International Journal of Dental Research and Allied Sciences
2021, Volume 1, Issue 1, Page No: 18-24

Available online at: www.tsdp.net

ISSN: 3062-3502

Original Article

Enhancing Confidence in Local Anaesthesia: Impact of Additional Educational Strategies in Dental Training

Jelena Ilić[1], Stefan Kovačević[1]*, Ivana Tomić[2]

[1]Department of Dentistry, Faculty of Medical Sciences, University of Kragujevac, Kragujevac, Serbia.
[2]Center for Rehabilitation Medicine, University Clinical Center Kragujevac, Faculty of Medical Sciences, University of Kragujevac, Kragujevac, Serbia.

***E-mail** ✉ stefank2025@hotmail.com

Received: 11 May 2021; **Revised:** 29 August 2021; **Accepted:** 08 September 2021

ABSTRACT

Local anaesthesia is introduced early during the practical phase of dental education. Nevertheless, many dental students report feelings of uncertainty and anxiety before their hands-on training in this skill. This research aimed to examine whether additional educational components in the instruction of local anaesthesia influence students' self-assurance when performing it. Participants were categorized into three groups (A, B, and C). Group A followed the same instructional format used in the prior academic year, consisting of four hours of theoretical teaching and four hours of practical exercises on peers. Group B performed their practical sessions in groups of three, where each student alternated between performing, receiving, and observing the injection procedure. Group C first trained with an anatomically precise model before practicing on a fellow student. After every instructional stage, students completed a questionnaire to assess their confidence in administering local anaesthesia. A significant improvement in confidence was observed after each phase. Combining theory with hands-on practice—especially when incorporating anatomically accurate models and peer-based learning—enhanced students' confidence in performing local anaesthesia. The highest confidence increase was recorded among students in group B, who alternated among performing, receiving, and observing.

Keywords: Undergraduate dental training, Clinical competence, Pedagogical approach, Local anaesthesia

How to Cite This Article: Ilić J, Kovačević S, Tomić I. Enhancing Confidence in Local Anaesthesia: Impact of Additional Educational Strategies in Dental Training. Int J Dent Res Allied Sci. 2021;1(1):18-24. https://doi.org/10.51847/dLfUjUyeww

Introduction

Dental training requires clinical practice on actual patients, necessitating instruction in local anaesthesia to ensure patient comfort. A recent review on local anaesthesia instruction in U.S. dental programs identified three primary teaching strategies: theoretical (textbooks and lectures), peer-based practical sessions, and exercises using anatomical simulation models. However, due to variability among studies, the authors could not clearly evaluate the effects of these pedagogical methods on student confidence. They concluded that limited evidence prevents determining the most effective instructional strategy for local anaesthesia [1].

Dental practitioners often experience stress or apprehension about administering anaesthesia, particularly when they lack sufficient experience. Reduced practice frequency tends to heighten both anxiety and stress. Previous studies have explored such factors: Wong *et al*. assessed dental hygiene students' anxiety levels and found that greater confidence corresponded to lower stress when performing injections [2]. Similarly, paediatric anaesthesia studies revealed higher stress levels in dental students than in experienced specialists [3].

Alternative training approaches beyond direct clinical exposure have proven useful in building students' confidence. Kenny *et al*. demonstrated that students

who watched instructional videos on paediatric anaesthesia displayed a notable and lasting boost in self-assurance [4]. Anatomically realistic models that allow for verification of proper anaesthetic administration offer another valuable teaching tool, enabling repetitive, self-directed practice. Prior evaluations have shown that students who practiced on models before clinical sessions felt significantly more prepared and confident when administering anaesthesia to peers [5]. Model-based training has also been linked to enhanced precision and motor coordination [6]. Nevertheless, such training alone does not guarantee proficiency in safely performing injections on patients [7].

According to Kolb's learning cycle, reflective observation is vital in skill acquisition [8]. Therefore, practical sessions should include opportunities for students to observe procedures performed by others, fostering reflection.

At Umeå University, local anaesthesia is one of the first clinical subjects taught, introduced in the fifth semester. The curriculum integrates literature review, lectures, demonstrations, group discussions, and supervised patient care. After observing demonstrations, students practice injections on classmates under the supervision of an oral surgeon and later perform the procedure on patients before extractions. This structured, stepwise approach—from observation to guided practice—resembles a master-apprentice model. Strong theoretical understanding supports skilled performance, while active participation and self-reflection help integrate new experiences with prior learning [9]. Course evaluations consistently indicate that students wish for additional clinical practice to strengthen their confidence in performing local anaesthesia.

This study therefore aimed to assess three distinct instructional approaches—one including anatomical models and observational learning—implemented in the local anaesthesia training of dental students at Umeå University. The findings are expected to guide improvements in local anaesthesia education and enhance students' confidence during clinical application.

Materials and Methods

In 2020, all fifth-semester undergraduate dental students at Umeå University (n = 72; 50 women and 22 men; mean age = 25; range 21–39) were invited to participate in a study evaluating whether supplementary educational components could increase confidence in local anaesthesia. Students received both verbal and written information about the voluntary nature of participation. Upon consent, each participant completed a questionnaire assessing confidence using a visual analogue scale from 0 to 10 (0 = "I feel completely unconfident performing anaesthesia independently" and 10 = "I feel entirely confident performing anaesthesia independently") [10, 11] (Appendix A).

Students were divided into three groups (A, B, and C) within the dental program. One group received standard instruction, while the other two followed modified versions. All teaching adhered to the program syllabus, and random assignment produced the following:

- Group A (n = 24; 14 women and 10 men; mean age = 25; range 21–31) followed the traditional format—four hours of theoretical lectures followed by four hours of peer practice in pairs.
- Group B (n = 25; 19 women and 6 men; mean age = 25; range 22–39) completed the same lecture series, followed by four hours of practical work in triads, rotating through the roles of performer, recipient, and observer.
- Group C (n = 23; 17 women and 6 men; mean age = 25; range 22–36) attended a four-hour theory lecture, then practiced for four hours using an anatomically accurate model (Frasaco, AG-3 IB) **(Figure 1)**.

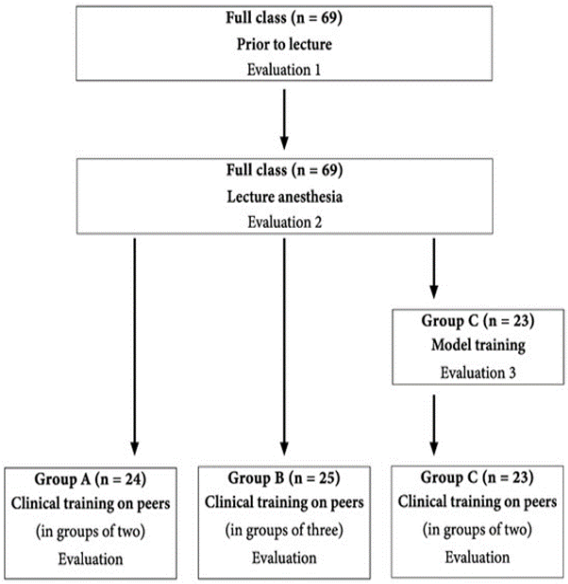

Figure 1. Overview of the study setup evaluating students' self-assessed confidence in administering local anaesthesia during the course "Oral Surgery 1" in the fifth semester. Three participants missed the theoretical lecture, leading to absent responses in evaluations 1 and 2. During the clinical portion, all 72 students were present.

The anatomical model featured four designated contact areas—mental foramen, mandibular foramen, incisive foramen, and greater palatine foramen—each covered with rubber material to mimic mucosal tissue. Students practiced simulated injections using dry needles, and correct needle tip placement was confirmed through acoustic feedback **(Figure 2)**.

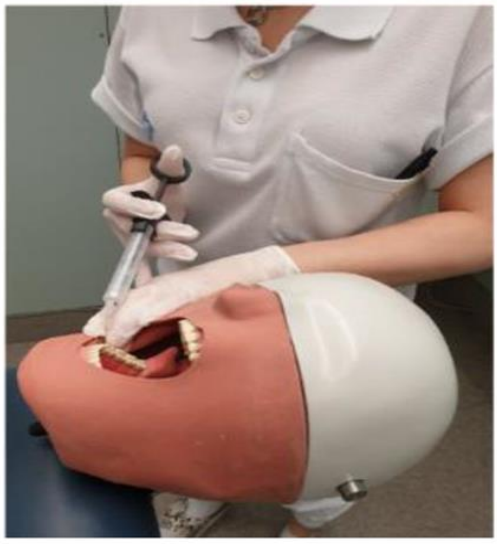

Figure 2. Dental student performing injection practice on the anatomical model.

Following the model-based exercise, group C undertook four hours of hands-on practice on peers in pairs. Because group C had an uneven number of participants, one subgroup included three students instead of two. All participants across groups A, B, and C were trained in the inferior alveolar nerve block using the conventional direct method. Throughout all anaesthesia attempts, four oral surgeons provided supervision. After every stage of the instructional sequence, students completed the aforementioned questionnaire. Their responses were collected twice, and the mean of the two data points was applied in statistical analysis.

Certain sections of the course, specifically the clinical training, coincided with the COVID-19 pandemic. By late March, most university courses in Sweden had moved to online instruction. However, programs involving clinical work were granted exemptions to continue under strict conditions, including full personal protective equipment and adjusted training environments. Consequently, the School of Dentistry at Umeå maintained its in-person clinical teaching. The initial lecture was delivered on campus before the transition to remote learning occurred.

Statistics

The non-parametric Mann–Whitney U-test was employed to evaluate differences in students' perceived confidence between the three instructional groups. A p-value threshold of ≤0.05 was applied for significance testing. Survey results are expressed as mean values with corresponding standard errors of the mean for each evaluation point **(Figure 3)**. Statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA).

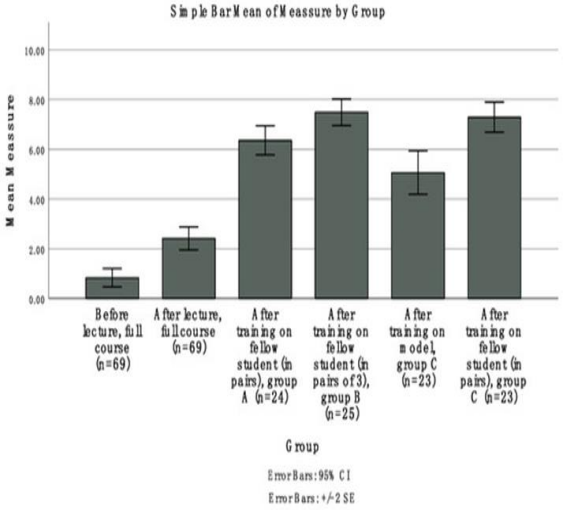

Figure 3. Students' self-rated confidence in independently administering anaesthesia before the lecture, after the lecture, after model training, and after peer training. Each question was rated on a 10-point visual analogue scale (0 = not at all confident, 10 = fully confident in performing anaesthesia independently).

Results and Discussion

The outcomes of the students' self-assessment for confidence after each instructional stage are displayed in **Figure 3**. Three students did not attend the theoretical lecture; hence, their data were absent from evaluations 1 and 2. All 72 participants completed the clinical training phase.

Table 1 presents the statistical evaluation of changes in confidence across different educational stages. A significant improvement in confidence after the theoretical component was observed ($p < 0.01$). Further significant increases were detected between the theoretical session and subsequent peer-based training conducted under supervision ($p < 0.01$). Comparatively, no statistically significant difference was identified between group C (model practice followed by paired peer work) and group B (peer training in groups of three) ($p = 0.69$).

Table 1. Statistical comparison between instructional stages using the Mann–Whitney U-test.

Comparison of Educational Steps	p-Value
Pre-lecture (entire cohort, n = 69) vs. Post-lecture (entire cohort, n = 69)	<0.01
Post-lecture (entire cohort, n = 69) vs. Post-paired training (Group A, n = 24)	<0.01
Post-paired training (Group A, n = 24) vs. Post-model training (Group C, n = 23)	0.01
Post-paired training (Group A, n = 24) vs. Post-triad training (Group B, n = 25)	0.03
Post-paired training (Group A, n = 24) vs. Post-model and paired training (Group C, n = 23)	0.02
Post-triad training (Group B, n = 25) vs. Post-model and paired training (Group C, n = 23)	0.69

The findings of this study, which explored how supplementary teaching components influence the confidence of undergraduate dental students learning local anaesthesia, demonstrate a gradual increase in self-assurance as the course progressed. It was clear, however, that students did not reach full confidence in performing anaesthesia independently after clinical training, regardless of the instructional format. Interestingly, several students reported feeling confident even before the initial theoretical lecture, likely due to previous professional backgrounds as dental hygienists or dental assistants.

The greatest improvement in self-reported confidence appeared after the clinical practice in which students administered injections to one another under supervision. While model-based exercises enhanced confidence in performing anaesthesia, peer practice in groups of three—where participants alternated as operator, recipient, and observer—yielded comparable outcomes to training that combined model use with paired peer exercises. Within a dense teaching curriculum, it is crucial to identify which form of training provides the most efficient learning outcome. Students trained with anatomical models (group C) displayed improved confidence. Model-based instruction alone significantly boosted self-assurance compared with theory-only teaching. When theoretical learning was paired with peer practice, students' confidence rose even further. A large-scale survey of 267 dental schools across Europe and Israel showed that many students felt uncertain when performing injections and preferred introductory sessions using anatomical models and extended guidance [12]. Students generally responded positively to practicing on anatomical models before treating real patients.

Nevertheless, other investigations relying primarily on jaw models have shown no substantial difference in students' ability to administer anaesthesia successfully to peers [5]. Such results highlight the benefit of using multiple pedagogical techniques in clinical instruction. Although model-based learning may not directly expand theoretical knowledge [7], it can enhance confidence and ease the transition to subsequent clinical experiences. Wong *et al*. found that greater confidence among dental hygiene students corresponded with reduced anxiety about administering anaesthesia [2]. Similarly, Kenny *et al*. demonstrated that students trained through instructional videos on paediatric anaesthesia exhibited significantly higher confidence levels both immediately post-training and at follow-up [4].

In the current study, every student practiced administering anaesthesia to peers under the supervision of an oral surgeon. Group B consisted of triads in which each student alternated performing, observing, and receiving anaesthesia. Groups A and C practiced in pairs, administering anaesthesia to one another. Group B achieved the highest confidence scores compared to groups A and C. Moreover, group C, which completed model-based practice before peer training, showed greater confidence than group A, which practiced only on peers without prior model work. Although model-based preparation increases assurance, practicing with a live partner—where one can observe reactions and communicate—appears to contribute more effectively to self-confidence during anaesthesia training.

Demonstrations and instructions by oral surgeons on how to deliver local anaesthesia resemble the traditional "master–apprentice" method of learning. Historically, this approach has been a central means of passing on professional skills [13]. In medical and dental education, practical learning frequently occurs when less experienced trainees learn through observation of and guidance from senior colleagues. According to Nielsen and Kvale, such learning through observation and imitation is a valid pedagogical method [13]. The act of learning anaesthesia administration represents an example of legitimate peripheral participation, where students first observe lectures and demonstrations, then perform on peers under supervision, and eventually administer anaesthesia to actual patients under instructor guidance. Kary *et al*. proposed that combining these three instructional approaches adequately prepares

students to administer anaesthesia confidently and independently [1].

Peer-based clinical training inevitably raises ethical considerations. A study examining ethical issues in anaesthesia teaching within U.S. dental schools revealed that most training was carried out without formal verbal or written consent [14]. Similarly, Hossaini's survey across three American dental schools reported that numerous students expressed ethical concerns about administering injections to peers solely for training purposes [15]. His overall conclusion suggested that this type of practice could be considered ethically problematic [15]. A study from eleven Turkish dental schools found that local anaesthesia instruction began in the fifth semester, though theoretical instruction started earlier [16]. Students' first injections were performed on peers under the supervision of oral surgeons. None of these institutions required ethics committee approval for student-to-student injections.

Comparable practices exist in Swedish dental schools, including Umeå, where two of the four schools introduce anatomical model practice before peer-based anaesthesia training (personal communication, MS). Although discussions regarding the ethical aspects of peer anaesthesia are ongoing at Umeå, students themselves often report that the experience is valuable, as it provides first-hand understanding of anaesthetic sensations. From an ethical viewpoint, it is reasonable to ask whether receiving anaesthesia personally contributes educationally [14]. Considering that many young adults in Sweden have never experienced local anaesthesia, the opportunity to undergo it may offer meaningful insight into the sensations their future patients will face. The Oral Surgery syllabus is reviewed and approved by the program council. Currently, students do not provide formal informed consent before receiving anaesthesia during training, an issue that warrants further attention. Nonetheless, no student is compelled to receive anaesthesia if contraindications exist, such as medical concerns or severe anxiety.

The literature presents a variety of methods for instructing students in local anaesthesia. The selection of these methods depends on factors such as institutional tradition, faculty availability, educational resources, and patient access. Owing to these differing conditions, each publication must be assessed based on its own conclusions, allowing readers to adapt the findings to their respective institutions. Evidence suggests that multiple dental programs are actively enhancing their teaching approaches for local anaesthesia. Feedback from Umeå dental students has revealed requests for more extensive hands-on training. While this is a valid suggestion, integrating additional sessions into an already demanding schedule poses challenges. Consequently, future instruction will maintain its current structure but involve groups of three students, where each participant alternates between administering, receiving, and observing the anaesthetic procedure. After all members complete their tasks, a clinical supervisor will facilitate group reflection and discussion. The observation phase provides valuable time for contemplation [17].

When students perform the anaesthetic injection themselves, their focus primarily lies on executing the technique, leaving little room for broader observation. Conversely, when they assume the observer role, they can evaluate both the technical steps and the patient's reaction, fostering deeper understanding of the clinical context. Findings from this study suggest that triad-based group training enhances student confidence in administering local anaesthesia compared to training limited to anatomical models.

The participants consisted only of students enrolled in the course during spring 2020. A larger sample size would have strengthened the study's reliability. Moreover, the students were not randomly assigned to groups. Initially, the dental program divides students into three groups due to scheduling constraints, and each receives identical course content and clinical exposure as prior cohorts. Hence, no student was disadvantaged compared to previous years.

Randomization occurred when the three established groups (A, B, and C) were allocated to three testing methods. Gender and age were not controlled for, which may have influenced outcomes, as previous research has reported gender-based differences in self-assessed competence, often favoring males [18]. Nevertheless, the number of participants per group ranged from 23 to 25, with similar mean ages and a predominance of female students, though proportions varied slightly. Confidence was measured using a visual analogue scale (VAS) ranging from 0 to 10. While this scale is commonly applied to evaluate pain, it is also widely used to assess subjective perceptions such as confidence [10, 11, 19]. The VAS is straightforward to use, time-efficient, and demonstrates strong reliability and validity [20]. Additionally, its application in prior studies [10, 11, 21, 22] enables cross-comparison of findings. One limitation, however, is that self-reported confidence does not always reflect actual proficiency. Feeling confident before performing the procedure does not guarantee skill mastery. Still, previous studies indicate

that self-assurance and perceived control contribute positively to learning outcomes [23, 24].

Conclusion

The study findings reveal that additional practice with anatomical models before peer-based exercises increases students' confidence in administering local anaesthesia. A similar effect was observed when students practiced in triads, allowing each to observe, perform, and reflect on the injection process within a clinical setting.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Kary AL, Gomez J, Raffaelli SD, Levine MH. Preclinical local anesthesia education in dental schools: a systematic review. J Dent Educ. 2018;82(9):1059–64.
2. Wong G, Apthorpe HC, Ruiz K, Nanayakkara S. Student-to-student dental local anesthetic preclinical training: impact on students' confidence and anxiety in clinical practice. J Dent Educ. 2019;83(1):56–63.
3. Farokh-Gisour E, Hatamvand M. Investigation of stress level among dentistry students, general dentists, and pediatric dental specialists during performing pediatric dentistry in Kerman, Iran, in 2017. Open Dent J. 2018;12(1):631–7.
4. Kenny KP, Alkazme AM, Day PF. The effect of viewing video clips of paediatric local anaesthetic administration on the confidence of undergraduate dental students. Eur J Dent Educ. 2018;22(1):e57–e62.
5. Lee JS, Graham R, Bassiur JP, Lichtenthal RM. Evaluation of a local anesthesia simulation model with dental students as novice clinicians. J Dent Educ. 2015;79(12):1411–7.
6. Lopez-Cabrera C, Hernandez-Rivas EJ, Komabayashi T, Galindo-Reyes EL, Tallabs-Lopez D, Cerda-Cristerna BI. Positive influence of a dental anaesthesia simulation model on the perception of learning by Mexican dental students. Eur J Dent Educ. 2017;21(2):e142–7.
7. Knipfer C, Rohde M, Oetter N, Muench T, Kesting MR, Stelzle F. Local anaesthesia training for undergraduate students—How big is the step from model to man? BMC Med Educ. 2018;18(1):308.
8. Kolb DA. Experiential learning: experience as the source of learning and development. Englewood Cliffs (NJ): Prentice-Hall; 1984. Vol. 1.
9. Wrenn J, Wrenn B. Enhancing learning by integrating theory and practice. Int J Teach Learn High Educ. 2009;21(2):248–65.
10. Rodd HD, Farman M, Albadri S, Mackie IC. Undergraduate experience and self-assessed confidence in paediatric dentistry: comparison of three UK dental schools. Br Dent J. 2010;208(5):221–5.
11. Wong S, Wong X, Vaithilingam R, Rajan S. Dental undergraduates' self-assessed confidence in paediatric dentistry. Ann Dent. 2015;22(1):22–30.
12. Brand HS, Tan LL, van der Spek SJ, Baart JA. European dental students' opinions on their local anaesthesia education. Eur J Dent Educ. 2011;15(1):47–52.
13. Nielsen K, Kvale S. Mästarlära—Lärande som social praxis. Lund (Sweden): Studentlitteratur; 2000.
14. Rosenberg M, Orr DL 2nd, Starley ED, Jensen DR. Student-to-student local anesthesia injections in dental education: moral, ethical, and legal issues. J Dent Educ. 2009;73(1):127–32.
15. Hossaini M. Teaching local anesthesia in dental schools: opinions about the student-to-student administration model. J Dent Educ. 2011;75(9):1263–9.
16. Tomruk CO, Oktay I, Sencift K. A survey of local anesthesia education in Turkish dental schools. J Dent Educ. 2013;77(3):348–50.
17. Abelsson A, Bisholt B. Nurse students learning acute care by simulation—Focus on observation and debriefing. Nurse Educ Pract. 2017;24(1):6–13.
18. Karaharju-Suvanto T, Napankangas R, Koivumaki J, Pyorala E, Vinkka-Puhakka H. Gender differences in self-assessed clinical competence—a survey of young dentists in Finland. Eur J Dent Educ. 2014;18(4):234–40.
19. Finch E, Fleming J, Brown K, Lethlean J, Cameron A, McPhail SM. The confidence of speech-language pathology students regarding communicating with people with aphasia. BMC Med Educ. 2013;13(1):92.
20. McCormack H, Horne D, Sheather S. Clinical applications of visual analogue scales: A critical review. Psychol Med. 1988;18(4):1007–19.

21. Sonbol HN, Abu-Ghazaleh SB, Al-Bitar ZB. Undergraduate experience and self-assessed confidence in paediatric dentistry at the University of Jordan Dental School. Eur J Dent Educ. 2017;21(2):e126–30.
22. Rajan S, Chen HY, Chen JJ, Chin-You S, Chee S, Chrun R, et al. Final year dental students' self-assessed confidence in general dentistry. Eur J Dent Educ. 2020;24(2):233–42.
23. Akbari O, Sahibzada J. Students' self-confidence and its impacts on their learning process. Am Int J Soc Sci Res. 2020;5(1):1–15.
24. Fine P, Leung A, Bentall C, Louca C. The impact of confidence on clinical dental practice. Eur J Dent Educ. 2019;23(2):159–67.