

The Transformation of Dental Education: A Social Constructivist Approach to Teaching and Learning in Dentistry

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Abstract

The dental profession is evolving, placing increasing demands on educators to deliver effective training programs. Over time, dental education has aligned with broader trends in higher education, shifting focus from an individualistic learning approach to a social constructivist framework. This study critically examines theories such as social constructivism and legitimate peripheral participation in the context of dental training, drawing on academic research, professional discourse, and personal experiences. Findings highlight a transformation in educational dynamics: students now occupy a central role in their learning, with instructors serving as facilitators. Social constructivism emerges as a foundational principle, fostering an environment where collaborative learning and interaction are integral. The concept of legitimate peripheral participation proves crucial, illustrating the progression of dental students from novices to skilled practitioners within a "community of practice." This developmental process involves not only acquiring knowledge and skills but also cultivating an identity aligned with the professional community. Such an approach ensures graduates are well-equipped to contribute effectively to the dynamic dental field.

1. Introduction

The evolution of the dental profession presents a dynamic and ever-changing landscape. Dental educators face significant challenges in delivering high-quality education and training programs to meet the demands of this evolving field. Over time, dental training has aligned itself with broader movements in higher education, transitioning from traditional, individual-centered learning approaches to those grounded in social constructivism and the concept of communities of practice [8]. Social Constructivism is a theory of learning that emphasises the role of social interactions and cultural context in the formation of knowledge. This approach prioritises collaborative learning, the development of practical skills, and the cultivation of professional identities.

This paper critically examines the impact of social constructivism and legitimate peripheral participation on undergraduate dental training [12]. Specifically, it

addresses the question:

Has the transformation of individual learning to communities of practice in a social learning environment had a positive impact on the learning of undergraduate dental students ?

Drawing on academic research, professional discourse, and personal experiences, the analysis demonstrates how these theories provide a solid foundation for understanding learning processes and highlights the challenges and opportunities they present.

2. Theoretical Foundations of Learning in Dentistry

Theoretical frameworks have long shaped the methodologies of dental education, emphasizing the diverse cognitive and interpersonal processes involved in learning. Historically, the apprenticeship model dominated, relying on observation, imitation, and guidance, aligning closely with pedagogical principles of unidirectional teaching [11]. However, contemporary theories highlight the importance of bidirectional communication, collaboration, and reflection in skill acquisition [7]. Kolb's experiential learning model underscores iterative cycles of experience and feedback [10]. However, cognitive apprenticeship strategies like modelling and scaffolding support the gradual development of autonomy in learners [1].

Addressing variability in learners' needs, concepts such as distributed scaffolding adapt support to individual developmental levels [16]. These theoretical foundations, blending traditional and modern approaches, provide a comprehensive framework for equipping dental students with the skills and reflective practices necessary for clinical competence.

2.1 Traditional Apprenticeship Model

Historically, the 12th-century apprenticeship model dominated education and training. This approach emphasized the transfer of skills and knowledge from an experienced mentor to a novice. It

aligns closely with the principles of pedagogy, where the teacher holds a central role, and the learner assumes a more passive position in the educational process [11]. The apprenticeship model remains highly relevant in dental education, where visualization, demonstration, observation, and imitation are crucial for skill acquisition.

However, the assumption of unilateral learning in this model has been challenged by researchers like Gallagher et al. who argue for the importance of bidirectional communication in effective teaching [7]. My personal experiences support this perspective. For example, as both a learner and a teacher, it has been found that constructive conversations, such as asking questions during a procedure and engaging in reflective dialogue afterward, significantly enhance understanding and skill development.

For instance, during dental training, competence in tasks like dental extractions developed through direct observation followed by discussions and reflection. Students were encouraged to prepare beforehand, practice on plastic models, and then observe their tutor perform the extraction. Subsequent attempts with minimal assistance, guided by feedback, were key to their learning. In teaching dental students, this approach is replicated, incorporating both verbal and clinical teaching, alongside opportunities for reflection and feedback. These interactions align with the andragogical principles of learning, emphasizing collaborative input between the educator and learner [11].

2.2. Experiential Learning

Kolb's experiential learning theory provides an additional lens to analyse the learning process [10]. Kolb emphasises the importance of reflection on concrete experiences, which leads to iterative cycles of learning [10]. Reflection can take various forms, including informal peer discussions and formal written accounts, such as e-portfolios. While written reflections provide structure, informal discussions with peers are often found to be more impactful, as they foster the exchange of diverse perspectives, thereby enriching the learning experience.

2.3. Problem-Based learning in Dental Education

Problem-based learning (PBL) has become a central component of dental education, particularly in fostering independent learning and critical thinking. By engaging students in group discussions on weekly topics, PBL encourages them to identify personal learning strategies and apply their knowledge in assessments. However, as noted in the literature and my personal experience, this method has limitations. For instance, the variability in content coverage across students can lead to gaps in foundational knowledge.

Additionally, less experienced tutors may struggle to facilitate PBL effectively.

To address these challenges, a blended approach that combines lectures with PBL and incorporates cognitive apprenticeship strategies could ensure consistent coverage of core concepts while encouraging independent exploration. This balance would better prepare students for real-world scenarios, where adaptability and self-reliance are critical.

2.4. Learning Environments and the Role of Teachers

Fry et al. argue that there is no single "best" teaching style, as the effectiveness of any approach depends on the context and the learners involved [6]. The learning environment plays a pivotal role in shaping motivation and engagement. My own experiences highlight the importance of a supportive and respectful environment. For example, during my vocational training year, my educational supervisor fostered a "climate of trust" by maintaining an open-door policy, holding regular meetings, and providing constructive feedback. In contrast, negative feedback given publicly can undermine one's confidence and motivation.

Creating a positive learning climate involves establishing mutual respect and focusing on constructive dialogue. Effective teachers act as facilitators, guiding students through their learning journey rather than dictating it.

2.5. Scaffolding and Cognitive Apprenticeship

Collins et al. introduced the concept of cognitive apprenticeship, which involves key strategies such as modelling, coaching, reflection, articulation, and exploration [1]. These strategies are particularly relevant in dental education, where students progress from performing procedures on plastic teeth to treating real patients. For instance, learning crown preparation is a staged process that begins with heavy guidance and gradually transitions to independent practice, embodying the principle of "scaffolding with fading."

This approach highlights the importance of tailoring guidance to individual needs, especially given the varying "zones of proximal development" observed among learners [16]. While scaffolding encourages students to build confidence and skills progressively, challenges arise when some students require more extensive support than others. Research by Puntambekar and Kolodner on "distributed scaffolding" addresses these challenges by emphasizing the need for tailored, layered support [14]. During dental teaching sessions, students are actively encouraged to voice concerns, ensuring personalised guidance that caters to their specific

needs and fosters meaningful learning experiences. For example, students may recall struggling with challenging procedures such as root canal treatments, and tutors who provide extended feedback and encouragement can significantly impact their understanding and confidence.

Furthermore, Roehler and Cantlon observed that effective scaffolding enables learners to take increasing responsibility, with teacher support gradually fading over time [15]. This underscores the importance of engaging learners in deeper critical thinking and problem-solving. By integrating distributed scaffolding into dental education, students can receive individualized attention, helping them overcome challenges and achieve autonomy. This approach not only enhances technical skill acquisition but also instills a sense of accomplishment and self-reliance, ensuring a more robust and personalized learning experience.

3. Social Constructivism in Dental Training

Social constructivism emphasizes the role of social interaction and shared experiences in learning, making it a valuable framework for dental education. Within dental schools, communities of practice comprising consultants, specialty dentists, nurses, and students foster collaboration and professional growth [12]. Student's progress from peripheral participants to active members of these communities through activities such as clinical teamwork, audits, and professional networks. These experiences provide opportunities to exchange knowledge, reflect on practice, and develop as independent learners. Tailored support in small clinical groups creates a less stressful environment, encouraging bilateral feedback between students and educators, which enhances the learning process. While traditional didactic models focus on knowledge transfer, they often fail to address critical thinking, teamwork, and the practical application of skills [13]. Team-based learning (TBL) addresses these gaps by promoting collaboration and problem-solving, such as alternating dentist and nurse roles during clinical sessions [9]. Despite challenges like variability in tutor expertise and mixed student satisfaction, TBL fosters active engagement and reflective practice, essential for preparing adaptive, collaborative clinicians in the modern healthcare environment. By incorporating social constructivist principles, dental training can move beyond technical skill acquisition to cultivate well-rounded practitioners capable of lifelong learning.

3.1. Communities Of Practice

Lave and Wenger's concept of communities of practice emphasises the importance of social learning within a professional community [12]. Dental schools

inherently function as such communities, encompassing consultants, specialty dentists, nurses, and students. Interaction within this hierarchy fosters professional development and collaboration.

Vygotsky's notion of "internalisation" underscores the idea that learning occurs through interaction, whether discovered individually or transmitted from others [16]. However, this process may not always consider the broader social and cultural context. Engeström expanded on Vygotsky's theory, suggesting that learning is influenced by social activity and shaped by interaction with others [3].

One manifestation of this concept is the "dental school family" system, where students from different year groups form mentoring networks. While this system was not in place during my own training, feedback from current students indicates that it provides valuable support and fosters a sense of belonging. Similarly, online dental platforms allow practitioners to showcase their work and engage in professional dialogue, further strengthening the community of practice. Throughout my teaching, students are encouraged to engage in both educational and social activities, fostering a sense of belonging within the dental community. Clinical sessions with small groups allow for individualised attention, promoting a positive learning environment where students feel supported and encouraged to take initiative. Additionally, feedback from students, facilitated through digital tools, contributes to mutual learning and continuous improvement.

3.2. Team-Based Learning

Traditional didactic training focuses on transmitting knowledge from teacher to student. While this approach is important for ensuring basic knowledge recall, it does not fully promote the application of knowledge in real-world contexts [13]. Social constructivism argues that clinical competency alone is insufficient; students must also develop critical thinking and teamwork skills [5].

Team-based learning (TBL) is another aspect of social constructivism that promotes collaboration and critical thinking [13]. By alternating roles as dentists and nurses during clinical sessions, students gain a deeper understanding of their peers' perspectives and reflect on their experiences. While TBL has its challenges, including variability in tutor expertise and lower initial satisfaction levels compared to traditional methods, it encourages active engagement and prepares students for collaborative practice [2].

4. Integration of Cognitive and Social Approaches

The transition from traditional, didactic models to social constructivist approaches do not imply the abandonment of earlier methods. Instead, effective

dental education incorporates elements of pedagogy, andragogy, cognitive and social learning theories. For example, while factual recall remains essential, the integration of critical thinking, problem-solving, and teamwork skills ensures a holistic approach to training.

Moreover, the interplay between these approaches aligns with Engeström's concept of activity theory, which views learning as a dynamic interaction between individuals and their social and cultural environments [3]. Dental training exemplifies this interplay, as students develop technical skills alongside professional identities through social interactions and shared experiences.

5. Challenges and Future Directions

Social constructivism has transformed dental education, emphasising collaborative learning and shared experiences. However, challenges remain, such as ensuring consistent content delivery and maintaining the effectiveness of tutor-led approaches like Problem-Based Learning (PBL) and Team-Based Learning (TBL). The growing role of digital dentistry and Artificial Intelligence (AI) offers promising solutions, providing advanced tools that can enhance and complement social constructivist teaching methods.

AI and digital technologies are reshaping the future of dental education by enabling simulated procedures, virtual reality training, and AI-driven assessments. These tools support diverse learning styles by offering immediate, personalised feedback and tailored educational experiences. For instance, virtual simulations create safe, controlled environments for students to practice clinical skills and engage in collaborative problem-solving, mirroring the dynamics of real-world dental practice. These innovations align with social constructivist principles, fostering reflective learning, peer interactions, and shared decision-making in both physical and virtual learning spaces.

While these advancements make education more accessible and interactive, they raise questions about the evolving nature of teacher-student relationships. On one hand, the use of AI and virtual platforms may risk reducing the personal connection between educators and learners. On the other hand, digital tools can enhance these connections by enabling more focused, data-driven feedback and fostering communities of practice beyond the traditional classroom. For example, online platforms can extend collaborative opportunities, allowing students to interact with peers and mentors across the globe, thus enriching their learning experience.

Future directions should examine the integration of AI and digital technologies with social constructivist frameworks, assessing their long-term impact on professional practice and patient care.

Additionally, exploring the balance between human interaction and technological support will be critical in determining whether these innovations enhance or diminish the personal aspects of education. By leveraging digital tools to complement traditional methods, dental education can evolve to meet the needs of diverse learners while retaining the core values of collaboration, reflection, and personalised guidance.

6. Conclusions

Dental education has undergone significant transformations over the past decade, with ongoing advancements shaping its future. The literature highlights the increasing adoption of social constructivism as a foundational framework in dental training. This paradigm shift emphasises the student as the central figure in the educational experience, with teachers serving as facilitators. The focus has transitioned from traditional, didactic methods to active, collaborative learning strategies that foster meaningful engagement and skill development.

The concept of "legitimate peripheral participation," as described by Lave and Wenger, aptly represents the journey of a novice first-year dental student to a competent graduate [12]. This developmental process allows learners to evolve their identity and become integral members of the "community of practice." This framework not only builds technical competency but also encourages the social and collaborative skills required for effective professional practice.

However, while social constructivism is predominant in contemporary dental education, its success is influenced by the integration of elements from other learning theories. Cognitive, behaviourist, and traditional apprenticeship models have all contributed to the evolution of the current educational approach. These elements ensure that the program remains diverse, addressing the varying needs of learners and enhancing its efficacy [4].

The outcomes of this blended approach are evident in the measurable success of dental training programs, such as high graduation rates and consistently positive student satisfaction levels. These indicators underscore the importance of ongoing refinement and adaptation in teaching strategies to meet the demands of modern dental practice.

The progressive adoption of social constructivism, combined with insights from other pedagogical models, has established a robust foundation for dental education. By fostering a collaborative and reflective learning environment, dental training programs can continue to equip future practitioners with the skills, knowledge, and adaptability needed to excel in an ever-evolving field.

6. References

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