AND 3D digital models AND anatomy (n = 8). In terms of article types, original articles constituted the largest portion (n = 68), while research articles totaled 61, and review articles were limited to 7 publications. All included articles were in English and available through open access sources, aligning with the applied inclusion criteria. Regarding subject coverage, education (n = 41), anatomy (n = 24), and 3D imaging (n = 23) were the most frequently represented categories. Less frequently encountered topics included biomechanical analysis and modeling (n = 4). All studies were also indexed under Medical Education and Quality Education within the Springer database classification system. This distribution highlights the concentration of recent literature around educational applications of 3D models, particularly in teaching contexts, and underscores the dominant role of open-access English-language research in this domain **(Table 2) (Figure 2).**

Table 2. Numerical distribution of included publications according to keywords and filtering criteria

Filters	"3D digital models" AND anatomy AND cadaver	"3D anatomical model" AND education AND cadaver	"3D model" AND anatomy AND teaching	"cadaver study" AND 3D digital models AND anatomy	Total
Original article	8	15	37	8	68
Research article	7	13	34	7	61
Review article	1	2	3	1	7
Open access	8	15	37	8	68
English	8	15	37	8	68
3D imaging	5	5	8	5	23
Anatomy	4	7	9	4	24
Education	3	8	27	3	41
Biomechanical analysis and modeling	1	0	3	0	4
Medicine Education	8	15	37	8	68
Quality Education	8	15	37	8	68
Total	8	15	37	8	68

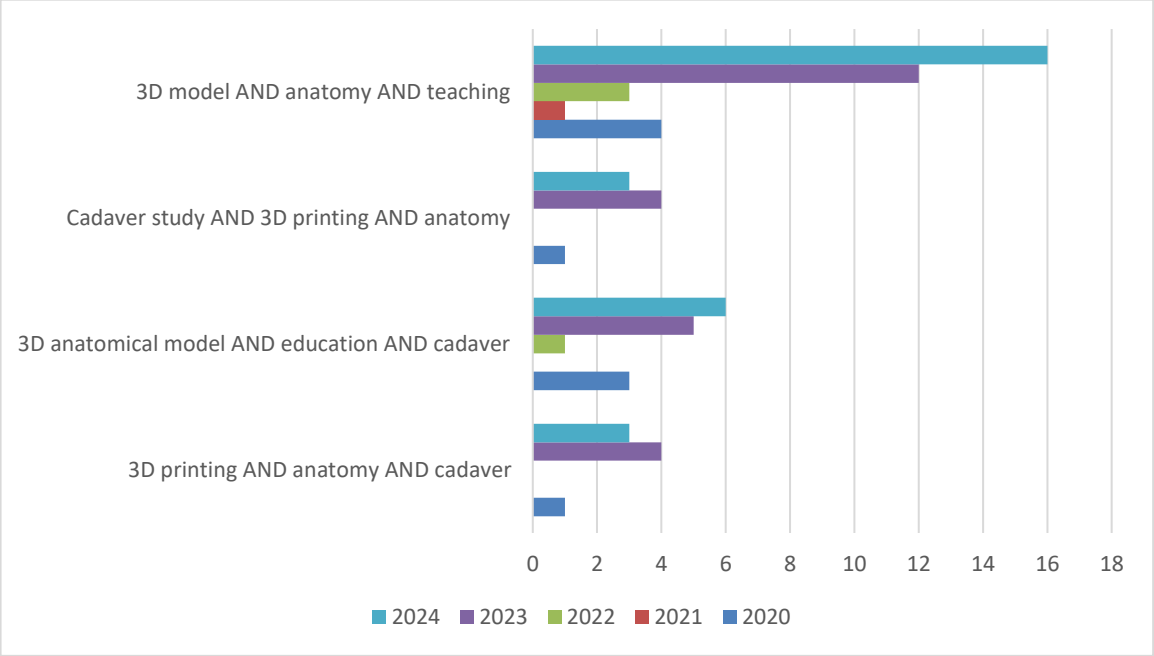

Figure 2. Distribution of publication by year

Moreover, the findings were evaluated based on quantitative indicators such as Altmetric Attention Scores (AAS), Twitter and Facebook mentions, Mendeley readers, and citation counts. These metrics aimed to reflect both the digital visibility and the academic impact of the selected publications. Below, the results are presented according to the respective keyword groupings.

Also, altmetric data were analyzed across four predefined keyword combinations to evaluate the digital visibility and academic impact of the included publications. The highest Altmetric Attention Score (AAS) was observed in the group "3D model AND anatomy AND teaching", with a score of 53, followed by "3D digital models AND anatomy AND cadaver" and "cadaver study AND 3D digital models AND anatomy", each with an AAS of 27, and "3D anatomical model AND education AND cadaver" with 25. In terms of social media engagement, the "3D model AND anatomy AND teaching" group also received the highest number of Twitter mentions (42) and Facebook mentions (3). This keyword group additionally stood out in terms of Mendeley readership, with 1423 readers, indicating strong academic interest. It was also associated with the highest citation count (206). Across all groups, a total of 132 AAS points, 80 Twitter mentions, 9 Facebook mentions, 3365 Mendeley readers, and 712 citations were recorded **(Table 3) (Figure 1).**

Table 3. Distribution of altmetric data according to keywords

Keywords	AAS	Twitter Mentions	Facebook Mentions	Mendeley Readers	Number of cites
3D digital models AND anatomy AND cadaver	27	9	2	675	183
3D anatomical model AND education AND cadaver	25	20	2	592	140
cadaver study AND 3D digital models AND anatomy	27	9	2	675	183
3D model AND anatomy AND teaching	53	42	3	1423	206
Total	132	80	9	3365	712

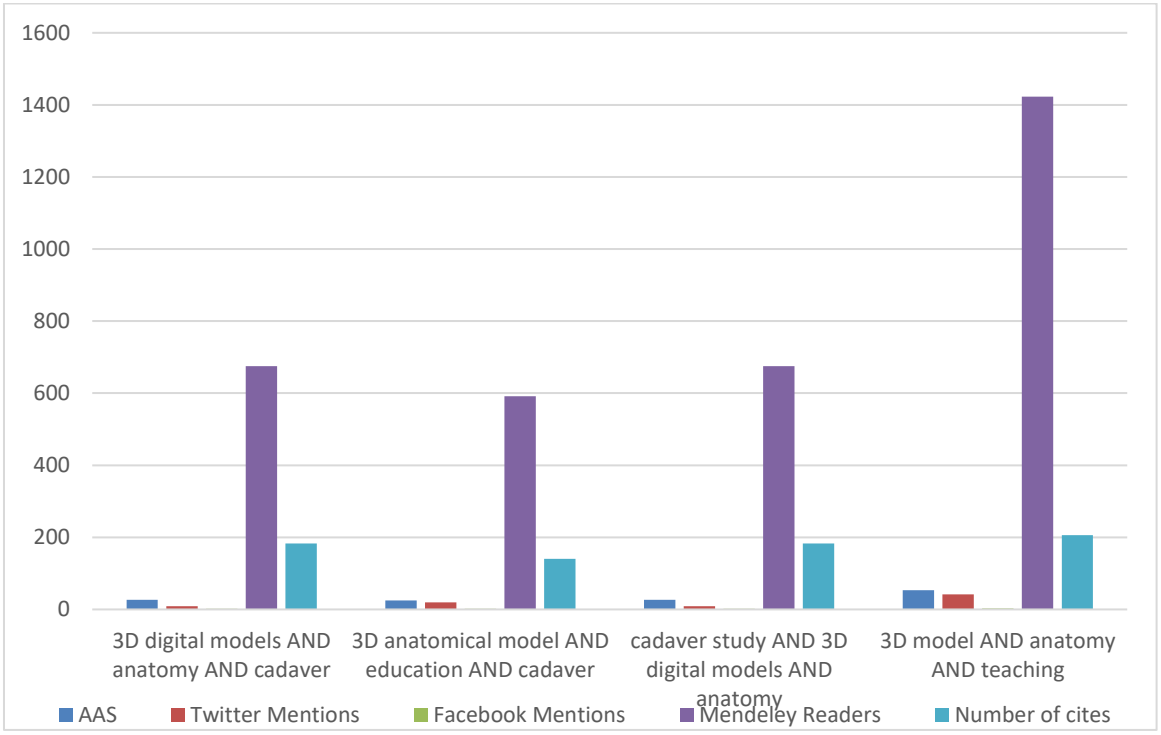

Figure 1. Distribution of twitter, facebook, and mendeley based on keywords

These findings suggest that research related to 3D models in teaching anatomy garners more online attention and academic engagement compared to studies focusing more narrowly on cadaver-based or digital models -specific contexts.

Moreover, a Pearson correlation analysis was performed to examine the relationships among Altmetric Attention Score (AAS), Twitter mentions, Facebook mentions, Mendeley readership, and citation counts. The results demonstrated very strong positive correlations between AAS and Mendeley readership (r = 0.999), as well as strong correlations between AAS and social media mentions, including Twitter (r = 0.917) and Facebook (r = 0.998). Citation counts showed moderate to high positive correlations with AAS (r = 0.728) and Mendeley readership (r = 0.748), while the correlation between Twitter mentions and citation counts was lower (r = 0.393) **(Table 4).** These findings support a significant association between digital attention metrics and traditional academic impact indicators, thereby reinforcing the relevance of altmetric data in assessing the visibility and influence of publications.

Table 4. Relationships between AAS, social media mentions, mendeley readers, and citations

Variables	Correlation Coefficient (r)
AAS - Twitter Mentions	0.917 (Very strong positive)
AAS - Facebook Mentions	0.998 (Almost perfect positive)
AAS - Mendeley Readers	0.999 (Very strong positive)
AAS - Number of cites	0.728 (Moderate to high positive)
Twitter - Facebook	0.943 (Strong positive)
Twitter - Mendeley	0.905 (Strong positive)
Twitter - Cites	0.393 (Moderate positive)
Facebook - Mendeley	0.995 (Almost perfect positive)
Facebook - Cites	0.677 (Moderate to high positive)
Mendeley - Cites	0.748 (Moderate to high positive)

Discussion

This study evaluated the academic and digital visibility of publications related to 3D-printed and cadaveric models in anatomy education over the past five years, with the hypothesis that 3D digital models focused studies would demonstrate greater scholarly and public engagement. The findings strongly support this hypothesis. A consistent rise in publication frequency was observed, particularly in 2023 and 2024 (Figure 1). This trend likely reflects the post-pandemic shift toward remote learning and the increasing integration of digital tools in medical education. Notably, publications using the keyword combination "3D digital models AND anatomy AND cadaver" peaked at 24 in 2024 the highest among all groups highlighting growing academic interest in hybrid anatomical education models that integrate technological innovation (Figure 2). Moreover, correlation analysis of this study revealed strong and statistically significant positive relationships among various altmetric indicators and traditional citation counts. Notably, the Altmetric Attention Score (AAS) showed very strong correlations with Mendeley readership (r = 0.999), Twitter mentions (r = 0.917), and Facebook mentions (r = 0.998), highlighting the close link between overall digital attention and specific social media platforms. Citation counts demonstrated moderate to high positive correlations with AAS (r = 0.728) and Mendeley readership (r = 0.748), suggesting that higher online engagement is generally associated with increased academic impact. However, the relatively lower correlation between Twitter mentions and citation counts (r = 0.393) may indicate that Twitter activity alone is a less consistent predictor of scholarly citations. These findings support the use of altmetric data as complementary indicators to traditional metrics, reflecting different dimensions of research visibility and influence in both academic and broader digital contexts, thereby strengthening the robustness of our study data.

In addition, altmetric indicators further supported this shift. While Twitter and Facebook activity remained modest overall, studies including 3D digital models keywords consistently showed higher engagement on Twitter, averaging around 10 mentions. Facebook, on the other hand, was rarely used for academic dissemination, suggesting limited utility for scholarly communication on that platform. The altmetric analysis revealed that overall social media engagement was relatively limited, particularly on Facebook. While Twitter mentions totaled 80 and Mendeley readers reached 3365, Facebook mentions remained notably low at only 9. Several factors may explain this limited presence. First, the study covers a recent five-year period (2020–2024), with a significant number of included publications concentrated in 2023 and 2024. Given this recency, it is likely that many publications have not yet had sufficient time to gain broader visibility on slower-growing platforms such as Facebook. In addition, shifting user

preferences may play a role; academic communities increasingly favor platforms like Twitter for scholarly dissemination due to their immediacy and interactive nature. Facebook, in contrast, may be less commonly used for sharing academic content in real time. Ethical considerations may also contribute studies involving cadaver-based methods or sensitive medical content are often less visible on general public platforms due to content policies or ethical reservations. Nonetheless, this study reveals that the themes highlighted in this study particularly the innovative use of 3D digital models in anatomy education will gain increasing visibility across social media in the future. The present findings may help raise awareness and contribute to greater social media dissemination in the coming years.

Mendeley readership emerged as the most reliable indicator of academic attention. Studies on 3D-printed models had substantially higher Mendeley reader counts, often exceeding 100. For example, a 2020 systematic review on 3D-printed anatomy models reached 272 readers and received 110 citations (9), while a 2023 study on pedagogical use of 3D models had 144 readers (10). Another 2024 study on immersive learning technologies in health education garnered 133 readers (11), indicating rising interest in augmented and virtual reality applications. A positive correlation was observed between Mendeley readers and citation counts, reinforcing the value of Mendeley as an early marker of scholarly impact. In contrast, cadaver-based studies generally received lower engagement across both altmetric and academic platforms. This may be attributed to logistical, ethical, and accessibility limitations that reduce their adaptability and visibility in digital and global educational settings. Several high-impact studies further illustrated this pattern. A 2021 systematic review on 3D digital models for interventional radiology training was cited 44 times (12), and a 2024 study on preoperative 3D modeling for shoulder surgery, despite being recent, already showed signs of strong academic interest (13). Similarly, studies involving virtual and augmented reality in pathology and anatomy education reported solid Mendeley readership, such as Moro et al. with 33 readers (14) and Timonen et al. with 52 readers (15). Although Twitter engagement was generally limited, papers addressing ethical debates or innovative methods gained higher Altmetric Attention Scores (AAS). For instance, a 2024 review on extended reality in surgical training reached an AAS of 10 (16), and a publication discussing the replacement of live animals in trauma simulation drew notable interest (AAS 8, 25 Mendeley readers) (17). These cases suggest that novelty, ethics, and clinical relevance may enhance both public and academic engagement. Analysis of publication venues also revealed noteworthy patterns. Journals like BMC Medical Education (60 articles) and Medical Science Educator (7 articles) led in publication count. This distribution reflects the cross-disciplinary nature of 3D digital models research, with applications spanning both educational and clinical domains. The prominence of BMC Medical Education highlights a growing emphasis on innovative teaching strategies in health sciences education. In terms of publication types, most studies were categorized as research articles (n = 49), followed by review articles (n = 7). This suggests that while the field is grounded in empirical work, there is also substantial effort to synthesize and evaluate existing literature. The relatively lower number of original studies (n = 12) points to a need for more primary, experimental research to further develop the evidence base. Despite the overall positive trends, certain subfields remained underrepresented. Topics such as pediatric anatomy, veterinary applications, pathology-based simulations, and real-time clinical 3D digital models integration were infrequently addressed. These areas offer valuable opportunities for future investigation, particularly in expanding the scope and inclusivity of anatomical education technologies.

In our analysis, the five publications with the highest altmetric scores stand out in terms of content type, recency, and digital engagement. The systematic review and meta-analysis by Ye et al. and the systematic review by Brumpt et al. provide comprehensive and up-to-date evidence regarding the effectiveness of 3D digital models in anatomy education, contributing significantly to both academic discourse and digital dissemination (9,10). Similarly, the randomized controlled trial conducted by Veer et al. explores the impact of mixed reality on interdisciplinary medical education specifically in physiology, anatomy, pathology, and pharmacology offering innovative pedagogical insights (18). Montesinos et al. present a transdisciplinary experiential learning approach within biomedical engineering education, proposing a systems-level model for healthcare training (19). Lastly, Torda introduces the CLASSIE model, which integrates virtual reality into ethical clinical decision-making, showcasing a novel method for incorporating medical ethics into medical curricula (20). These studies have garnered high visibility and sharing rates on social media platforms due to their innovative educational approaches, interdisciplinary content, and open-access publication format. This suggests that both academic value and digital accessibility play crucial roles in enhancing the online impact of educational research.

Finally, the findings demonstrate that 3D digital models have become a central focus in anatomy education, surpassing cadaver-based models in both academic and digital impact. Mendeley readership, in particular, proved a consistent and meaningful proxy for academic interest. These results not only validate the growing role of educational technologies in medical education but also highlight the need for continued innovation and exploration in this

evolving field.

Study limitations

This study has several limitations. It included only publications with accessible altmetric data and valid DOIs, potentially excluding relevant research not tracked by altmetric. Moreover, open access status, indexing differences, and journal visibility may have influenced attention metrics. Therefore, while altmetrics provide useful insights, they should be interpreted alongside traditional bibliometric indicators for a more comprehensive understanding. Moreover, one notable limitation of this study is its reliance solely on the Springer Nature database for the literature review. While this approach ensured methodological consistency and enabled a highly specific search process focused on anatomical content, it may have excluded relevant studies indexed in other major databases such as PubMed, Scopus, or Web of Science. This may limit the generalizability of the findings to some extent. Future research would benefit from adopting a broader search strategy that includes multiple databases to capture a more comprehensive range of publications. This is particularly important for studies aiming to explore broader or interdisciplinary topics beyond the scope of anatomy. Expanding the database coverage could strengthen the evidence base and provide a more nuanced understanding of trends across educational or scientific domains.

Conclusion

This study provides a focused assessment of the academic and digital visibility of publications related to 3D digital models and cadaver-based methods in anatomy education from 2020 to 2024. The analysis of altmetric indicators such as Altmetric Attention Scores, social media mentions, Mendeley readership, and citation counts revealed that studies involving 3D digital models generally achieved greater scholarly impact, particularly through higher citation rates and Mendeley reader counts. Although social media engagement was modest overall, certain topics with technological or ethical relevance drew notable public interest. The observed correlation between Mendeley readership and citation counts highlights Mendeley's potential as an early indicator of academic impact. Additionally, gaps in areas such as pediatric applications and clinical use of 3D models suggest promising directions for future research. Overall, this study demonstrates the value of integrating altmetric analysis with traditional bibliometrics to capture a publication's broader influence in both academic and public domains.

Acknowledgements: *None*
Ethical Approval: *This study did not need to be approved by an ethics committee, because it only conducted altmetric analyses on classical studies that have been published.*
Author Contributions: *Concept: K.AG. Literature Review: K.AG. Design: K.AG. Data acquisition: K. AG. Analysis and interpretation: K.AG. Writing manuscript: K.AG. Critical revision of manuscript: K.AG.*
Conflict of Interest: *The author(s) do not have any potential conflict of interest regarding the research. authorship and/or publication of this article.*
Data Availability: *No datasets were generated or analyzed during the current study.*
Financial Disclosure: *No financial support was received for this study.*

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