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Dental Students Perceptions of AI in the Classroom

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Abstract

Artificial Intelligence (AI) is rapidly transforming healthcare and clinical practice, yet its integration into dental education remains insufficiently understood. Although AI technologies have demonstrated the potential to enhance simulation-based learning, clinical decision-making, and personalized instruction, little empirical evidence exists regarding how dental students perceive AI within the educational environment. This study investigates the relationship between AI implementation and dental student satisfaction by examining the influence of faculty preparedness, confidence in AI-supported learning, institutional governance, and student tenure. Using a survey of 75 students enrolled at an accredited U.S. dental school, data were analyzed using ordinary least squares regression to evaluate factors associated with student satisfaction. The findings reveal that faculty preparedness to effectively integrate AI into teaching is the strongest positive predictor of student satisfaction, underscoring the critical importance of faculty development and institutional investment in AI competencies. Contrary to expectations, students expressing greater confidence in AI-enhanced learning reported lower levels of satisfaction, suggesting that expectations for AI-enabled education may exceed institutional implementation. Perceived AI-supported institutional governance also demonstrated a negative relationship with student satisfaction, indicating that administrative AI initiatives alone may not enhance the student experience. These findings suggest that successful AI adoption in dental education depends on faculty readiness. This study contributes to the emerging literature on AI in dental education by providing empirical evidence that can guide curriculum design, faculty development, institutional policy, and strategic investment as dental schools prepare future clinicians for an increasingly AI-enabled healthcare environment.

Keywords: Artificial Intelligence, Dental Education, Faculty Preparedness, Student Satisfaction, Technology Adoption, Dental Informatics.

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1. INTRODUCTION

Dental schools have long sought ways to expose their students to realistic situations in training (Mays, 2016). Artificial Intelligence (AI) can help in this (Agrawal & Nikhade, 2022), but schools struggle to fully leveraged the potential benefits of cutting-edge technology, and so there is little understanding in the field about how to realize value from AI (Thurzo, et al., 2023). This work uses Melville, et al., (2004), IT business value model to explore how dental schools can not only invest in AI but realize value from it, in the form of student satisfaction.

AI can be harnessed in pre-clinical dental education to enhance dexterity, oral health and technical knowledge, and virtual reality experiences (Thurzo et al., 2023). Various types of AI applications can contribute to these specific areas. AI-powered VR simulations can replicate real dental procedures, enabling students to practice and improve their dexterity and technical skills. These simulations can mimic tasks such as drilling, cavity preparation, and dental restorations, providing a risk-free environment for skill development. It can also enhance VR experiences by providing haptic feedback through specialized devices. Students can practice diagnosing, treatment planning, and communicating treatment options to these virtual patients, enhancing their oral health knowledge and patient interaction skills. Students can receive guidance on their technique and decision-making in real time, allowing continuous improvement. AI can also curate data from real patient cases and treatment outcomes, allowing students to analyze and discuss these cases to better understand clinical scenarios and the decision-making process in dental care.

AI is addressed in the roadmap of almost every company, including those with no technological focus (Winter et al., 2021). Our findings suggest that the successful integration of Artificial Intelligence into dental education requires special consideration, because it depends not simply on the availability of advanced technologies, but on the educational environment in which those technologies are implemented. Analysis of responses from 75 dental students demonstrates that AI has the potential to enhance the educational experience when supported by knowledgeable faculty, meaningful instructional practices, and institutional commitment. Our results further indicate that students place greater value on faculty preparedness than on technology alone; this suggests that AI should be viewed as a tool that strengthens teaching rather than replaces it. Collectively, these findings contribute to a growing body of evidence that successful AI adoption in dental schools requires a balanced approach that integrates technological innovation with faculty development, student engagement, and effective organizational leadership.

1.1 Contributions

This article makes three specific contributions to the information systems (IS) understanding of AI implementation in the context of dental education. First, it contributes to the field's understanding of AI's impact on learning outcomes. Amid all the hype that surrounds AI as it becomes increasingly integrated into learning environments, it is essential to evaluate their impact on student outcomes. Second, it provides a new understanding of the role of technology in dental education. Overall, the results of our survey indicate that cultivating an atmosphere of instructor confidence with AI tools influences student satisfaction in the AI era. Third, it provides novel insights about enhancing student satisfaction and success. The ultimate goal of the study is to improve dental student satisfaction. By understanding the impact of AI advancements on student satisfaction, dental schools can identify strategies to enhance the learning experience and adapt their teaching methods and provide students with the necessary tools and resources for success.

1.2 Background

When prospective students are deciding which dental school to attend, one of the key influences for them is to choose a dental school they know will provide them with the opportunity to acquire extensive

clinical experience based on the availability of patients (Istrate, et al., 2021). This involves the number of procedures a student will complete before they graduate from dental school, and this number varies from school to school. Dental education consists of a combination of theoretical training with laboratory simulation components and clinical practice. The process from a theoretical framework to a clinical setting is important and challenging in dental education. Therefore, there is an urgent need for instructional methods that can improve dental students' ability to integrate dental theory and clinical practice.

In the United States, dental students undergo a rigorous four-year program. During the first two years, students focus on medically oriented classes, such as biochemistry, anatomy, physiology, oral biology, preventive dentistry, and dental anatomy. Students also spend significant time in pre-clinical dental labs (simulation, bench, and wet). This training is vital for skills development and to ensure that students can perform safe and competent dental procedures on patients.

At the end of the second year, students take the first section of the national board exam. From that point forward, they spend less time in the classroom and begin treating patients in the dental clinic under faculty supervision. The knowledge and self-assurance gained through simulation laboratory training are crucial for preparing them for this transition. Students spend even more time treating patients in their senior year, while also preparing for the second portion of the national examination.

1.3 Problem and Motivation

The field of dental education in the United States is challenged by a shortage of proficient dental professionals, deficiencies in practical training, and escalating demand for dental services. Within this context, dental schools grapple with internal and external obstacles such as evolving regulatory frameworks (such as Medicaid), gaps in their technological capabilities, diminished patient volumes, the distinction between public and private organizational structures, and the mounting concerns of rising tuition costs and student debt burdens. The rising demand for dental services imposes a significant obligation on dental schools to provide students with an education that equips them for success in the dental profession.

However, the conventional classroom-centric model of dental education faces inherent limitations in preparing students comprehensively. This limitation is particularly glaring in an era where technology, specifically AI, has precipitated transformative revolutions across various industries. In essence, the problem lies in the unfulfilled potential of AI to revolutionize dental education and the critical need to bridge this gap to better prepare dental students. In the landscape of dental education in the United States, the imperative for revitalization predates the current AI revolution: "Revitalization of dental education in the United States is an imperative, but it depends mainly on the willingness of dental school faculty to make great changes" (DePaola, 2008).

But this rejuvenation hinges significantly on the willingness of dental school faculty to champion substantial reforms; technology can help, but only if matched with change to the institution. Others have recognized the need for change within the halls of academia and the entire spectrum of oral healthcare. This imperative is underscored by the work of Garcia and Sohn (2012), who call for change at the crossroads of tradition and innovation, to explore the potential of emerging technologies, particularly AI, in revolutionizing dental education. The current lecture-based approach in dental education fails to deliver desired learning outcomes, leaving students poorly prepared for practical challenges in the profession (Nizami et al., 2023). Despite the potential benefits of AI in learning environments, the impact of this technology on dental school outcomes in the United States is largely unknown. As Thurzo et al. (2023) observed, the precise impact of AI on dental education outcomes in the United States remains largely shrouded in uncertainty.

2. LITERATURE REVIEW

The use of AI in healthcare practice and research has become a global objective, with the United States leading the way (Schleyer et al., 2011). Its implementation can significantly impact dental informatics (DI) (AbuSalim et al., 2022) by significantly enhancing dental research, practice, administration, and education. DI is a subdiscipline of medical informatics (MI), which is an interdisciplinary field comprised of software, computer science, medicine, information science, statistics, cognitive sciences, and

mathematics (Islam et al., 2022), plays a crucial role in lowering healthcare costs, enhancing healthcare services, and reducing medical errors (Wyatt and Liu, 2002).

2.1 AI and Dental Informatics

As a subdiscipline of MI, DI also influences the development of MI. Although there are similarities between DI and MI in medical research, separate studies specifically focused on DI are essential. Through DI, computer applications can improve dental practice and education (Cimino, 2006). Early practitioners of DI defined their method as the application of information science to medical problems (Reynolds et al., 2008), and DI has contributed to advancements that have reduced operation time and invasiveness while improving patients' comfort (Salagare & Prasad, 2020). Moreover, it has helped the field of dentistry to embrace digital workflow (Joda et al., 2017), improving treatment planning, design, prototyping, implant surgery, and the creation of specialized prosthetics. Unfortunately, most dentists do not know about DI, its objectives, accomplishments thus far, and how to actively participate (Schleyer, 2003).

Additionally, AI has played an increasingly prominent role in orthodontics (Monill-González et al., 2021), enhancing the accuracy and efficiency of the diagnostic process. Advancements such as introducing more aesthetically pleasing treatment options, adopting fully digital workflows, utilizing temporary anchorage devices, and new imaging techniques have revolutionized orthodontic care, benefiting both patients and professionals alike (Khanna & Dhaimade, 2017). AI has improved the prediction of treatment outcomes (Monill-González et al., 2021); this facilitates treatment planning. However, AI-based knowledge does not negate the crucial role of healthcare professionals (Khanna & Dhaimade, 2017; Monill-González et al., 2021), who possess their own specialized training and years of experience. But AI can be a valuable tool, especially when there are time restrictions, and can help clinicians make specific clinical decisions.

2.2 Dental Education and AI in Dental Schools

The use of AI in dentistry (Monill-González et al., 2021) has become a reality, highlighting significant advancements in dental education. One example would be haptic gloves, which allow dental students to experience the sensation of virtual objects while practicing suturing or administering a nerve block (Locurcio, 2022). This technology can vastly improve students' technique over time and provide immediate feedback, such as the accuracy of needle insertion.

In the field of dental education, the metaverse (Locurcio, 2022), an extension of the internet that facilitates user interaction with one another and the virtual environment, has been investigated. Multiple technologies, including virtual reality and augmented reality, enable this interaction. Historically, dental education has employed a variety of instructional strategies (Radianti et al., 2020); as a result, there may be many opportunities to enhance different strategies by implementing AI in the dental classroom.

2.3 Organizational Strategy and Technology Adoption

Current trends and future directions for integrating AI into dental practice have been explored, highlighting dental diagnosis, treatment planning, and patient care benefits (Saini & Vaseen, 2019). AI's past, present, and future in healthcare have been widely discussed (Wang et al., 2019), and have been considered for a long time. The initial use of AI in the field of medicine in 1976 has been documented, where a computer algorithm was employed to identify the underlying causes of acute abdominal pain. Subsequently, a plethora of AI applications in medicine have been proposed, encompassing various areas of specialization (Aung et al., 2021). These applications range from helping detect diseases, such as identifying skin cancers in dermatology or diabetic retinopathy in ophthalmology, to improving pathology classification, such as interpreting radiology scans or delineating features in cardiology (Wang et al., 2019). Recently, AI has demonstrated its potential to predict disease patterns and epidemiology, as exemplified by machine learning-based algorithms developed during the COVID-19 pandemic (Chen & See, 2020).

Despite the substantial investments made by the healthcare industry in AI technology, the adoption and implementation of AI solutions in healthcare remain at an early stage. Several significant challenges currently confronting the healthcare sector include the need for cost reduction, the scarcity of physicians

leading to burnout, and the growing emphasis on chronic disease management (Chen & See, 2020; Wang et al., 2019). Given the critical strain on the healthcare workforce, AI - particularly deep learning - has been suggested to play a pivotal role in addressing these challenges and bridging the gap in healthcare delivery.

3. MODEL AND HYPOTHESIS

The research model (Figure 1) explains student satisfaction as the product of a number of independent variables. We define our dependent variable, Student Satisfaction, as "*student satisfaction within the organizational process of dental education*" and measure it with items such as "How satisfied are you with the level of AI Technology incorporated into NYU Dentistry preclinical and clinical education?". Our definitions and sample operationalization items are listed with each hypothesis, along with logic for the relationships we expect to find in our data.

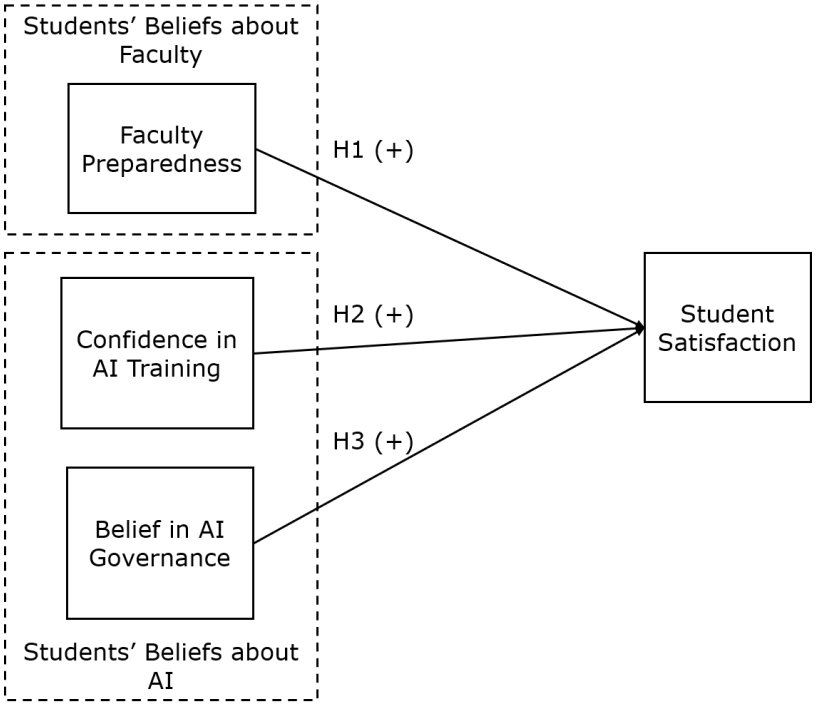

Figure 1. Research Model and Hypotheses – Student Satisfaction

3.1 Hypothesis 1: The Effect of Faculty Preparedness

- The first factor to consider is Faculty Preparedness, which we define as "*A student's perception of the readiness, skills, and knowledge possessed by their instructors to effectively use AI in their teaching practices*" and measure with items such as "How would you rate the readiness of your faculty to use digital technology in the teaching environment?". Consistent with the IT business value framework (Melville et al., 2004), faculty preparedness represents a complementary human resource that determines whether an IT investment such as AI translates into improved organizational performance.

Several mechanisms might explain the positive impact of faculty preparedness on student satisfaction. Faculty members who are proficient in utilizing AI/technology might be better equipped to design and deliver engaging and interactive learning experiences that cater to the diverse needs and preferences of students. AI-driven teaching tools and resources might help create dynamic and immersive learning environments. So, faculty preparedness to use AI/technology might enhance instructional effectiveness and improve learning outcomes (Islam et al., 2022). Educators who leverage AI-driven teaching modalities can provide timely feedback, adaptive learning pathways, and personalized support to students, resulting in a more effective learning process and increased student achievement (Nizami et al., 2023).

Additionally, perceptions of faculty preparedness might contribute to the overall student satisfaction with their educational experience. If they do, then students might associate faculty competence in the use of AI with a supportive and enriching learning environment. Thus, we offer the following hypothesis.
H1: *Faculty Preparedness will positively relate to Student Satisfaction*.

3.2 Hypothesis 2: The Effect of Confidence in AI Training

- Hypothesis 2 concerns whether Confidence in AI Training contributes to their satisfaction in the dental school. This confidence, defined as "*The belief, held by a student, that exposure to AI technology in the classroom improves clinical skill*" is measured with items such as "If you were exposed to a fully developed AI Technology environment in your preclinical labs, do you believe that it would have improved your confidence level in the clinical environment?". This independent variable represents student confidence and should have a relationship with their satisfaction with the educational experience in dental education. This is because students are more likely to actively engage with AI-driven teaching modalities when they have self-efficacy for this activity (Liang, et al., 2023). This might lead to higher levels of satisfaction and academic success. Confidence reflects students' expectations for the value AI will deliver in the classroom. This construct was selected to reflect part of the value that AI integration might offer, from the student's perspective. Confidence might enable students to actively engage with AI-driven teaching modalities, take ownership of their learning, and pursue opportunities for growth and skill development.

A student's level of Confidence in AI Training should contribute to a positive perception of the educational institution's commitment to innovation and excellence in education. Specifically, their beliefs that they can successfully improve by taking advantage of AI integration should lead them to report satisfaction with the educational process. Thus, we offer the following hypothesis.
H2: *Confidence in AI Training will positively relate to variance in Student Satisfaction*.

3.3 Hypothesis 3: The Effect of Belief in AI Governance

- Perceptions on how AI impacts institutional governance also plays a role in how satisfied students feel during their dental education. In this context, "governance" refers to the management of student work and progress. Accordingly, we include the independent variable of Belief in AI Governance, defined as "A student's belief that AI technologies can improve their school's ability to manage the learning experience," measured with items such as "Do you believe that ML and its predictive capabilities could transform how education institutions track students' performance and address issues?". Consistent with our emphasis on value, Governance was included to reflect the organization's administrative and managerial efficacy in converting AI investment into performance gains

A belief in AI as having a role in teaching may reflect perceptions, attitudes, and confidence in the effectiveness and benefits of AI-driven teaching modalities within their educational experience. The integration of AI technologies in institutional governance enhances the efficiency, transparency, and effectiveness of decision-making processes within the educational institution. AI-driven analytics, data-driven insights, and predictive modeling enable institutional leaders to make informed decisions, allocate resources strategically, and respond proactively to emerging challenges and opportunities. We expect perceptions of a streamlined governance structure to contribute to student satisfaction and confidence in the institution's commitment to excellent education. Based on this, we offer the following hypothesis.
H3: *Belief in AI Governance will positively relate to variance in Student Satisfaction*.

3.4 A Regression Equation to Predict Student Satisfaction

Additionally, the control variable of tenure in school might play a significant role in determining student satisfaction within the organizational context of dental education, so it is included in the model. By accounting for the influence of time spent in the institution, researchers can better assess the unique contributions of other independent variables. This rounds out our model, with a regression formula of:

$$Satisfaction = \beta_0 + \beta_1 FacultyPrep + \beta_2 Confidence + \beta_3 Governance + \beta_4 Tenure + \mu_i$$

In conclusion, student belief in AI/Technology in Teaching and AI impact on institutional governance serve as independent variables that positively influence student satisfaction within the organizational context of dental education. By fostering a culture of belief in the benefits of AI-driven teaching modalities and integrating AI technologies into governance processes, educational institutions can

enhance student engagement, motivation, and satisfaction. This can ultimately contribute to a more enriching and rewarding educational experience.

4. METHOD

Our level of analysis is the individual, and our population of interest consists of dental students. Our sample frame consisted of students at an accredited dental school in the North-Eastern United States, recruited by email from faculty. Our sample consisted of 75 full-time dental students. Perception items regarding AI referenced the terms used at the institution for their AI implementations: Robotics, Machine Learning, and Deep Learning. Data was analyzed using R and ordinary least squared regression. The student survey consisted of 18 items organized into four sections: demographic information, faculty preparedness, student confidence in AI, and institutional investment in AI technology. Items combined Likert-scale, binary, and open-ended formats and were administered via Qualtrics.

5. RESULTS

Dependent variable: Satisfaction; R2 = 0.473	
Faculty Prep.	0.580 (0.098)***
Confidence	-0.457 (0.164)***
Governance	-0.493 (0.257)*
Tenure	-0.98 (0.059)*
Constant	1.836 (0.364)***

Table 1. Coefficients (Betas); R2 = 0.473; Significance: *p < 0.1, **p < 0.05; ***p < 0.01

As shown in Table 1, H1 is supported as faculty preparedness to use AI technology in the school is positively related to student satisfaction ($p < 0.001$). H3 is not supported since the help of AI technology to improve school governance is negatively associated with student satisfaction, and the significance test ($p < 0.1$) indicates only moderate confidence in the observed relationship. Surprisingly, H2 is not supported and students who believe that exposure to AI in the preclinical labs will improve their confidence in the clinical environment might be *less* satisfied with the incorporation of AI technology in their school.

6. DISCUSSION AND CONCLUSION

Based on our survey data, we propose the following generalizations about how students' beliefs and perceptions affect their satisfaction with the dental education process.

1. Faculty Preparedness (H1): The analysis supported H1, indicating a significant positive relationship between faculty preparedness to use AI/technology and student satisfaction ($\beta = 0.580$, $p < 0.001$). These findings underscore the importance of adequately training faculty members to effectively integrate AI/technology into their teaching practices.

2. Confidence in AI Training (H2): Contrary to expectations, H2 was found to be reversely supported. Students who believed that exposure to AI technology in preclinical laboratories would enhance their confidence in the clinical environment expressed lower satisfaction with the incorporation of AI technology into the school ($\beta = -0.457$, $p < 0.01$). This unexpected result suggests that students with high expectations for AI/technology integration may have requirements or standards regarding its application that the institution has yet to meet.

3. Belief in AI Governance (H3): H3 was not supported, as the analysis revealed a negative correlation between Student Satisfaction and the perception that AI technology is used in school governance, although not statistically significant at the conventional level ($\beta = -0.493$, $p < 0.1$). More research is required to understand the implications of this relationship.

6.1 Guidance to Industry

Based on the regression results and the implications they suggest, the following recommendations can be made.

1. Enhance Faculty Preparedness: Institutions should prioritize providing training and support to faculty to enhance their preparedness in utilizing AI technology competently. Faculty can integrate AI technology into their teaching practices more effectively with the aid of professional development programs, workshops, and resources, thereby enhancing student satisfaction.

2. Respond to Student Expectations: Institutions should assess and address students' AI/technology integration expectations and standards. By understanding these expectations and meeting them, institutions can increase student satisfaction. Interviews and focus groups are examples of qualitative research methods that can provide valuable insights into students' perspectives and help tailor interventions accordingly.

6.2 Limitations and Directions for Future Research

The unexpected observation that levels of Confidence in AI/Technology were negatively related to those of student satisfaction calls for an approach of abductive reasoning, followed by transparent hypothesizing after results are known ("THARKING"). This result is particularly exciting, given the hype that surrounds AI. It might be that the extravagant claims made of AI in the popular press have created impossible expectations, and what is known about expectation disconfirmation (Lankton and McKnight, 2012) may be leveraged to explain dissatisfaction with AI in the context of dental education.

6.3 Conclusion

Rather than serving solely as a technological enhancement, AI has the potential to transform how students learn, how faculty teach, and how dental schools evaluate educational quality and institutional performance. This study demonstrates that technology alone is insufficient to improve educational outcomes. The greatest benefits are realized when AI is implemented within a learning environment characterized by faculty readiness, thoughtful instructional design, and organizational support. These findings provide a practical framework for dental educators, administrators, and policymakers seeking to implement AI in ways that improve both student experiences and institutional effectiveness.

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