

RESEARCH

Open Access



# Insights into research activities of senior dental students in the Middle East: A multicenter preliminary study

Mohammad S. Alrashdan<sup>1,2\*</sup>, Abubaker Qutieshat<sup>3,4</sup>, Mohamed El-Kishawi<sup>5</sup>, Abdulghani Alarabi<sup>6</sup>, Lina Khasawneh<sup>7</sup> and Sausan Al Kawas<sup>1</sup>

## Abstract

**Background** Despite the increasing recognition of the importance of research in undergraduate dental education, limited studies have explored the nature of undergraduate research activities in dental schools in the Middle East region. This study aimed to evaluate the research experience of final year dental students from three dental schools in the Middle East.

**Methods** A descriptive, cross-sectional study was conducted among final-year dental students from three institutions, namely Jordan University of Science and Technology, University of Sharjah (UAE), and Oman Dental College. Participants were asked about the nature and scope of their research projects, the processes involved in the research, and their perceived benefits of engaging in research.

**Results** A total of 369 respondents completed the questionnaire. Cross-sectional studies represented the most common research type (50.4%), with public health (29.3%) and dental education (27.9%) being the predominant domains. More than half of research proposals were developed via discussions with instructors (55.0%), and literature reviews primarily utilized PubMed (70.2%) and Google Scholar (68.5%). Regarding statistical analysis, it was usually carried out with instructor's assistance (45.2%) or using specialized software (45.5%). The students typically concluded their projects with a manuscript (58.4%), finding the discussion section most challenging to write (42.0%). The research activity was considered highly beneficial, especially in terms of teamwork and communication skills, as well as data interpretation skills, with 74.1% of students reporting a positive impact on their research perspectives.

**Conclusions** The research experience was generally positive among surveyed dental students. However, there is a need for more diversity in research domains, especially in qualitative studies, greater focus on guiding students in research activities, especially in manuscript writing and publication. The outcomes of this study could provide valuable insights for dental schools seeking to improve their undergraduate research activities.

**Keywords** Dental research, Dental education, Undergraduate, Literature review, Publication

\*Correspondence:

Mohammad S. Alrashdan  
malrashdan@sharjah.ac.ae

Full list of author information is available at the end of the article



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

## Introduction

The importance of research training for undergraduate dental students cannot be overstressed and many reports have thoroughly discussed the necessity of incorporating research components in the dental curricula [1–4]. A structured research training is crucial to ensure that dental graduates will adhere to evidence-based practices and policies in their future career and are able to critically appraise the overwhelming amount of dental and relevant medical literature so that only rigorous scientific outcomes are adopted. Furthermore, a sound research background is imperative for dental graduates to overcome some of the reported barriers to scientific evidence uptake. This includes the lack of familiarity or uncertain applicability and the lack of agreement with available evidence [5]. There is even evidence that engagement in research activities can improve the academic achievements of students [6]. Importantly, many accreditation bodies around the globe require a distinct research component with clear learning outcomes to be present in the curriculum of the dental schools [1].

Research projects and courses have become fundamental elements of modern biomedical education worldwide. The integration of research training in biomedical academic programs has evolved over the years, reflecting the growing recognition of research as a cornerstone of evidence-based practice [7]. Notwithstanding the numerous opportunities presented by the inclusion of research training in biomedical programs, it poses significant challenges such as limited resources, varying levels of student preparedness, and the need for faculty development in research mentorship [8, 9]. Addressing these challenges is essential to maximize the benefits of research training and to ensure that all students can engage meaningfully in research activities.

While there are different models for incorporating research training into biomedical programs, including dentistry, almost all models share the common goals of equipping students with basic research skills and techniques, critical thinking training and undertaking research projects either as an elective or a summer training course, or more commonly as a compulsory course required for graduation [2, 4, 10].

Dental colleges in the Middle East region are not an exception and most of these colleges are continuously striving to update their curricula to improve the undergraduate research component and cultivate a research-oriented academic teaching environment. Despite these efforts, there remains a significant gap in our understanding of the nature and scope of student-led research in these institutions, the challenges they face, and the perceived benefits of their research experiences. Furthermore, a common approach in most studies in this domain is to confine data collection to a single center

from a single country, which in turn limits the value of the outcomes. Therefore, it is of utmost importance to conduct studies with representative samples and preferably multiple institutions in order to address the existing knowledge gaps, to provide valuable insights that can inform future curricular improvements and to support the development of more effective research training programs in dental education across the region. Accordingly, this study was designed and conducted to elucidate some of these knowledge gaps.

The faculty of dentistry at Jordan University of Science and Technology (JUST) is the biggest in Jordan and adopts a five-year bachelor's program in dental surgery (BDS). The faculty is home to more than 1600 undergraduate and 75 postgraduate students. The college of dental medicine at the University of Sharjah (UoS) is also the biggest in the UAE, with both undergraduate and postgraduate programs, local and international accreditation and follows a (1+5) program structure, whereby students need to finish a foundation year and then qualify for the five-year BDS program. Furthermore, the UoS dental college applies an integrated stream-based curriculum. Finally, Oman Dental College (ODC) is the sole dental school in Oman and represents an independent college that does not belong to a university body.

The aim of this study was to evaluate the research experience of final year dental students from three major dental schools in the Middle East, namely JUST from Jordan, UoS from the UAE, and ODC from Oman. Furthermore, the hypothesis of this study was that research activities conducted at dental schools has no perceived benefit for final year dental students.

The rationale for selecting these three dental schools stems from the diversity in the dental curriculum and program structure as well as the fact that final year BDS students are required to conduct a research project as a prerequisite for graduation in the three schools. Furthermore, the authors from these dental schools have a strong scholarly record and have been collaborating in a variety of academic and research activities.

## Materials and methods

The current study is a population-based descriptive cross-sectional observational study. The study was conducted using an online self-administered questionnaire and targeted final-year dental students at three dental schools in the Middle East region: JUST from Jordan, UoS from the UAE, and ODC from Oman. The study took place in the period from January to June 2023.

For inclusion in the study, participants should have been final-year dental students at the three participating schools, have finished their research project and agreed to participate. Exclusion criteria included any students not in their final year, those who have not conducted or

finished their research projects and those who refused to participate.

The study was approved by the institutional review board of JUST (Reference: 724–2022), the research ethics committee of the UoS (Reference: REC-22-02-22-3) as well as ODC (Reference: ODC-MA-2022-166). The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [11]. The checklist is available as a supplementary file.

Sample size determination was based on previous studies with a similar design and was further confirmed with a statistical formula. A close look at the relevant literature reveals that such studies were either targeting a single dental or medical school or multiple schools and the sample size generally ranged from 158 to 360 [4, 8–10, 12]. Furthermore, to confirm the sample size, the following 2-step formula for finite population sample size calculation was used [13]:

Step 1:

$$\text{Initial sample size } (n) = \frac{Z^2 \times P \times (1 - P)}{E^2}$$

Wherein  $Z$  is the confidence level at 95% =1.96,  $P$  is the population proportion=0.5, and  $E$  is the margin of error=0.05. Based on this formula, the resultant initial sample size was 384.

Step 2:

$$\text{Adjusted sample size} = \frac{n}{1 + \left(\frac{n-1}{N}\right)}$$

Wherein  $n$  is the initial sample size=384,  $N$  is the total population size (total number of final year dental students in the 3 schools)=443. Based on this formula, the adjusted sample size was 206.

An online, self-administered questionnaire comprising 13 questions was designed to assess the research experience of final year dental students in the participating schools. The questionnaire was initially prepared by the first three authors and was then reviewed and approved by the other authors. The questionnaire was developed following an extensive review of relevant literature to identify the most critical aspects of research projects conducted at the dental or medical schools and the most common challenges experienced by students with regards to research project design, research components, attributes, analysis, interpretation, drafting, writing, and presentation of the final outcomes.

The questionnaire was then pretested for both face and content validity. Face validity was assessed by a pilot study that evaluated clarity, validity, and comprehensiveness in a small cohort of 30 students. Content validity was assessed by the authors, who are all experienced

academics with remarkable research profiles and experience in supervising undergraduate and postgraduate research projects. The authors critically evaluated each item and made the necessary changes whenever required. Furthermore, Cronbach's alpha was used to assess the internal consistency/ reliability of the questionnaire and the correlation between the questionnaire items was found to be 0.79. Thereafter, online invitations along with the questionnaire were sent out to a total of 443 students, 280 from JUST, 96 from UoS and 67 from ODC, which represented the total number of final year students at the three schools. A first reminder was sent 2 weeks later, and a second reminder was sent after another 2 weeks.

In addition to basic demographic details, the questionnaire comprised questions related to the type of study conducted, the scope of the research project, whether the research project was proposed by the students or the instructors or both, the literature review part of the project, the statistical analysis performed, the final presentation of the project, the writing up of the resultant manuscript if applicable, the perceived benefits of the research project and finally suggestions to improve the research component for future students.

The outcomes of the study were the students' research experience in terms of research design, literature review, data collection, analysis, interpretation and presentation, students' perceived benefits from research, students' perspective towards research in their future career and students' suggestions to improve their research experience.

The exposures were the educational and clinical experience of students, research supervision by mentors and faculty members, and participation in extracurricular activities, while the predictors were the academic performance of students, previous research experience and self-motivation.

The collected responses were entered into a Microsoft Excel spreadsheet and analyzed using SPSS Statistics software, version 20.0 (SPSS Inc., Chicago, IL, USA). Descriptive data were presented as frequencies and percentages. For this study, only descriptive statistics were carried out as the aim was not to compare and contrast the three schools but rather to provide an overview of the research activities at the participating dental schools.

The heatmap generated to represent the answers for question 11 (perceived benefits of the research activity) was created using Python programming language (Python 3.11) and the pandas, seaborn, and matplotlib libraries. The heatmap was customized to highlight the count and percentage of responses in each component, with the highest values shown in red and the lowest values shown in blue.

## Results

Potentially eligible participants in this study were all final year dental students at the three dental schools (443 students, 280 from JUST, 96 from UoS and 67 from ODC). All potentially eligible participants were confirmed to be eligible and were invited to participate in the study.

The total number of participants included in the study, i.e. the total number of students who completed the questionnaire and whose responses were analyzed, was 369 (223 from JUST, 80 from UoS and 66 from ODC). The overall response rate was 83.3% (79.6% from JUST, 83.3% from UoS and 98.5% from ODC).

The highest proportion of participants were from JUST ( $n=223$ , 60.4%), followed by UoS ( $n=80$ , 21.7%), and then ODC ( $n=66$ , 17.9%). The majority of the participants were females ( $n=296$ , 80.4%), while males represented a smaller proportion ( $n=73$ , 19.6%). It is noteworthy that these proportions reflect the size of the cohorts in each college.

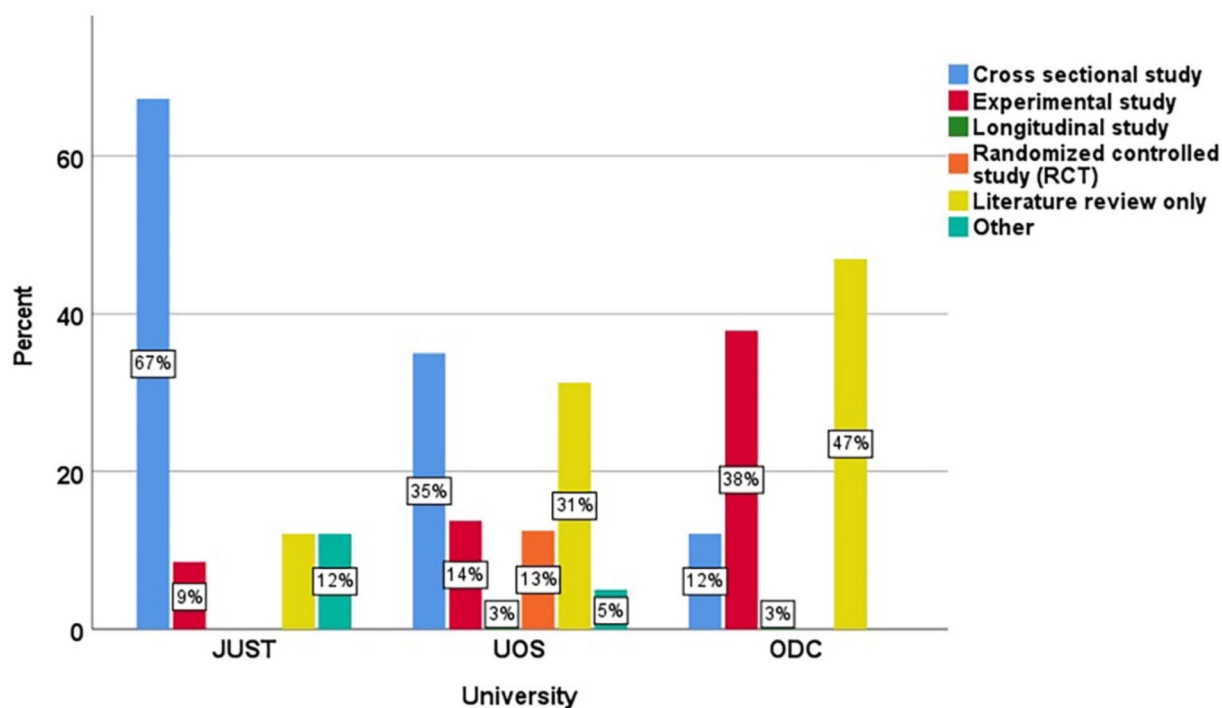
With regards to the type of study, half of final-year dental students in the 3 colleges participated in observational cross-sectional studies (i.e., population-based studies) ( $n=186$ , 50.4%), while literature review projects were the second most common type ( $n=83$ , 22.5%), followed by experimental studies ( $n=55$ , 14.9%). Longitudinal studies randomized controlled trials, and other types of studies (e.g., qualitative studies, case reports) were less common,

with ( $n=5$ , 1.4%), ( $n=10$ , 2.7%), and ( $n=30$ , 8.1%) participation rates, respectively. Distribution of study types within each college is shown Fig. 1.

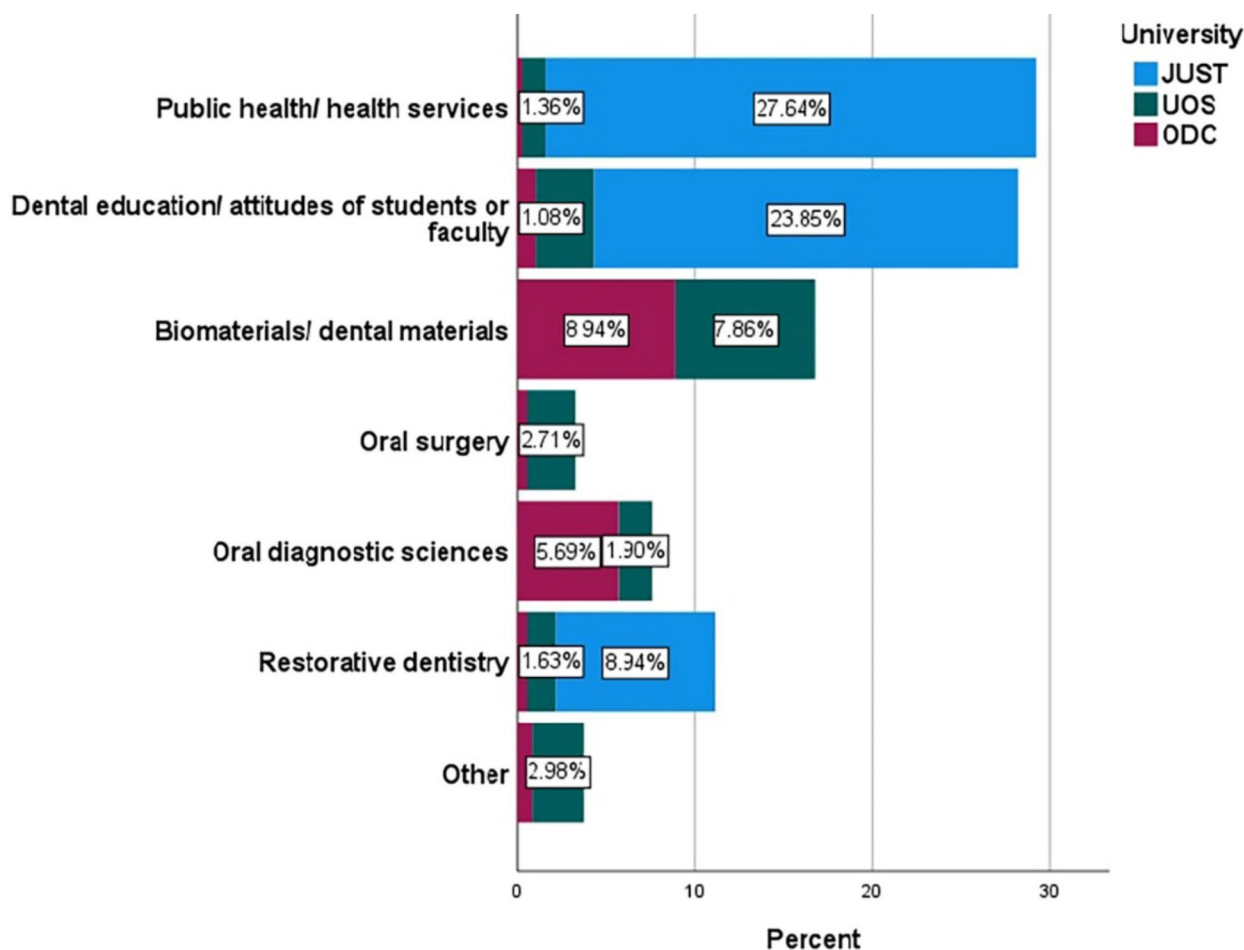
The most common scope of research projects among final-year dental students was in public health/health services ( $n=108$ , 29.3%) followed by dental education/attitudes of students or faculty ( $n=103$ , 27.9%) (Fig. 2). Biomaterials/dental materials ( $n=62$ , 16.8%) and restorative dentistry ( $n=41$ , 11.1%) were also popular research areas. Oral diagnostic sciences (oral medicine/oral pathology/oral radiology) ( $n=28$ , 7.6%), oral surgery ( $n=12$ , 3.2%) and other research areas ( $n=15$ , 4.1%) were less common among the participants. Thirty-two students (8.7%) were engaged in more than one research project.

The majority of research projects were proposed through a discussion and agreement between the students and the instructor (55.0%). Instructors proposed the topic for 36.6% of the research projects, while students proposed the topic for the remaining 8.4% of the projects.

Most dental students (79.1%) performed the literature review for their research projects using internet search engines. Material provided by the instructor was used for the literature review by 15.5% of the students, while 5.4% of the students did not perform a literature review. More than half of the students ( $n=191$ , 51.7%) used multiple



**Fig. 1** Distribution in percent of study types within each college. JUST: Jordan University of Science and Technology, UOS: University of Sharjah, ODC: Oman Dental College



**Fig. 2** Percentages of the scope of research projects among final-year dental students. JUST: Jordan University of Science and Technology, UOS: University of Sharjah, ODC: Oman Dental College

search engines in their literature search. The most popular search engines for literature review among dental students were PubMed (70.2% of cases) and Google Scholar (68.5% of cases). Scopus was used by 12.8% of students, while other search engines were used by 15.6% of students.

The majority of dental students ( $n=276$ , 74.8%) did not utilize the university library to gain access to the required material for their research. In contrast, 93 students (25.2%) reported using the university library for this purpose.

Dental students performed statistical analysis in their projects primarily by receiving help from the instructor ( $n=167$ , 45.2%) or using specialized software ( $n=168$ , 45.5%). A smaller percentage of students ( $n=34$ , 9.4%) consulted a professional statistician for assistance with statistical analysis. At the end of the research project, 58.4% of students ( $n=215$ ) presented their work in the form of a manuscript or scientific paper. Other methods of presenting the work included PowerPoint

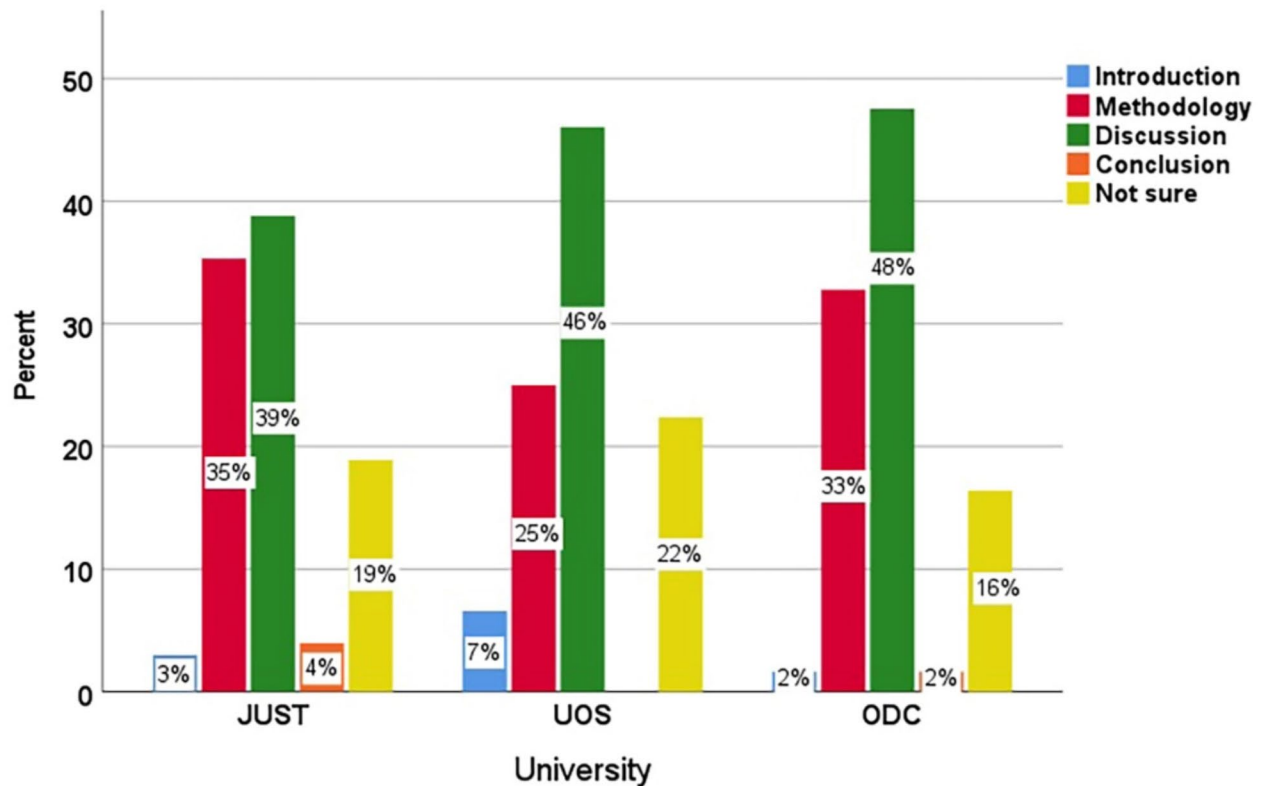
presentations ( $n=80$ , 21.7%) and discussions with the instructor ( $n=74$ , 19.8%).

For those students who prepared a manuscript at the conclusion of their project, the most difficult part of the writing-up was the **discussion** section ( $n=155$ , 42.0%), followed by the methodology section ( $n=120$ , 32.5%), a finding that was common across the three colleges. Fewer students found the introduction ( $n=13$ , 3.6%) and conclusion ( $n=10$ , 2.7%) sections to be challenging. Additionally, 71 students (19.2%) were not sure which part of the manuscript was the most difficult to prepare (Fig. 3).

The dental students' perceived benefits from the research activity were evaluated across seven components, including literature review skills, research design skills, data collection and interpretation, manuscript writing, publication, teamwork and effective communication, and engagement in continuing professional development.

The majority of students found the research activity to be beneficial or highly beneficial in most of the areas,





**Fig. 3** Percentages of the most difficult part reported by dental students during the writing-up of their projects. JUST: Jordan University of Science and Technology, UOS: University of Sharjah, ODC: Oman Dental College

with the highest ratings observed in teamwork and effective communication, where 33.5% rated it as beneficial and 32.7% rated it as highly beneficial. Similarly, in the area of data collection and interpretation, 33.0% rated it as beneficial and 27.5% rated it as highly beneficial. In the areas of literature review skills and research design skills, 28.6% and 34.0% of students rated the research activity as beneficial, while 25.3% and 22.7% rated it as highly beneficial, respectively. Students also perceived the research activity to be helpful for the manuscript writing, with 27.9% rating it as beneficial and 19.2% rating it as highly beneficial.

When it comes to publication, students' perceptions were more variable, with 22.0% rating it as beneficial and 11.3% rating it as highly beneficial. A notable 29.9% rated it as neutral, and 17.9% reported no benefit. Finally, in terms of engaging in continuing professional development, 26.8% of students rated the research activity as beneficial and 26.2% rated it as highly beneficial (Fig. 4).

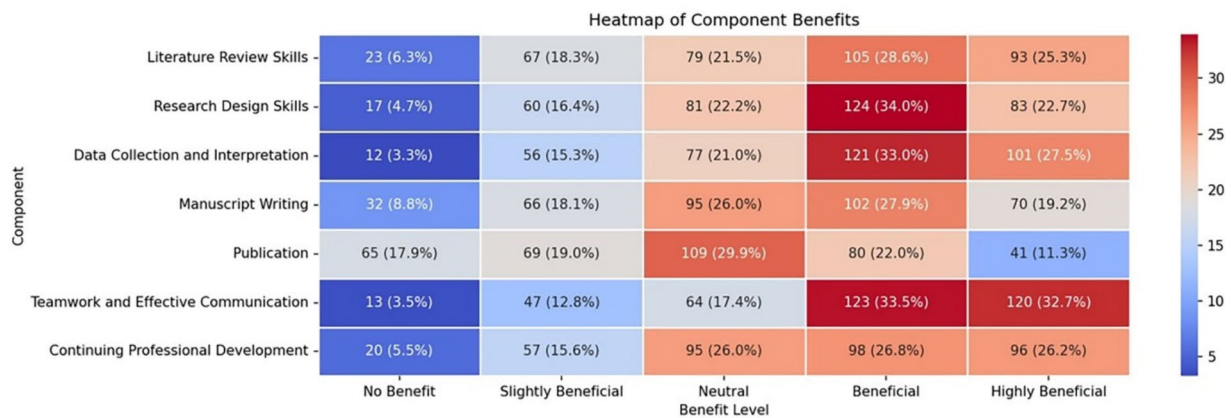
The research course's impact on students' perspectives towards being engaged in research activities or pursuing a research career after graduation was predominantly positive, wherein 274 students (74.1%) reported a positive impact on their research perspectives. However, 79

students (21.5%) felt that the course had no impact on their outlook towards research engagement or a research career. A small percentage of students ( $n=16$ , 4.4%) indicated that the course had a negative impact on their perspective towards research activities or a research career after graduation.

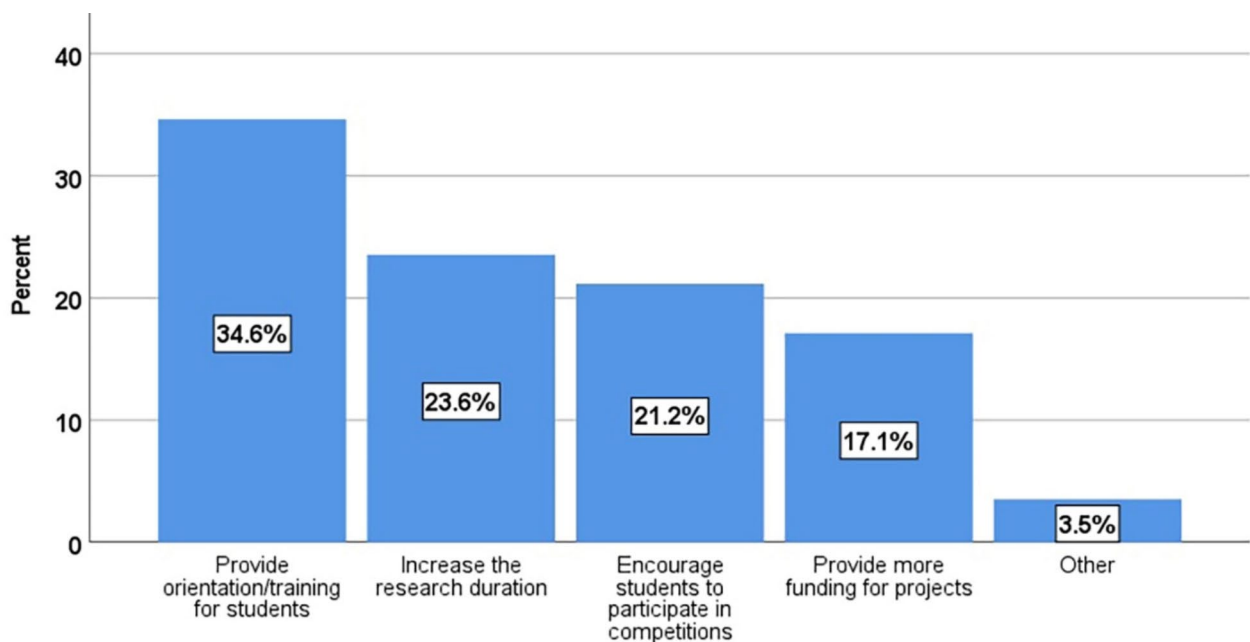
Finally, when students were asked about their suggestions to improve research activities, they indicated the need for more training and orientation ( $n=127$ , 34.6%) as well as to allow more time for students to finish their research projects ( $n=87$ , 23.6%). Participation in competitions and more generous funding were believed to be less important factors to improve students' research experience ( $n=78$ , 21.2% and  $n=63$ , 17.1%, respectively). Other factors such as external collaborations and engagement in research groups were even less important from the students' perspective (Fig. 5).

## Discussion

To the best of our knowledge, this report is the first to provide a comprehensive overview of the research experience of dental students from three leading dental colleges in the Middle East region, which is home to more than 50 dental schools according to the latest SCImago



**Fig. 4** Heatmap of the dental students’ perceived benefits from the research activity



**Fig. 5** Percentages of dental students’ suggestions to improve research activities at their colleges

Institutions Ranking® (<https://www.scimagoir.com>). The reasonable sample size and different curricular structure across the participating colleges enhanced the value of our findings not only for dental colleges in the Middle East, but also to any dental college seeking to improve and update its undergraduate research activities. However, it is noteworthy that since the study has included only three dental schools, the generalizability of the current findings would be limited, and the outcomes are preliminary in nature.

Cross-sectional (epidemiological) studies and literature reviews represented the most common types of research among our cohort of students, which can be attributed

to the feasibility, shorter time and low cost required to conduct such research projects. On the contrary, longitudinal studies and randomized trials, both known to be time consuming and meticulous, were the least common types. These findings concur with previous reports, which demonstrated that epidemiological studies are popular among undergraduate research projects [4, 10]. In a retrospective study, Nalliah et al. also demonstrated a remarkable increase in epidemiological research concurrent with a decline in the clinical research in dental students’ projects over a period of 4 years [4]. However, literature reviews, whether systematic or scoping, were not as common in some dental schools as in our cohort.

For instance, a report from Sweden showed that literature reviews accounted for less than 10% of total dental students' projects [14]. Overall, qualitative research was seldom performed among our cohort, which is in agreement with a general trend in dental research that has been linked to the low level of competence and experience of dental educators to train students in qualitative research, as this requires special training in social research [15, 16].

In terms of the research topics, public health research, research in dental education and attitudinal research were the most prevalent among our respondents. In agreement with our results, research in health care appears common in dental students' projects [12]. In general, these research domains may reflect the underlying interests of the faculty supervisors, who, in our case, were actively engaged in the selection of the research topic for more than 90% of the projects. Other areas of research, such as clinical dentistry and basic dental research are also widely reported [4, 10, 14, 17].

The selection of a research domain is a critical step in undergraduate research projects, and a systematic approach in identifying research gaps and selecting appropriate research topics is indispensable and should always be given an utmost attention by supervisors [18].

More than half of the projects in the current report were reasonably selected based on a discussion between the students and the supervisor, whereas 36% were selected by the supervisors. Otuyemi et al. reported that about half of undergraduate research topics in a Nigerian dental school were selected by students themselves, however, a significant proportion of these projects (20%) were subsequently modified by supervisors [19]. The autonomy in selecting the research topic was discussed in a Swedish report, which suggested that such approach can enhance the learning experience of students, their motivation and creativity [20]. Flexibility in selecting the research topic as well as the faculty supervisor, whenever feasible, should be offered to students in order to improve their research experience and gain better outcomes [12].

Pubmed and Google Scholar were the most widely used search engines for performing a literature review. This finding is consistent with recent reviews which classify these two search systems as the most commonly used ones in biomedical research despite some critical limitations [21, 22]. It is noteworthy that students should be competent in critical appraisal of available literature to perform the literature review efficiently. Interestingly, only 25% of students used their respective university library's access to the search engines, which means that most students retrieved only open access publications for their literature reviews, a finding that requires attention from faculty mentors to guide students to utilize the

available library services to widen their accessibility to available literature.

Statistical analysis has classically been viewed as a perceived obstacle for undergraduate students to undertake research in general [23, 24] and recent literature has highlighted the crucial need of biomedical students to develop necessary competencies in biostatistics during their studies [25]. One obvious advantage of conducting research in our cohort is that 45.5% of students used a specialized software to analyze their data, which means that they did have at least an overview of how data are processed and analyzed to reach their final results and inferences. Unfortunately, the remaining 54.5% of students were, partially or completely, dependent on the supervisor or a professional statistician for data analysis. It is noteworthy that the research projects were appropriately tailored to the undergraduate level, focusing on fundamental statistical analysis methods. Therefore, consulting a professional statistician for more complex analyses was done only if indicated, which explains the small percentage of students who consulted a professional statistician.

Over half of participating students (58.4%) prepared a manuscript at the end of their research projects and for these students, the **discussion** section was identified as the most challenging to prepare, followed by the methodology section. These findings can be explained by the students' lack of knowledge and experience related to conducting and writing-up scientific research. The same was reported by Habib et al. who found dental students' research knowledge to be less than that of medical students [26]. The skills of critical thinking and scientific writing are believed to be of paramount importance to biomedical students and several strategies have been proposed to enhance these skills especially for both English and non-English speaking students [27–29].

Dental students in the current study reported positive attitude towards research and found the research activity to be beneficial in several aspects of their education, with the most significant benefits in the areas of teamwork, effective communication, data collection and interpretation, literature review skills, and research design skills. Similar findings were reported by previous studies with most of participating students reporting a positive impact of their research experience [4, 10, 12, 30]. Furthermore, 74% of students found that their research experience had a positive impact on their perspectives towards engagement in research in the future. This particular finding may be promising in resolving a general lack of interest in research by dental students, as shown in a previous report from one of the participating colleges in this study (JUST), which demonstrated that only 2% of students may consider a research career in the future [31].



Notably, only 11.3% of our students perceived their research experience as being highly beneficial with regards to publication. Students' attitudes towards publishing their research appear inconsistent in literature and ranges from highly positive rates in developed countries [4] to relatively low rates in developing countries [8, 32, 33]. This can be attributed to lack of motivation and poor training in scientific writing skills, a finding that has prompted researchers to propose strategies to tackle such a gap as mentioned in the previous section.

Finally, key suggestions by the students to improve the research experience were the provision of more training and orientation, more time to conduct the research, as well as participation in competitions and more funding opportunities. These findings are generally in agreement with previous studies which demonstrated that dental students perceived these factors as potential barriers to improving their research experience [8, 10, 17, 30, 34].

A major limitation of the current study is the inclusion of only three dental schools from the Middle East which may limit the generalizability and validity of the findings. Furthermore, the cross-sectional nature of the study would not allow definitive conclusions to be drawn as students' perspectives were not evaluated before and after the research project. Potential confounders in the study include the socioeconomic status of the students, the teaching environment, previous research experience, and self-motivation. Moreover, potential sources of bias include variations in the available resources and funding to students' projects and variations in the quality of supervision provided. Another potential source of bias is the non-response bias whereby students with low academic performance or those who were not motivated might not respond to the questionnaire. This potential source of bias was managed by sending multiple reminders to students and aiming for the highest response rate and largest sample size possible.

In conclusion, the current study evaluated the key aspects of dental students' research experience at three dental colleges in the Middle East. While there were several perceived benefits, some aspects need further reinforcement and revision including the paucity of qualitative and clinical research, the need for more rigorous supervision from mentors with focus on scientific writing skills and research presentation opportunities. Within the limitations of the current study, these outcomes can help in designing future larger scale studies and provide valuable guidance for dental colleges to foster the research component in their curricula. Further studies with larger and more representative samples are required to validate these findings and to explore other relevant elements in undergraduate dental research activities.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12909-024-05955-5>.

Supplementary Material 1

Supplementary Material 2

## Acknowledgements

The authors would like to acknowledge final year dental students at the three participating colleges for their time completing the questionnaire.

## Author contributions

M.A.: Conceptualization, data curation, project administration; supervision, validation, writing - original draft; writing - review and editing. A.Q.: Conceptualization, data curation, project administration; writing - review and editing. M.E.: Conceptualization, data curation, project administration; validation, writing - original draft; writing - review and editing. A.A.: data curation, writing - original draft; writing - review and editing. L.K.: Conceptualization, data curation, validation, writing - original draft; writing - review and editing. S.A.: Conceptualization, writing - review and editing.

## Funding

No funding was received for this study.

## Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

The current study was approved by the institutional review board of Jordan University of Science and Technology (Reference: 724–2022), the research ethics committee of the University of Sharjah (Reference: REC-22-02-22-3) and Oman Dental College (Reference: ODC-MA-2022-166).

### Informed consent

Agreement to the invitation to fill out the questionnaire was considered as an implied consent to participate.

### Consent for publication

not applicable.

### Competing interests

The authors declare no competing interests.

### Author details

<sup>1</sup>Department of Oral and Craniofacial Health Sciences, College of Dental Medicine, University of Sharjah, P.O.Box: 27272, Sharjah, UAE

<sup>2</sup>Department of Oral Medicine and Oral Surgery, Faculty of Dentistry, Jordan University of Science and Technology, Irbid, Jordan

<sup>3</sup>Department of Adult Restorative Dentistry, Oman Dental College, Muscat, Sultanate of Oman

<sup>4</sup>Department of Restorative Dentistry, Dundee Dental Hospital & School, University of Dundee, Dundee, UK

<sup>5</sup>Preventive and Restorative Dentistry Department, College of Dental Medicine, University of Sharjah, Sharjah, UAE

<sup>6</sup>Clinical Sciences Department, College of Dentistry, Ajman University, Ajman, UAE

<sup>7</sup>Department of Prosthodontics, Faculty of Dentistry, University of Science and Technology, Irbid, Jordan

Received: 12 August 2023 / Accepted: 24 August 2024

Published online: 04 September 2024

## References

- Emrick JJ, Gullard A. Integrating research into dental student training: a global necessity. *J Dent Res*. 2013;92(12):1053–5.
- Ramachandra SS. A comprehensive template for inclusion of research in the undergraduate dental curriculum. *Health Professions Educ*. 2020;6(2):264–70.
- Al Sweleh FS. Integrating scientific research into undergraduate curriculum: a new direction in dental education. *J Health Spec*. 2016;4(1):42–5.
- Nalliah RP, Lee MK, Da Silva JD, Allareddy V. Impact of a research requirement in a dental school curriculum. *J Dent Educ*. 2014;78(10):1364–71.
- Lang ES, Wyer PC, Haynes RB. Knowledge translation: closing the evidence-to-practice gap. *Ann Emerg Med*. 2007;49(3):355–63.
- Fechheimer M, Webber K, Kleiber PB. How well do undergraduate research programs promote engagement and success of students? *CBE Life Sci Educ*. 2011;10(2):156–63.
- Kingsley K, O'Malley S, Stewart T, Howard KM. Research enrichment: evaluation of structured research in the curriculum for dental medicine students as part of the vertical and horizontal integration of biomedical training and discovery. *BMC Med Educ*. 2008;8:1–10.
- Alsalem SA, Alkhairi MAY, Alzahrani MAA, Alwadai MI, Alqahtani SSA, Alaseri YFY, et al. Challenges and Barriers toward Medical Research among Medical and Dental students at King Khalid University, Abha, Kingdom of Saudi Arabia. *Front Public Health*. 2021;9:706778.
- Soe HHK, Than NN, Lwin H, Htay MNNN, Phyu KL, Abas AL. Knowledge, attitudes, and barriers toward research: the perspectives of undergraduate medical and dental students. *J Educ Health Promotion*. 2018;7(1):23.
- Amir LR, Soekanto SA, Julia V, Wahono NA, Maharani DA. Impact of Undergraduate Research as a compulsory course in the Dentistry Study Program Universitas Indonesia. *Dent J (Basel)*. 2022;10(11).
- Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The strengthening of reporting of Observational studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet*. 2007;370(9596):1453–7.
- Van der Groen TA, Olsen BR, Park SE. Effects of a Research Requirement for Dental students: a retrospective analysis of students' perspectives across ten years. *J Dent Educ*. 2018;82(11):1171–7.
- Althubaiti A. Sample size determination: a practical guide for health researchers. *J Gen Family Med*. 2023;24(2):72–8.
- Franzén C. The undergraduate degree project—preparing dental students for professional work and postgraduate studies? *Eur J Dent Educ*. 2014;18(4):207–13.
- Edmunds S, Brown G. Doing qualitative research in dentistry and dental education. *Eur J Dent Educ*. 2012;16(2):110–7.
- Moreno X. Research training in dental undergraduate curriculum in Chile. *J Oral Res*. 2014;3(2):95–9.
- Liu H, Gong Z, Ye C, Gan X, Chen S, Li L, et al. The picture of undergraduate dental basic research education: a scoping review. *BMC Med Educ*. 2022;22(1):569.
- Omar A, Elliott E, Sharma S. How to undertake research as a dental undergraduate. *BDJ Student*. 2021;28(3):17–8.
- Otuyemi OD, Olaniyi EA. A 5-year retrospective evaluation of undergraduate dental research projects in a Nigerian University: graduates' perceptions of their learning experiences. *Eur J Dent Educ*. 2020;24(2):292–300.
- Franzén C, Brown G. Undergraduate degree projects in the Swedish dental schools: a documentary analysis. *Eur J Dent Educ*. 2013;17(2):122–6.
- Thakre SB, Golawar SH, Thakr SS, Gawande AV. Search engines use for effective literature search in biomedical research. 2014.
- Gusenbauer M, Haddaway NR. Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. *Res Synthesis Methods*. 2020;11(2):181–217.
- Lorton L, Rethman MP. Statistics: curse of the writing class. *J Endod*. 1990;16(1):13–8.
- Leppink J. Helping medical students in their study of statistics: a flexible approach. *J Taibah Univ Med Sci*. 2017;12(1):1–7.
- Oster RA, Enders FT. The Importance of Statistical Competencies for Medical Research Learners. *J Stat Educ*. 2018;26(2):137–42.
- Habib SR, AlOtaibi SS, Abdullatif FA, AlAhmad IM. Knowledge and attitude of undergraduate Dental students towards Research. *J Ayub Med Coll Abbottabad*. 2018;30(3):443–8.
- Florek AG, Dellavalle RP. Case reports in medical education: a platform for training medical students, residents, and fellows in scientific writing and critical thinking. *J Med Case Rep*. 2016;10:86.
- Wortman-Wunder E, Wefes I. Scientific writing workshop improves confidence in critical writing skills among trainees in the Biomedical sciences. *J Microbiol Biol Educ*. 2020;21(1).
- Barroga E, Mitoma H. Critical thinking and scientific writing skills of Non-anglophone Medical students: a model of Training Course. *J Korean Med Sci*. 2019;34(3):e18.
- Kyaw Soe HH, Than NN, Lwin H, Nu Htay MNN, Phyu KL, Abas AL. Knowledge, attitudes, and barriers toward research: the perspectives of undergraduate medical and dental students. *J Educ Health Promot*. 2018;7:23.
- Alrashdan MS, Alazzam M, Alkhader M, Phillips C. Career perspectives of senior dental students from different backgrounds at a single Middle Eastern institution. *BMC Med Educ*. 2018;18(1):283.
- Chellaiyan VG, Manoharan A, Jasmine M, Liaquathali F. Medical research: perception and barriers to its practice among medical school students of Chennai. *J Educ Health Promot*. 2019;8:134.
- Jeelani W, Aslam SM, Elahi A. Current trends in undergraduate medical and dental research: a picture from Pakistan. *J Ayub Med Coll Abbottabad*. 2014;26(2):162–6.
- Yu W, Sun Y, Miao M, Li L, Zhang Y, Zhang L, et al. Eleven-year experience implementing a dental undergraduate research programme in a prestigious dental school in China: lessons learned and future prospects. *Eur J Dent Educ*. 2021;25(2):246–60.

## Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.