


# The approach to undergraduate research projects at Namibia's first School of Medicine

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**Background.** The integration of undergraduate research (UR) in biomedical curricula has gained much interest.

**Objective.** To investigate the research focus of compulsory UR in the medical curriculum of the University of Namibia's School of Medicine.

**Methods.** A retrospective mixed-methods document review was performed on 42 research projects using the 5C framework that assessed students' ability to Cite, Compare, Contrast, Critique and Connect in their research reports.

**Results.** Students' research projects focused on internal medicine (29%;  $n=12$ ), paediatrics (26%;  $n=11$ ), obstetrics and gynaecology (19%;  $n=8$ ), surgery (10%;  $n=4$ ), psychiatry (5%;  $n=2$ ) and oncology (2%;  $n=1$ ). A final category is *other*, which included health professions education and anatomy (10%;  $n=4$ ). Students' reports had *aims*, *objectives* or *goals* that were correctly done. Students' review of the literature reflected their ability to cite relevant scholarly works and to compare these by highlighting agreements or disagreements. Contrasting and critiquing research findings proved to be challenging.

**Conclusion.** Findings from the current study indicate variability in the degree of students' research competence. It appears that the elements of critical thinking and appraisal require further strengthening within the existing curriculum.

*Afr J Health Professions Educ* 2023;15(2)e1690. <https://doi.org/10.7196/AJHPE.2023.v15i2.1690>

Student participation in undergraduate research (UR) has gained much ground in recent years.<sup>[1]</sup> Active participation in UR has the potential to develop critical thinking, engage students in inquiry-based learning, and facilitate the formation of linkages between research and teaching.<sup>[1-3]</sup> The importance and value of UR have been recorded extensively and include the development of skills and interest in research,<sup>[4]</sup> the fostering of advancement of clinician-scientists<sup>[5]</sup> and the acquisition of transferable skills such as communication and teamwork.<sup>[6,7]</sup> Most UR programmes involve teaching research methods that help students to develop research-related inquiry skills, participate in research discussions, learn about current research within a specific discipline, assist with data collection and undertake research, and learn about problem solving.<sup>[8]</sup>

The facilitation of UR programmes has many challenges. Knight *et al.*<sup>[6]</sup> reported that finding enough skilled supervisors is particularly challenging. Furthermore, the supervision of research projects must compete with a full academic curriculum and deadlines associated with each phase of the project.<sup>[6]</sup> The ability of inquiry-based learning activities such as UR to stimulate interest among students rests upon various factors. Students should be afforded opportunities to explore what they want to learn, as well as the questions they have regarding a subject-specific research project.<sup>[8]</sup> Experience has shown that students tend to encounter difficulties in writing research proposals, as they do not fully comprehend what constitutes a good research proposal.<sup>[9]</sup> The ability to translate students' research projects into a presentation at a scientific meeting or a publication in a peer-reviewed academic journal is another challenge.<sup>[10]</sup> One possible reason for these challenges points towards the perceptions of academic staff who view students' projects as being of poor quality and thus unpublishable.<sup>[6]</sup>

Despite the potential barriers, UR remains relevant.<sup>[1]</sup> It is important to note that quality and impactful scientific research aimed at addressing

the disease burden requires the emergence of physician-scientists.<sup>[11]</sup> Early introduction of UR in medical curricula has the potential to foster physician-scientists.<sup>[11,11]</sup> Practice-based learning that relies on the interaction between theoretical concepts and experience gained through active research was proposed by De Vegt *et al.*<sup>[11]</sup> in 2021. Practical experience through active engagement in UR is believed to help students form a closer connection between research and theory.<sup>[11]</sup>

In this article, we report on the nature of medical students' research reports at the University of Namibia (UNAM)'s School of Medicine (SoM). We address the evaluation of one of the sixth-year cohorts and the research reports associated with the MB ChB degree programme.

## Setting

Initially, at UNAM, UR modules were presented as Independent Research Studies (IRS), Research Methods and Project for the MB ChB and BPharm degree programmes, respectively.<sup>[12]</sup> The modules were developed to instil the underlying skills critical to research (the intended learning outcomes for both modules are presented in Table 1).<sup>[12]</sup> Currently, the modules continue to form a compulsory element of the curricula, notwithstanding changes in the names of these modules and the extension of the MB ChB programme to include a sixth academic year (formerly offered over 5 years<sup>[12]</sup>). The UR commences with a Research Methods and Proposal Writing module (8 credits and 160 notional hours) and ends with the Research Project module (8 credits and 320 notional hours), which is facilitated in a blended format across different schools within the faculty. As for the MB ChB programme, the first module is offered afresh to each cohort during their third academic year. Therefore, all MB ChB students are expected to progress from the conceptualisation of a research project through writing a proposal in their third academic year. This approach is facilitated through

**Table 1. The intended learning outcomes of the two undergraduate research modules**

- Explain the purpose of clinical research.
- Differentiate types of research (clinical, basic science, health services).
- Describe the different types of research designs.
- Design research instruments.
- Apply research methods in designing a research proposal.
- Develop an understanding of research methodology.
- Critically review literature.
- Identify the research question.
- Formulate hypotheses, problem statement and justification of the study.
- Formulate objectives.
- Select study design and strategy.
- Define the study population, sampling and sample size determination.
- Specify variables, data collecting tools and data collection methods.
- Develop data management and analysis plan.
- Determine the budget and research project administration.
- Interpret results and write report.
- Apply principles of medical ethics in research.

a blended learning format and is aimed at fostering research-related skills. Consequently, the topics of UR at UNAM are proposed by each student and/or their supervisor. Members of the school serve as supervisors and guide students toward streamlining their projects. All academic members are required to supervise student projects and the overall aim is to serve as mentors throughout students' research journey.

Once the Research Methods and Proposal Writing module is completed, students progress by obtaining ethical approval from the Namibian Ministry of Health and Social Services through the school's research committee. Ethical approval is obtained during the fourth-fifth academic year, where self-directed learning and supervisor engagement are exercised intensively. The fifth and sixth academic years are devoted to data collection and writing of a research report, which accounts for the Research Project module.

## Materials and methods

A retrospective mixed-methods approach was followed, which entailed a qualitative document review (QDR) with the presentation of dichotomous data in quantitative form. The study was conducted by one of our undergraduate MB ChB students (MAK) and co-authors in 2021 to assess the research focus of UR projects. The study was done at UNAM's SoM and data were obtained from the MB ChB research reports of the 2017 cohort. A total of 45 research reports were reviewed and 42 were finally subjected to QDR. Three reports were excluded, as they were either proposals or from repeating students, and without ethical approval, as opposed to completed projects. The thematic focus, based on a clinical specialty or related to biomedical science, was documented. The research reports were assessed for alignment of the aim and goals of each project and whether these were achieved by the methods used and the findings that were presented. This procedure was assessed through the identification of alignment between the aim, objective and goals and the presentation of the research findings. The assessment of the 42 research reports led to the production of categorical data for the study, where the research components were evaluated as variables. The research reports were evaluated by determining if the specific component was included or not, and if it was correctly done by producing dichotomous data with yes (1) or no (0) scores, respectively. Descriptive statistics were carried out to produce frequencies of the research components included in the reports.

Finally, document analysis entailed a conceptual approach, whereby important components of students' research reports were assessed. The criteria for QDR were adapted from the 5C approach (Cite, Compare, Contrast, Critique and Connect) to writing a literature review.<sup>[13]</sup> Even though Sudheesh *et al.*<sup>[13]</sup> used the 5C approach to appraise a literature review, the current study employed the same framework to appraise the research reports. For the purpose of our study, we wanted to establish whether the research report:

- kept to its primary focus by *citing* relevant scholarly works (Cite or C1)
- *compared* the literature by highlighting what the literature agrees on (C2A) and whether similar approaches (C2B) were used to analyse the research phenomenon (Compare or C2)
- referred to *contrasting* done in reference to the current body of knowledge (Contrast or C3)
- *critiqued* the literature in reference to the findings (Critique or C4);
- made *connections* (C5A) with the current body of knowledge and *synthesise* (C5B) new information in writing the discussion (Connect or C5).

## Results

A total of 45 research reports and proposals were supervised by 25 staff members. Forty-two students' research reports met the criteria for QDR (Supplementary material A: <https://www.samedical.org/file/2010>). Three projects were excluded from the study, as they were proposals of repeating students that were not finalised, with no ethical approval. On average, each staff member supervised 2 student projects. Eight staff members supervised 2 student projects, and 3 supervised 3 projects at a time. However, 1 supervisor supervised 4 projects, while most ( $n=13$ ) supervised only 1 project at a time.

Overarching research themes were identified based on the primary clinical specialties of internal medicine, paediatrics, obstetrics and gynaecology, psychiatry, surgery and oncology. Most projects focused on internal medicine (29%;  $n=12$ ), followed by paediatrics (26%;  $n=11$ ) and obstetrics and gynaecology (19%;  $n=8$ ), while only 2 projects focused on psychiatry (5%) and 1 project on oncology (2%). Four projects (10%) focused on surgery and 4 more were categorised as *other* (10%). The latter included 3 health professions education themes and 1 anatomy-based study (Fig. 1). The titles of these research reports are presented in Supplementary material A (<https://www.samedical.org/file/2010>), while the frequencies of the different themes are shown in Fig. 1. These findings were considered as the research focus of each student.

The second aspect of the current study considered the approach of students' research reports. The reports were assessed to determine whether they included the aims, objectives and goals and if they were correctly done (achieved). The majority of the research reports included the relevant components that were assessed (Table 2). The overarching aim component was included in 98% ( $n=41$ ) of the reports and 86% ( $n=36$ ) included long-term goals (Supplementary material B: <https://www.samedical.org/file/2010>). Clear and well-structured objectives were observed in 74% ( $n=31$ ), whereas the remainder of the reports (26%;  $n=11$ ) only stated an overarching aim. Some research reports combined the objectives, aims and goals under the objectives heading, which reflects the researcher's inability to differentiate between these concepts. A total of 34 reports (81%) achieved their outlined objectives, goals and aims (Supplementary material B: <https://www.samedical.org/file/2010>).

Furthermore, the quality of the research reports was critically appraised using the 5C framework, which demonstrated varied results in the report consistency (Table 1). In writing the report's framework, most students (79%;  $n=33$ ) could keep to the primary focus (C1) throughout. Students were able to find relevant literature and point out what is known, what is agreed on, make connections and then synthesise. It was observed that most (95%;  $n=40$ ) of the reports included a comparison (agree: C2A) with the existing literature. In addition, 76% ( $n=32$ ) of the reports aligned the cited literature with the research phenomenon under investigation with similar approaches (C2B), which were mostly international or local studies. Close to half (48%;  $n=20$ ) of the reports had contrasting (C3) or different approaches to the research questions in terms of the population and methodology used. However, few reports (14%;  $n=6$ ) critiqued (C4) the existing literature in terms of the limitations of the approach used, the reproducibility of the outcomes and the appropriateness or limitations of the methodology that was applied to the studies that they cited. The majority of students

succeeded in making connections (C5A; 74%;  $n=31$ ) between their literature review, study variables, methodology and results. However, slightly more than half (57%;  $n=24$ ) of the students were able to synthesise new information (C5B) based on their results.

## Discussion

The integration of UR in biomedical curricula has been found to be feasible, especially through a practice-based learning approach.<sup>[1]</sup> Research should be encouraged early on in students' medical career.<sup>[14]</sup> UR at UNAM's SoM forms a compulsory element for all MB ChB students, and staff members are required to serve as mentors and advisors over a period of 4 years. The final outcome for each student is a research report. Students' research efforts also provide opportunities for independent learning and development of research-related skills. We assessed the quality of students' research reports by using a 5C framework.<sup>[13]</sup>

Findings from this study indicate that most students selected topics that focused on internal medicine and elements of maternal and child

health. This selection is of particular interest, as the disease burden in Namibia relates to communicable diseases (e.g. tuberculosis and HIV) and non-communicable diseases (especially diabetes and cardiovascular-related conditions).<sup>[15,16]</sup> Equally, students predominantly conduct their clinical rotations in the two referral state hospitals in Namibia, which treat many disease cases. They are therefore exposed to the heart of the current health burden.

Findings further indicate variability in the degree of students' research competence. The review of the literature was well executed and reflected students' ability to cite relevant scholarly works and draw comparisons (compare). The majority of the reports had aims, objectives or goals that were correctly done. However, students' ability to contrast their research findings with those of previous work proved to be challenging. The same holds true for students' ability to critique current literature related to their study and connecting their findings with those of previous work. It appears that these elements of critical thinking and appraisal require further strengthening within the existing curriculum. Critical appraisal is one of the primary research-related attributes that relies on critical evaluation of data and the subsequent synthesis of new information.<sup>[5]</sup>

Barriers to critical thinking, as discussed by Mangena and Chabeli,<sup>[17]</sup> include lack of faculty knowledge, poor educational backgrounds, inappropriate student selection criteria, insufficient facilitation of critical thinking in medical education, resistance to change by faculty members and inappropriate assessment activities. Again, these barriers were not assessed within the context of the current study, but they all have merit. One of the major contributions to these barriers is the student-supervisor challenge,

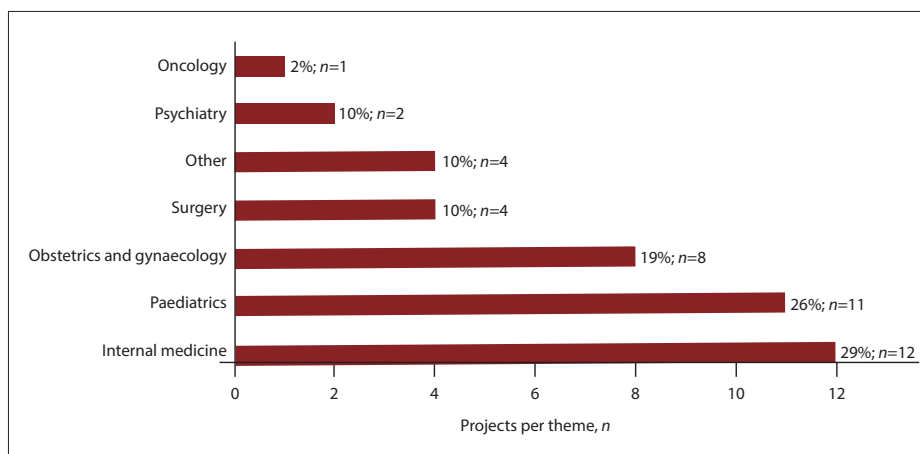


Fig. 1. Overarching undergraduate research themes associated with students' projects.

Table 2. Evaluation of research reports based on the 5C conceptual framework,  $n=42$

5C framework	Definition of framework	Score	Reports, $n$ (%)
Primary focus (C1)	Primary focus by <i>citing</i> relevant scholarly works	0; 1	9 (21); 33 (79)
Agree (C2A)	<i>Compare</i> the literature by highlighting what the literature agrees on	0; 1	2 (5); 40 (95)
Approach (C2B)	<i>Compare</i> the literature by establishing if similar approaches were used to analyse the research phenomenon	0; 1	10 (24); 32 (76)
Contrasting (C3)	<i>Contrast</i> done with reference to the current body of knowledge	0; 1	22 (52); 20 (48)
Critiqued literature (C4)	<i>Critique</i> the literature with regard to the findings	0; 1	36 (86); 6 (14)
Connect (C5A)	<i>Connections</i> made with the current body of knowledge	0; 1	11 (26); 31 (74)
Synthesis (C5B)	<i>Synthesis</i> of new information in writing the discussion	0; 1	18 (43); 24 (57)

5C = Cite, Compare, Contrast, Critique and Connect; 1 = yes; 0 = no.

which relates to the distribution of students per supervisor. We found that the quality of research supervision might be impeded by the large number of student projects per supervisor. This situation in turn could impact the quality of students' projects. Solutions to mitigate this phenomenon are therefore warranted. A possible solution might be to form research teams, where a larger project is broken down and pursued by a small cohort of students. The larger project could therefore be subdivided into specific research questions and objectives, permitting one supervisor to facilitate multiple projects.

Compulsory research in undergraduate medical curricula, as presented here, has the advantage of fostering clinician-scientists.<sup>[5,11]</sup> However, this comes at a price. Some of the major challenges, which were not explored in this article, relate to the allocation of supervisors, supervisors' competence in the study area and finding novel and worthwhile project ideas. These issues, as well as other challenges and barriers associated with UR, are well documented.<sup>[5,11,18,19]</sup>

Finally, the overall impact of UR projects requires further investigation and should be assessed by considering their value in relation to the existing body of knowledge, influence on practice and ability to augment or transform existing policies. The current study did not assess whether students' data analyses were appropriately aligned with the methodology used, and further research is required to fully assess the overall quality of the projects.

## Conclusion

In this study we aimed to appraise the nature of UR of medical students using a transferrable 5C approach framework. Findings indicate that students displayed a general understanding of research writing and methodology. The majority of undergraduate MB ChB students appear to have a clear understanding of the aims, goals and objectives and how to achieve them through the research project. However, critical thinking proved to be a major challenge. The study emphasises the value of the framework that was used to gauge the nature of UR and subsequently rectify possible gaps and limitations regarding the inclusion of UR in curricula. The authors also believe that the current study provides some insights and important considerations that permit the reader to incorporate UR in their curricula.

**Declaration.** None.

**Acknowledgements.** The authors wish to acknowledge students and supervisors, without whom this study would not have been possible.

**Author contributions.** All authors contributed to the study conception and design. The qualitative document analysis was done by MAK. Data analyses were performed by HZ and LNNS, and OKHK worked on the background and setting sections. The first draft of the manuscript was written by QW and reviewed by HZ. All authors read and approved the final manuscript.

**Funding.** None.

**Conflicts of interest.** None.

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Accepted 22 January 2023.