

## Digital teaching methodology among the dental students a questionnaire based survey

Running Title: Digital teaching methodology

### Abstract

**Background** : The implementation of digital technologies in dental curricula has started globally and reached varying levels of penetration counting on local resources and demands. One of the biggest challenges in digital education is the need to continuously adapt and adjust to the developments in technology and apply these to dental practice in communicating with dental professionals, medical doctors, dental technicians, and insurance providers, dental students need to be prepared to manage digitized data, ensure patient safety, and understand the advantages and limitations of conventional and digital processes. **Aim** : To create awareness about digital teaching methodology among the dental students. **Materials and Methods** : A cross-sectional survey was conducted among the adolescent population with a sample size of 120. A self administered structured questionnaire was prepared based on digital teaching methodology and consisted of 13 questions. It was circulated to participants through an online platform (google form). The statistics were done using SPSS software, chi-square test was used to check the association and P value of 0.05 was said to be statistically significant. The pros of the survey is that the adolescents of different lifestyles and cultures were surveyed. Children and adults were excluded from the survey. Simple random sampling method was the sampling method used to minimise the sampling bias. **Result** : The results showed that the dental students are aware about the digital teaching methodology. **Conclusion** : The people are aware of the digital teaching methodology. But more awareness needs to be spread so that digital handling can be improvised in the near future.

Keywords: insurance providers; dental students; digital technologies

## Introduction

Digital Technology has reached various levels of interest in the dental field and curriculum depending on the local resources and demands. The biggest challenge in digital education is the need for continuous adaptation and adjustment to the developments in digital technology and to apply such methods in the dental curriculum[1]. A variety of digital technologies are now available to dentists and it is impressive and evolving. Starting from CBCD and 3-D printers and digital radiography and intra-oral scanners, the implementation of such digital technology in the everyday practices of dentists is becoming more common. So consequently as technology improves and continues to transform in the field of dental practice to remain updated and relevant, both the current and future practitioners are away from being able to correlate the art of digital technology into the practises[2]. The introduction of intra oral optical scanning helps the present anatomical situation to be digitised by enabling laboratory fabrication of restorations and to plan for oral rehabilitation with a set up[2,3], to superimpose the situation with 3-D radiography [2–4].The penetration of the scanners are still in limitations in dental clinics[5]. Dental technicians used 3-D model files from iOS by the dentists or they took it from dusk and conventional castes to fill or facilitate the fabrications of restoration . Compared to the waxing method, the digital design offers various advantages for quality control like providing data about the material thickness and values of connector cross sections. But the main shortcomings of lost wax casting were shrinkage cavities, with the digital workflow deliberately being benefited when the industrially manufactured products can be used with additive printing from improved material properties[3].

3-D education programs have been introduced to enhance the students' critical thinking, interactivity. Clinical correlations with the integration of multiple dental disciplines. 3D visualisation allows insights in to the tooth morphology and it also helps to facilitate treatment planning with removable partial denture programs brackets (RPD)[3,6]. The digital technology includes 3-D printing of teeth (virtual) which has been mostly suggested to enhance the transparency for all the dental students due to identical setups[3,6,7].

A recent review on the application of augmented reality (AR) and virtual reality (VR) in dental medicine showed that the use of AR or VR technologies for motor skill training and the clinical testing of maxillofacial surgical protocols has been increasing [3,6–8] . Finally it concluded that these various digital technologies are highly valuable in dental undergraduate education and postgraduate education also. The overall offering interactive learning concepts with 24 seven axes and the objective evaluation. A recent review analyzed the application of

VR in pre-clinical education and it identified four education themes (validation, realism of simulation hardware) Which started highlighting the need for better evidence for the utility of VR in dental education [3,6–9]. After conversation with medical doctors, dental professionals, insurance providers, dental technicians, the dental students will have to be prepared to manage and handle digitised data, understand the limitations and benefits of conventional and digital processes and ensure patient safety.

It looks like digitalisation has a major effect or impact on dental education, after addressing various aspects like, 3-D imaging, digital radiography, dental simulator motor skills including iOS with 3-D printing. Digital applications can improve dental education and implement evidence-based services related to the acceptance of digital education.

The aim of this questionnaire approach was to investigate the knowledge and awareness of digital education in dental students and to create awareness of digital education among dental students Our team has extensive knowledge and research experience that has translated into high quality publications[10–12][13–18],[19][20],[21][22],[23][24][25–29] [30–34]

## **Materials and Methods**

The sample size used for the study is 120. A self structured questionnaire was prepared and uploaded in Google forms. This standard questionnaire in Google forms has been circulated among the sample study population and at the end of the survey, all the data were collected and the data were analysed using chi-square analysis. The chi-square analysis was done using the software SPSS IBM.

## **Results**

Among these people 78.33% think that digital teaching is a boon and 21.61% think that it's been (Figure 1) . 64.17% support and consider digital teaching the best teaching methodology, 24.17% do not consider and 11.67% on both sides (Figure 2). 48.33% of students consider smart learning, 27.50% consider online education and 24.17% consider traditional black board teaching (Figure 3). 70.00% of students concentrate and study during digital methodology like smart learning and 20.83% can't concentrate and 19.17% or on either (Figure 4). 40% of the females considered digital teaching as a boon (Figure 5).

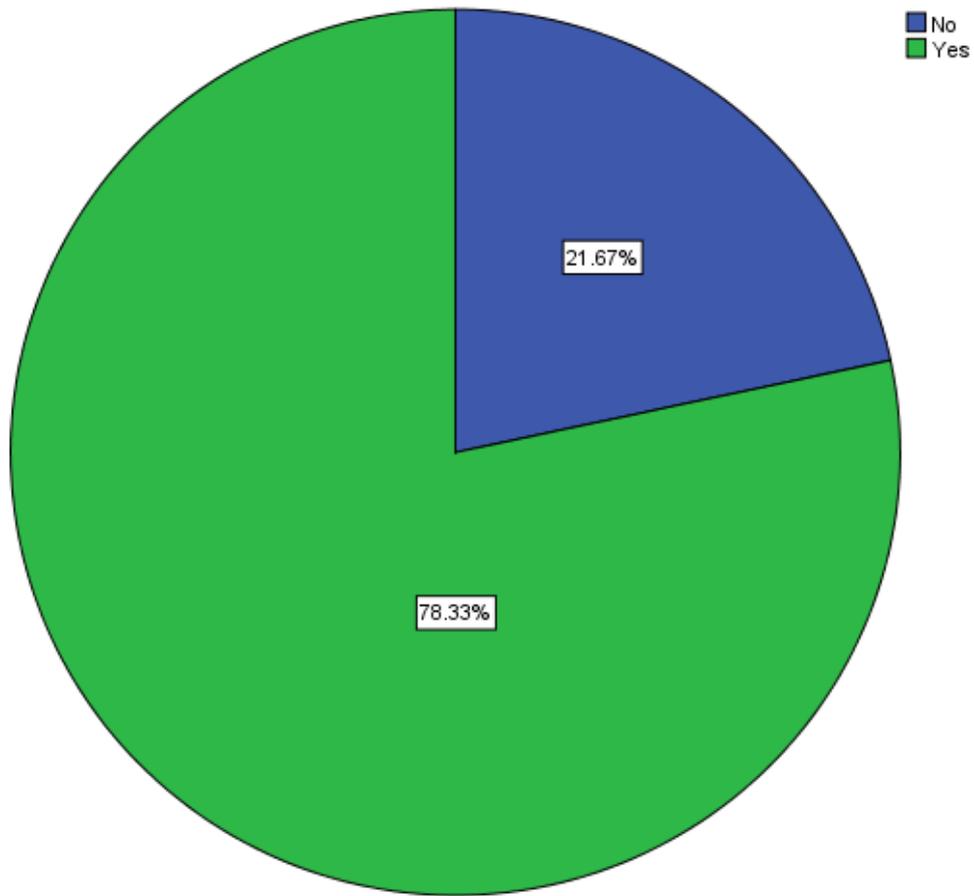


Figure 1. Pie chart showing the percentage distribution of whether digital teaching is a boon or a bane among dental students. Whereas, green represents Yes ( 78.33%) and blue colour represents No (21.67%).

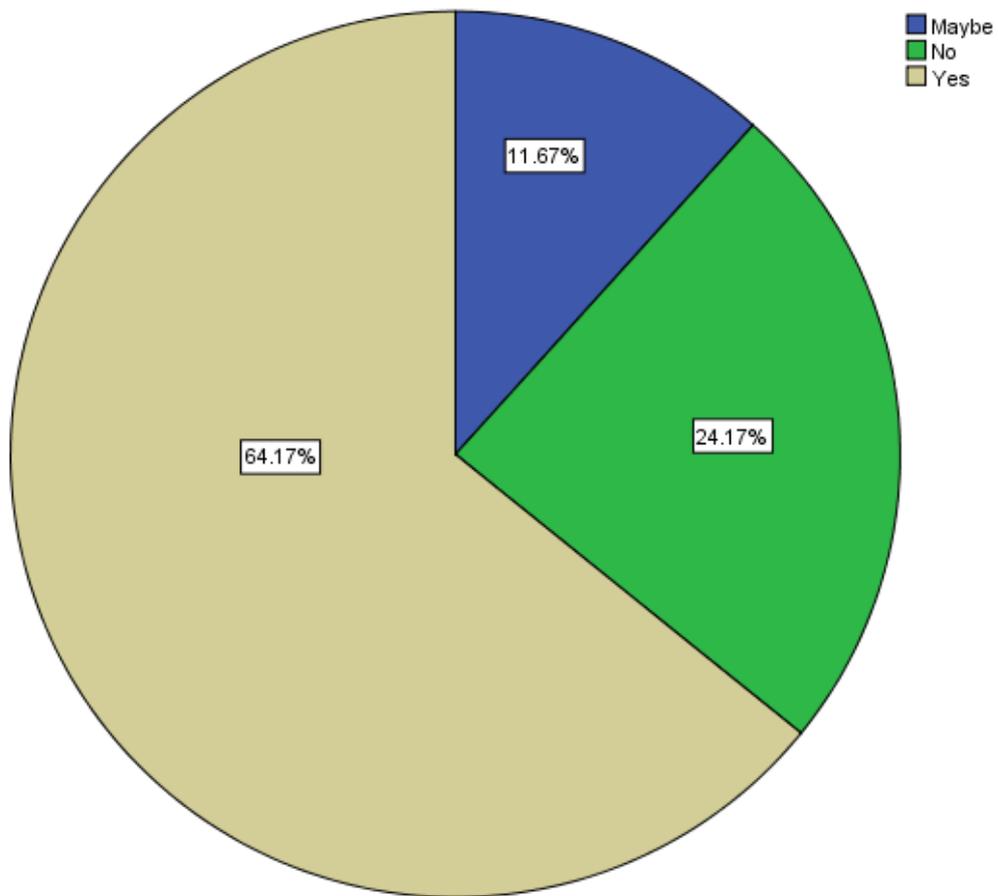


Figure 2 : Pie chart showing the percentage distribution of the best teaching methodology among dental students. Whereas, beige colour represents Yes (64.17%), green colour represents No (24.17%), the blue colour represents maybe (11.67%).

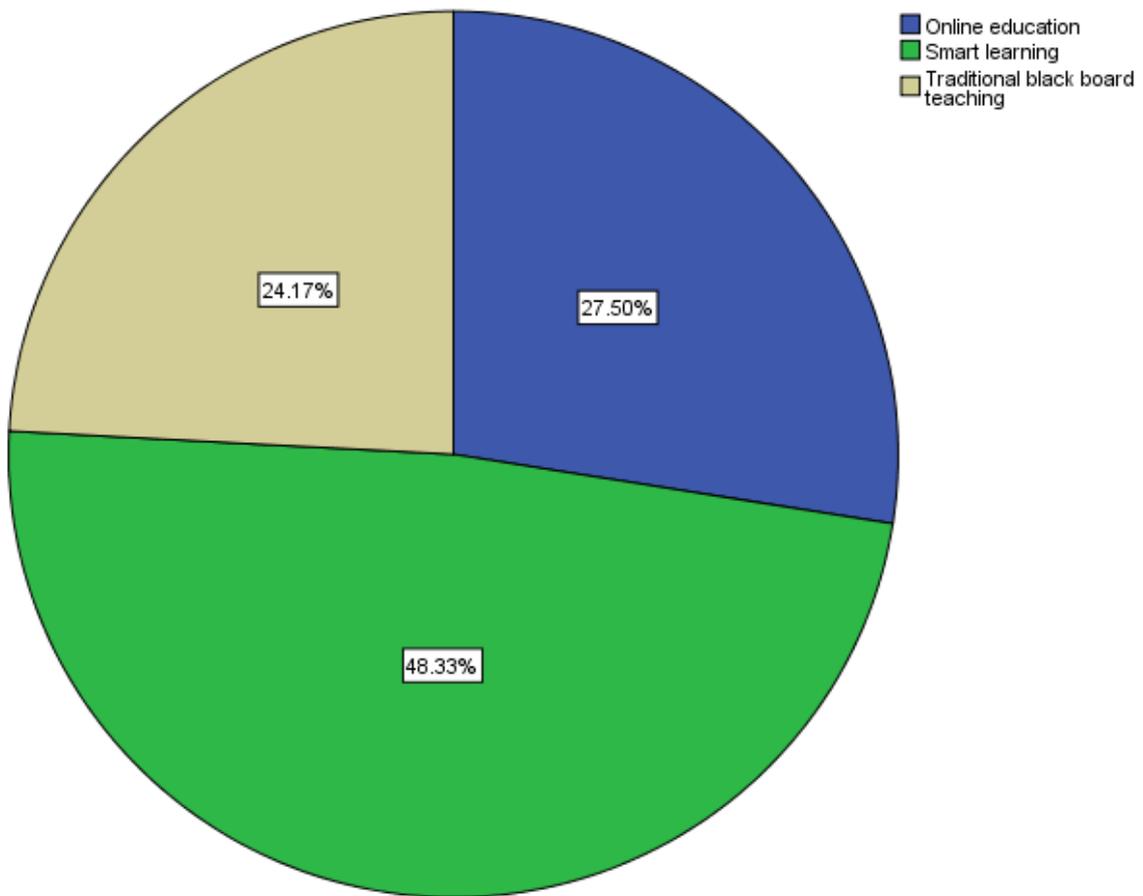


Figure 3 : Pie chart showing the percentage distribution of benefits of digital technology among dental students. Whereas, green colour represents smart learning (48.33%), the blue colour represents online education (27.50%), beige colour represents (24.17%).

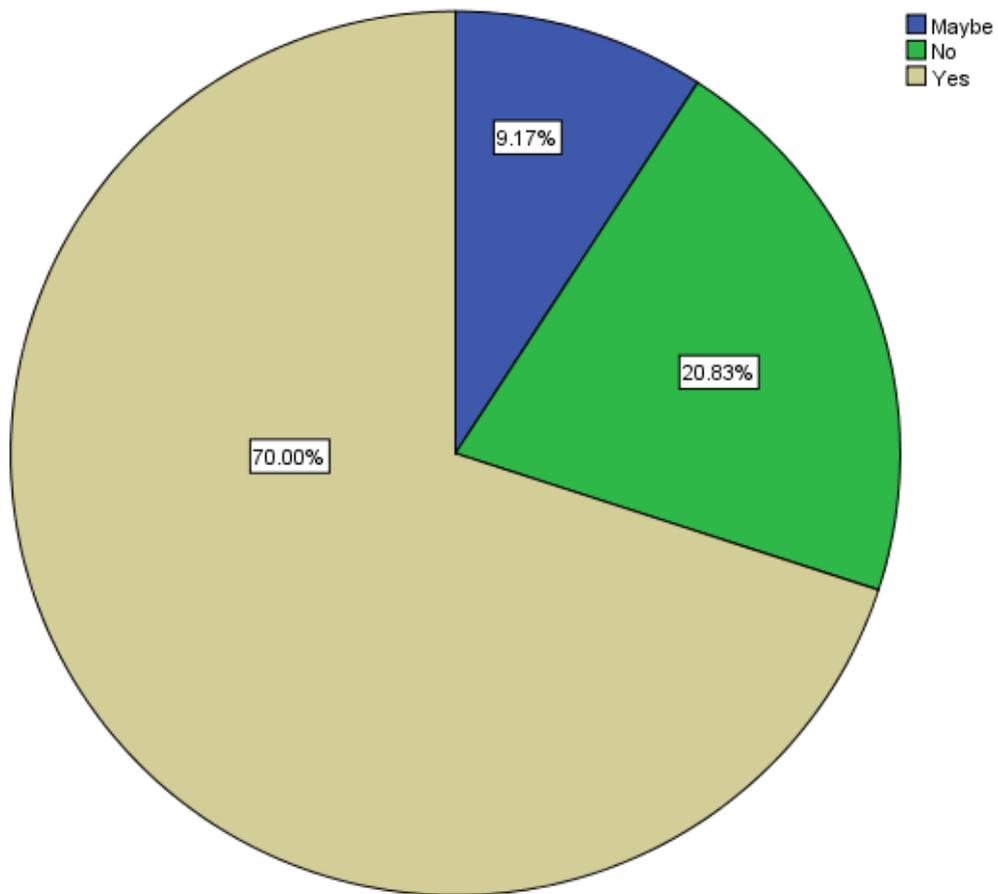


Figure 4 : Pie chart representing the percentage distribution of study concentration in digital teaching methods among dental students. Whereas, beige colour represents Yes (70.00%), green colour represents No (20.83%), the blue colour represents maybe (9.17%).

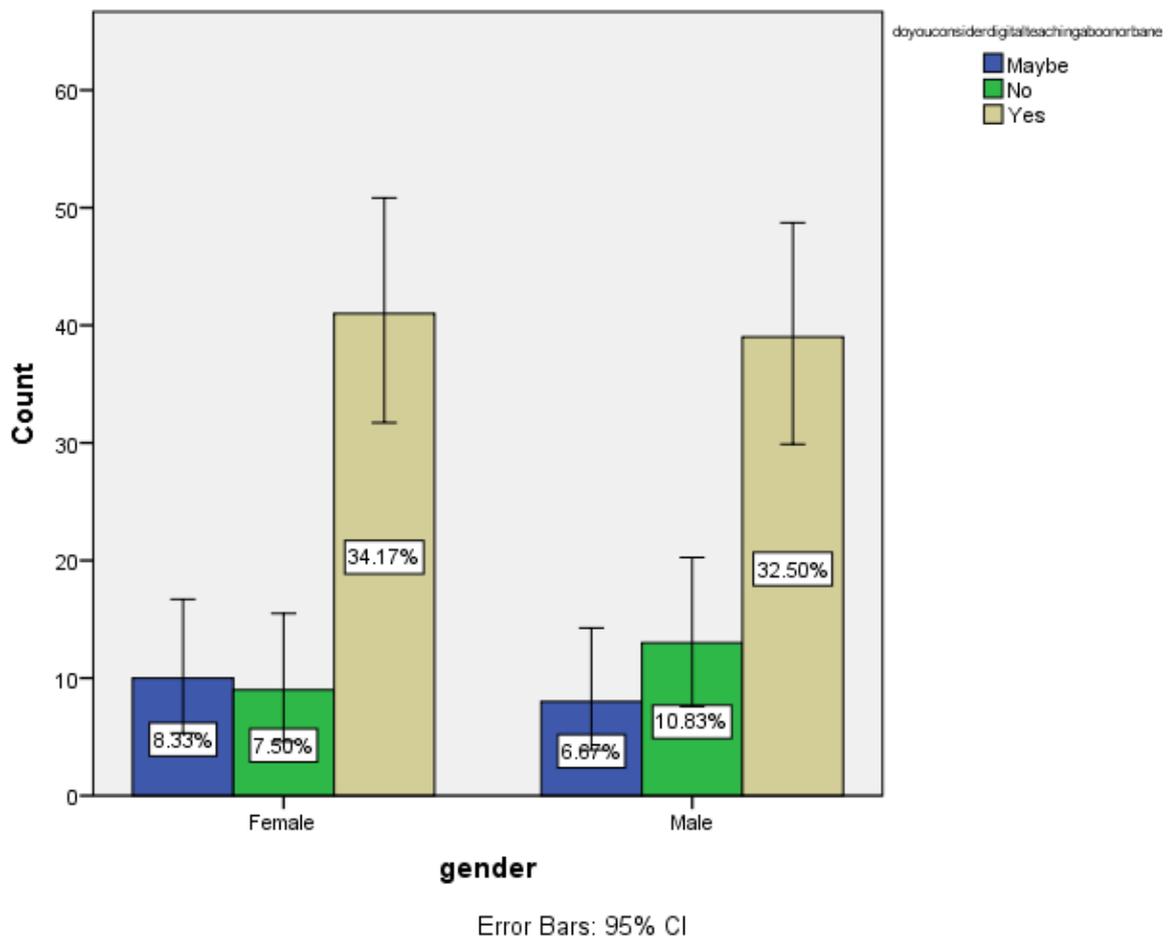


Figure 5 : Bar graph showing the association between gender and whether digital teaching is a boon or a bane among dental students. The X-axis represents gender and the Y -axis represents the number of responses. The green colour represents Yes, and the blue colour represents No. The females were more in support towards digital teaching as a boon than males. Pearson's chi square test showed P value was 0.19 (<0.05), hence insignificant.

## Discussion

From the survey conducted among dental undergraduates, 29.17% of males prefer smart learning and 19.17% of females prefer smart learning. 11.67% of males prefer online education and 15.8% of females prefer online education. 9.17% of males prefer traditional blackboard teaching and 15.00% of females prefer traditional blackboard teaching. There are 50% of females and 50% of male dental undergraduates that participated in the survey. 26.61% of first years 32% second year is 27.50% 30 or 13.33% fourth years. Figure 1 : Among these people 78.33% think that digital teaching is a boon and 21.61% think that it's been. Figure 2 : 64.17% support and consider digital teaching the best teaching

methodologies, 24.17% do not consider and 11.67% on both sides. Figure 3 : 48.33% students consider smart learning, 27.50% consider online education and 24.17% students consider traditional black board teaching. Figure 4 : The 70.00% students concentrate and study during digital methodology like smart learning and 20.83% can't concentrate and 19.17% or on either side of it.

Association of gender with digital teaching considering it as a boon or a bane, Association of gender with best teaching methodology. In recent years the requirements of modern education have changed[35] described that 83.5% of the dental students at the University of Tennessee USA expected to be taught using CAL approaches[36] .[37] Recommended that in the current era of digital technology, modern teaching methods such as simulation trainers should be integrated into dental education as is the standard in other businesses such as aviation or automobile traffic[4]. However,[38][35,36,39]advised against a radical shift from conventional teaching methods to digital technologies, as demanded by[40,41]

The concept for the implementation of digital dentistry into our preclinical curriculum consisted of two training modules that enabled the CAL systems to be integrated into the prevailing curriculum without completely replacing the conventional teaching methods. This approach allows a step-by-step implementation as recommended by[35][35,36]

After the training modules most of the students stated that they felt confident of using the digital preparation analysis by themselves or of manufacturing a chair side restoration using the CAD or CAM workflow. These results show that the structure of the curriculum consisting of lectures, demonstrations and training of practical skills in small groups, seems to be comprehensible for the students. However such a curriculum involves high staff which is consistent with the experiences of all the authors[40,42][40,42,43].

### **Conclusion:**

The people are aware of the digital teaching methodology. But more awareness needs to be spread so that digital handling can be improvised in the near future.

## Reference

- [1] Zitzmann NU, Matthisson L, Ohla H, Joda T. Digital Undergraduate Education in Dentistry: A Systematic Review. *International Journal of Environmental Research and Public Health* 2020;17:3269. <https://doi.org/10.3390/ijerph17093269>.
- [2] Prager MC, Liss H. Assessment of Digital Workflow in Predoctoral Education and Patient Care in North American Dental Schools. *Journal of Dental Education* 2020;84:350–7. <https://doi.org/10.21815/jde.019.177>.
- [3] Joda T, Lenherr P, Dedem P, Kovaltschuk I, Bragger U, Zitzmann NU. Time efficiency, difficulty, and operator's preference comparing digital and conventional implant impressions: a randomized controlled trial. *Clinical Oral Implants Research* 2017;28:1318–23. <https://doi.org/10.1111/clr.12982>.
- [4] Joda T, Ferrari M, Bragger U, Zitzmann NU. Patient Reported Outcome Measures (PROMs) of posterior single-implant crowns using digital workflows: A randomized controlled trial with a three-year follow-up. *Clinical Oral Implants Research* 2018;29:954–61. <https://doi.org/10.1111/clr.13360>.
- [5] Touhami D, Merlo C, Hohmann J, Essig S. The use of ultrasound in primary care: Longitudinal billing and cross-sectional survey study in Switzerland n.d. <https://doi.org/10.21203/rs.3.rs-18174/v2>.
- [6] Goodacre CJ. Digital Learning Resources for Prosthodontic Education: The Perspectives of a Long-Term Dental Educator Regarding 4 Key Factors. *Journal of Prosthodontics* 2018;27:791–7. <https://doi.org/10.1111/jopr.12987>.
- [7] Boer IR de, de Boer IR, Wesselink PR, Vervoorn JM. The creation of virtual teeth with and without tooth pathology for a virtual learning environment in dental education. *European Journal of Dental Education* 2013;17:191–7. <https://doi.org/10.1111/eje.12027>.
- [8] Joda T, Gallucci GO, Wismeijer D, Zitzmann NU. Augmented and virtual reality in dental medicine: A systematic review. *Computers in Biology and Medicine* 2019;108:93–100. <https://doi.org/10.1016/j.combiomed.2019.03.012>.
- [9] Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine* 2009;6:e1000097. <https://doi.org/10.1371/journal.pmed.1000097>.
- [10] Saraswathi I, Saikarthik J, Senthil Kumar K, Madhan Srinivasan K, Ardhanaari M, Gunapriya R. Impact of COVID-19 outbreak on the mental health status of undergraduate medical students in a COVID-19 treating medical college: a prospective longitudinal study. *PeerJ* 2020;8:e10164.
- [11] Santhakumar P, Roy A, Mohanraj KG, Jayaraman S, Durairaj R. Ethanolic Extract of Capparis decidua Fruit Ameliorates Methotrexate-Induced Hepatotoxicity by Activating Nrf2/HO-1 and PPAR $\gamma$  Mediated Pathways. *Ind J Pharm Educ* 2021;55:s265–74.
- [12] Nambi G, Kamal W, Es S, Joshi S, Trivedi P. Spinal manipulation plus laser therapy versus laser therapy alone in the treatment of chronic non-specific low back pain: a randomized controlled study. *Eur J Phys Rehabil Med* 2018;54:880–9.
- [13] Rajakumari R, Volova T, Oluwafemi OS, Rajesh Kumar S, Thomas S, Kalarikkal N. Grape seed extract-soluplus dispersion and its antioxidant activity. *Drug Dev Ind Pharm*

2020;46:1219–29.

- [14] Clarizia G, Bernardo P. Diverse Applications of Organic-Inorganic Nanocomposites: Emerging Research and Opportunities: Emerging Research and Opportunities. IGI Global; 2019.
- [15] Prakash AKS, Devaraj E. Cytotoxic potentials of *S. cumini* methanolic seed kernel extract in human hepatoma HepG2 cells. *Environmental Toxicology* 2019;34:1313–9. <https://doi.org/10.1002/tox.22832>.
- [16] Tahmasebi S, Qasim MT, Krivenkova MV, Zekiy AO, Thangavelu L, Aravindhan S, et al. The effects of oxygen-ozone therapy on regulatory T-cell responses in multiple sclerosis patients. *Cell Biol Int* 2021;45:1498–509.
- [17] Wadhwa R, Paudel KR, Chin LH, Hon CM, Madheswaran T, Gupta G, et al. Anti-inflammatory and anticancer activities of Naringenin-loaded liquid crystalline nanoparticles in vitro. *J Food Biochem* 2021;45:e13572.
- [18] Vivekanandhan K, Shanmugam P, Barabadi H, Arumugam V, Raj DDRD, Sivasubramanian M, et al. Emerging Therapeutic Approaches to Combat COVID-19: Present Status and Future Perspectives. *Frontiers in Molecular Biosciences* 2021;8. <https://doi.org/10.3389/fmolb.2021.604447>.
- [19] Ezhilarasan D. Critical role of estrogen in the progression of chronic liver diseases. *Hepatobiliary Pancreat Dis Int* 2020;19:429–34.
- [20] Egbuna C, Mishra AP, Goyal MR. Preparation of Phytopharmaceuticals for the Management of Disorders: The Development of Nutraceuticals and Traditional Medicine. Academic Press; 2020.
- [21] Kamath SM, Manjunath Kamath S, Jaison D, Rao SK, Sridhar K, Kasthuri N, et al. In vitro augmentation of chondrogenesis by Epigallocatechin gallate in primary Human chondrocytes - Sustained release model for cartilage regeneration. *Journal of Drug Delivery Science and Technology* 2020;60:101992. <https://doi.org/10.1016/j.jddst.2020.101992>.
- [22] Barabadi H, Mojab F, Vahidi H, Marashi B, Talank N, Hosseini O, et al. Green synthesis, characterization, antibacterial and biofilm inhibitory activity of silver nanoparticles compared to commercial silver nanoparticles. *Inorganic Chemistry Communications* 2021;129:108647. <https://doi.org/10.1016/j.inoche.2021.108647>.
- [23] Bharath B, Perinbam K, Devanesan S, AlSalhi MS, Saravanan M. Evaluation of the anticancer potential of Hexadecanoic acid from brown algae *Turbinaria ornata* on HT–29 colon cancer cells. *Journal of Molecular Structure* 2021;1235:130229. <https://doi.org/10.1016/j.molstruc.2021.130229>.
- [24] Gowhari Shabgah A, Ezzatifar F, Aravindhan S, Olegovna Zekiy A, Ahmadi M, Gheibihayat SM, et al. Shedding more light on the role of Midkine in hepatocellular carcinoma: New perspectives on diagnosis and therapy. *IUBMB Life* 2021;73:659–69.
- [25] Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Oral Pathol Med* 2019;48:299–306.
- [26] R H, Hannah R, Ramani P, Ramanathan A, Jancy MR, Gheena S, et al. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology* 2020;130:306–12. <https://doi.org/10.1016/j.oooo.2020.06.021>.
- [27] J PC, Pradeep CJ, Marimuthu T, Krithika C, Devadoss P, Kumar SM. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. *Clinical Implant Dentistry and Related Research* 2018;20:531–4. <https://doi.org/10.1111/cid.12609>.
- [28] Wahab PUA, Abdul Wahab PU, Madhulaxmi M, Senthilnathan P, Muthusekhar MR,

- Vohra Y, et al. Scalpel Versus Diathermy in Wound Healing After Mucosal Incisions: A Split-Mouth Study. *Journal of Oral and Maxillofacial Surgery* 2018;76:1160–4. <https://doi.org/10.1016/j.joms.2017.12.020>.
- [29] Mudigonda SK, Murugan S, Velavan K, Thulasiraman S, Krishna Kumar Raja VB. Non-suturing microvascular anastomosis in maxillofacial reconstruction- a comparative study. *Journal of Cranio-Maxillofacial Surgery* 2020;48:599–606.
- [30] Krishnaswamy H, Muthukrishnan S, Thanikodi S, Arockiaraj G, Venkatraman V. Investigation of air conditioning temperature variation by modifying the structure of passenger car using computational fluid dynamics. *Thermal Science* 2020;24:495–8. <https://doi.org/10.2298/tsci190409397k>.
- [31] Sathish T, Karthick S. Wear behaviour analysis on aluminium alloy 7050 with reinforced SiC through taguchi approach. *Journal of Materials Research and Technology* 2020;9:3481–7.
- [32] Campeau PM, Kasperaviciute D, Lu JT, Burrage LC, Kim C, Hori M, et al. The genetic basis of DOORS syndrome: an exome-sequencing study. *Lancet Neurol* 2014;13:44–58.
- [33] Dhinesh B, Niruban Bharathi R, Isaac JoshuaRamesh Lalvani J, Parthasarathy M, Annamalai K. An experimental analysis on the influence of fuel borne additives on the single cylinder diesel engine powered by Cymbopogon flexuosus biofuel. *J Energy Inst* 2017;90:634–45.
- [34] Parthasarathy M, Isaac JoshuaRamesh Lalvani J, Dhinesh B, Annamalai K. Effect of hydrogen on ethanol-biodiesel blend on performance and emission characteristics of a direct injection diesel engine. *Ecotoxicol Environ Saf* 2016;134:433–9.
- [35] Welk A, Maggio MP, Simon JF, Scarbecz M, Harrison JA, Wicks RA, et al. Computer-assisted learning and simulation lab with 40 DentSim units. *Int J Comput Dent* 2008;11:17–40.
- [36] Alves LS, de Oliveira RS, Nora ÂD, Lemos LFC, Rodrigues JA, Zenkner JEA. Dental Students' Performance in Detecting In Vitro Occlusal Carious Lesions Using ICDAS with E-Learning and Digital Learning Strategies. *Journal of Dental Education* 2018;82:1077–83. <https://doi.org/10.21815/jde.018.100>.
- [37] Murbay S, Chang JWW, Yeung S, Neelakantan P. Evaluation of the introduction of a dental virtual simulator on the performance of undergraduate dental students in the pre- clinical operative dentistry course. *European Journal of Dental Education* 2020;24:5–16. <https://doi.org/10.1111/eje.12453>.
- [38] Margaryan A, Littlejohn A, Vojt G. Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education* 2011;56:429–40. <https://doi.org/10.1016/j.compedu.2010.09.004>.
- [39] Luz PB, Stringhini CH, Otto BR, Port ALF, Zaleski V, Oliveira RS, et al. Performance of undergraduate dental students on ICDAS clinical caries detection after different learning strategies. *European Journal of Dental Education* 2015;19:235–41. <https://doi.org/10.1111/eje.12131>.
- [40] Jackson TH, Zhong J, Phillips C, Koroluk LD. Self-Directed Digital Learning: When Do Dental Students Study? *Journal of Dental Education* 2018;82:373–8. <https://doi.org/10.21815/jde.018.040>.
- [41] Prensky M. Digital Natives, Digital Immigrants Part 1. *On the Horizon* 2001;9:1–6. <https://doi.org/10.1108/10748120110424816>.
- [42] Joda T, Zarone F, Ferrari M. The complete digital workflow in fixed prosthodontics: a systematic review. *BMC Oral Health* 2017;17:124.
- [43] Vuchkova J, Maybury T, Farah CS. Digital interactive learning of oral radiographic anatomy. *European Journal of Dental Education* 2012;16:e79–87. <https://doi.org/10.1111/j.1600-0579.2011.00679.x>.

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