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Research Article:

Challenges of Project Defence in Final-Year Clinical Chemistry Projects in Medical Laboratory Science and the Way Forward

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ABSTRACT:

The final year project defence is a key part of undergraduate education in Medical Laboratory Science, enabling students to demonstrate their knowledge of scientific research, laboratory methods, data analysis and clinical interpretation. In Clinical Chemistry, the defence of the project is particularly crucial, as students are expected to relate biochemical principles to laboratory findings and their clinical implications. However, students often face difficulties such as inadequate preparation for research, limited laboratory resources, insufficient understanding of research methods, difficulties in statistical analysis, poor interpretation of biochemical data, ineffective communication skills, and a lack of confidence during oral examinations. These hurdles may prevent students from showing their true abilities and devalue the educational benefits of the research process. This article reviews the main obstacles faced by students in defending their final year project in the area of Clinical Chemistry in Medical Laboratory Science and suggests practical ways of enhancing the same. Suggested interventions include enhancing research supervision, facilitating access to laboratory facilities, implementing organised training in research methods, conducting mock defences, enhancing statistics and scientific writing skills and implementing standardised assessment rubrics. It also highlights the importance of academic integrity, quality assurance, ethical compliance and the integration of clinical reasoning in undergraduate research. A coordinated strategy of students, supervisors, departments and institutional administration is important to increase the quality of project defence and prepare graduates for evidence-based laboratory practice.

Keyword: Clinical Chemistry, Project Defence, Medical Laboratory Science, Undergraduate Research, Laboratory Quality Assurance, Research Supervision, Oral Examination.

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INTRODUCTION

Undergraduate research is an important part of professional training in Medical Laboratory Science. It allows students to apply theoretical knowledge to scientific problems, to develop practical laboratory abilities, to critically assess scientific evidence and to recognize the importance of laboratory investigations in the diagnosis, monitoring and management of disease. These competences are especially crucial in Clinical Chemistry, because laboratory results need to be interpreted according to biochemical pathways, physiological processes, analytical methodologies and clinical circumstances [1].

The final-year project defence is the formal academic exercise when students show their comprehension of the study they have done. It usually comprises presenting the research problem, describing the technique, summarising the findings, answering questions from examiners and defending the conclusions and recommendations. The defence, so to speak, goes beyond the student's capacity to write a dissertation: it analyses scientific thinking, independent knowledge, communication and the capacity to support methodological and analytical choices [2].

Project defence can be a daunting task for final year

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Medical Laboratory Science students despite its relevance. Knowledge of biochemical tests, specimen management, analytical performance, reference intervals, statistical methodologies and clinical significance of laboratory data are typically included in Clinical Chemistry projects. It could be hard for students to combine all these components into a coherent scientific explanation, especially if there is a lack of laboratory access, research supervision, time and money.

Therefore, the quality of project defence is determined by a complex of interrelated criteria such as the level of student preparedness, the quality of supervision provided by the supervisor, the availability of laboratory resources, the quality of research training, and the consistency of departmental evaluation methods. This review highlights the major problems encountered by students during the defence of their final year clinical chemistry project in medical laboratory science and the practical measures that can be adopted to improve student performance, research quality and professional competence.

Major Problems of Project Defence in Clinical Chemistry

One of the great obstacles faced in the project defence is certain students' inability to articulate the scientific ideas that underlie their research. A student can write a good paper and not be able to explain why a certain biochemical parameter was chosen, how it connects to the study question, or what physiological mechanism is underlying the findings.
For example, a student examining antioxidant status in patients with anaemia has to know the activities of superoxide dismutase, catalase and glutathione peroxidase where relevant and the relationship between oxidative stress, hyperglycaemia and cellular damage. The student of liver function, too, must be conscious of the biochemical relevance and limitations of alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, bilirubin and other pertinent indicators.

Students who merely memorise their work, without acquiring conceptual understanding, may find that they cannot answer questions that ask for explanation or application of knowledge. This degrades their performance and also casts doubt on how deep they are involved in the research.

Research methodology often poses a problem in the defence of the project. Students frequently have difficulty justifying their research design, sampling strategy, sample size, inclusion and exclusion criteria, specimen collection processes, and choice of laboratory methods [3].

The validity of the laboratory results is directly affected by the methodological choices used in Clinical Chemistry. Students should be aware of the reasons why serum or plasma were utilised, how the specimens were obtained, processed and stored, the analytical method employed, and how potential sources of error were controlled.

For example, a student carrying out a fasting blood glucose measurement should be able to describe the significance of fasting state, specimen handling, analytical principle of the method employed and the influence of delayed processing on glucose concentration. A student studying lipid profiles should be aware of the pre-analytical factors and constraints of any estimated parameters. Not explaining those decisions demonstrates a gap between doing a technique and knowing the science that underlies it.

Research in Clinical Chemistry sometimes requires reagents, calibrators, control materials, laboratory equipment, consumables and access to working analytical instruments. Such criteria might be quite challenging for students and supervisors at resource-scarce schools.

A limited availability of automated chemical analysers, spectrophotometers, centrifuges, refrigerators and other critical equipment may delay experiments or limit the range of research students can perform. Research progress could also be hampered by shortages of reagents, malfunction of equipment, expensive maintenance expenses and unstable power supplies. Students may also be limited financially in terms of achieving suitable sample numbers, retesting, purchasing quality control supplies or using outside laboratories as necessary.

These restrictions may lead to conclusions that are limited in quality and completeness. Students may therefore find it difficult to explain unanticipated

outcomes or limits coming from procedures that could not be completed as originally planned during defence.

Hence, institutions must realise that student research performance is not just a matter of individual efforts, but also the provision of adequate facilities and academic support [4].

Furthermore, another major challenge is Statistical analysis. Students may be able to give the number of findings but struggle to explain what those results indicate, or why a specific statistical test was used. Typical errors include using improper statistical tests, not checking the necessary assumptions, misinterpretation of p-values, confusing standard deviation with standard error, and over-reliance on statistical significance. For example, a student performing a comparison of the mean catalase activity between diabetes patients and seemingly healthy controls should appreciate the rationale of the comparison, the appropriateness of the statistical test, the meaning of the reported p-value, and the significance of effect magnitude and variability. A statistically significant finding does not inevitably mean that it is clinically important, nor does a non-significant result prove that there is no difference. Interpretation should take into account study methodology, sample size, uncertainty, biological plausibility, and limits of the measures.

Students should also grasp that the selection of statistical methods should be guided by the research topic, data characteristics, study design and related assumptions, rather than by mimicking the methods employed in prior publications.
Indeed, Clinical Chemistry demands more than the ability to quantify biological markers. Students should be able to interpret results using relevant biochemical principles and explain the possible clinical significance. A common problem is to indicate whether a result rose or decreased without explaining why the change occurred. For example, documenting lower catalase activity in a study population does not necessarily demonstrate the cause of that drop. The learner should analyse potential mechanisms, the nature of the population, analytical limits and alternate interpretations. Similarly, increased serum enzyme activity might be caused by many factors and should not be automatically assigned to a single disease or pathologic mechanism.

Students should know the difference between association and causation, especially in observational and cross-sectional studies. They must also be aware that laboratory findings should be interpreted within the limitations of the research design and cannot be used for clinical diagnosis.

The discussion part should also interpret the results, compare them with the literature, examine probable causes for similarities and discrepancies and highlight the ramifications of the findings.
Some students just rewrite their results in paragraph form, without giving a proper scientific explanation. Others refer to earlier studies without showing how the studies connect to their own findings.
Not searching the literature, use of old references, restricted access to full text articles and poor knowledge of scientific writing may lead to problems. Some pupils also have difficulty distinguishing between what is already known and what they themselves think.

A strong defence needs students to justify how their findings are consistent or inconsistent with past studies and to evaluate changes in demographic characteristics, study design, sample size, analytical methodologies and laboratory conditions.
The challenge consequently is not only finding references but critically evaluating and applying the literature to the study problem.

In fact, Project defence may be very stressful event, especially for students who do not have much experience with formal scientific presentations. Students are nervous and forget essential facts. They talk unclearly and read excessively from slides or provide inadequate answers to queries.

Some students take hard questions as an attack, rather as an opportunity to show what they know. Some people get defensive when examiners find faults in their work.

The ability to do effective oral presentations is a skill that develops through systematic education, practice, feedback and assessment. Learning opportunities, modelling, feedback and assessment were highlighted as important elements for the development of oral presentation competence in higher education. Thus, the students should not be expected to develop strong defensive skills just by preparing their final presentations[5].

The quality of project supervision can also have a significant effect on students' preparedness for defence.

Students may not receive adequate assistance when supervisors have excessive teaching loads, huge numbers of supervisees, or limited time for research mentoring.

Inadequate input on proposals, technique, laboratory methods, data analysis, and draft chapters might result in incomplete projects and weak arguments. Supervisors who give conflicting guidance might also cause misunderstanding regarding what is expected in terms of research.

Effective supervision should comprise regular meetings, clear milestones, constructive criticism, and ensuring that learners comprehend the research decisions they make.

The supervisor should not be confined to improving the grammar or editing the dissertation. It should also involve helping the learner develop independent scientific reasoning and the ability to explain and defend the work.
Another problem is to find out if the students really comprehended and were part of the research they present. Concerns may develop in cases where students rely on third parties to write their projects, to produce analyses, to prepare presentations, or to interpret outcomes.

Other concerns include plagiarism, faked or manipulated data, incorrect use of references, inability to acknowledge support, and poor documentation of ethical approval.

Clinical Chemistry initiatives involving human subjects, identifiably human information, human samples or experimental animals require proper ethical monitoring and conformity with relevant institutional rules. Students should be aware of informed consent if available, confidentiality, safe handling of specimens, correct record keeping and the need of reporting results truthfully. They should be able to discuss what they did personally in the research and what they did with aid.

Professional laboratory practice relies on research integrity, as incorrect or misleading results might have major implications. A valuable basis for understanding laboratory processes, quality assurance, documentation and control of errors is provided by the World Health Organization Laboratory Quality Control System: Handbook [6].

Likewise, the absence of clear and uniform standards for assessment may harm the Project defence as well. Different examiners may have different values on presentation style, knowledge of methodology, statistical interpretation, written presentation or answers to questions.

If marking requirements are not properly conveyed pupils may not know what a satisfactory defence is. Differences in methods of inquiry and expectations may also contribute to the uniformity of assessment between pupils.
A good system of assessment should take account of the quality of research, the student's knowledge of that research, the appropriateness of the technique, the interpretation of evidence and the capacity to express scientific reasoning.
Assessment should not be based primarily on the student's confidence or fluency, because confidence in the presentation does not necessarily mean that the student has a good scientific grasp [7].

The Way Forward: Approaches for Improving Project Defence

Improving project defence among final year Clinical Chemistry students in Medical Laboratory Science involves collaborative effort of students, supervisors, academic departments, institutional management and examiners. Good techniques should include better training in research methodology, better supervision, better presenting skills, better statistical competence, enough laboratory resources and academic integrity.

Students should be trained in research methods, before they start the final stages of their projects. Departments should offer formal training in research design, hypothesis generation, sample-size calculation, sampling procedures, specimen collecting, laboratory techniques, data management, and data interpretation. Students of Clinical Chemistry should also be trained specifically in analytical principles, calibration, internal quality control, pre-analytical and post-analytical mistakes, reference intervals and limitations of laboratory data. This training should include a mixture of lectures, practical exercises, case discussions, journal appraisal and supervised research tasks. This method allows learners to comprehend not only how to perform laboratory procedures but also the scientific principles that underlie their application [8].
Proper supervision and guidance are also very vital in

enhancing students' success in project defence. Departments should clarify expectations for supervisors and students alike including regular meetings, agreed project milestones, progress reports and documented feedback. Supervisors should examine the student's knowledge of their study during the project, not at the end of the dissertation. Students should be encouraged to clarify their research conclusions, justify their analytical approaches and debate unexpected findings during supervision meetings. Where possible, a co-supervisor or mentor with experience in biostatistics, laboratory quality management, or a related clinical discipline may be involved to provide extra direction. Good mentoring should assist technical and academic areas sufficiently while fostering student freedom. Students should also be required to do mock defences before the formal test so they are prepared for the questioning and presentation aspects of project defence. These exercises should be as near to the real examination as possible and include supervisors, academic staff and fellow students. Participants should ask questions related to the study problem, objectives, methods, results, discussion, limitations and recommendations. The feedback should highlight areas for improvement such as: not explaining clearly, relying too much on the presentation slides, poor time management, and not justifying methodological decisions. Repeated practice can help kids build confidence, enhance their communication skills, and learn how to respond appropriately to enquiries without being defensive. It also permits supervisors to discover knowledge deficiencies to be attended to before the official defence.

Another key approach is to enhance students' ability to analyse data statistically and understand data. Clinical Chemistry studies often include the study of biochemical measures, comparison of experimental or clinical groups and the exploration of correlations between laboratory variables. Departments should consequently offer practical training in acceptable statistical methodologies and associated analytical tools. Students must learn to arrange data, choose the right statistical test, check assumptions, present descriptive statistics, assess uncertainty, and report findings appropriately. Where resources permit, access to a biostatistician or authorised statistical advisor could eliminate needless analytical errors. Students also should have to justify their statistical choices in their own terms. This will assist examiners to differentiate between true comprehension and mechanical use of statistical software or reliance on another person's analysis [9].

Sufficient laboratory space and research resources should also be available. Institutional management should focus on the upkeep of critical laboratory equipment, the availability of reliable reagents and consumables and the establishment of adequate laboratory quality management procedures. Departments may develop shared equipment schedules, reagent inventories, maintenance plans and collaboration partnerships with recognised diagnostic laboratories or research institutions. If a suggested experiment is found to be unfeasible due to financial constraints or equipment limitations, then students and supervisors must agree upon a scientifically valid alternative before the commencement of data collection. Students should not be encouraged to generate spurious results or to report incomplete experiments as if they had been completed successfully. Instead, constraints should be acknowledged explicitly and taken into account when evaluating the findings [10].

Standardised assessment criteria should also be implemented to ensure transparency, fairness and consistency during project defence. A systematic grading rubric should show the components of the exam, maximum marks and required standards of achievement. The department shall approve the final allocation and in accordance with institutional standards. Examiners should be given the same evaluation rubric and use it consistently, but with the latitude to ask questions suitable to the subject and technique of each research project. Using well-defined criteria would minimise unwarranted variability in evaluation and assist learners comprehend the standards that are required of them.

In addition, departments should foster scientific writing and critical evaluation abilities throughout the research process. Students need to be taught how to write coherent research reports, how to use acceptable referencing styles, how to avoid plagiarism and how to critically analyse scientific publications. Workshops in writing abstracts, literature searches, citation management, interpretation of tables and figures and scientific presentation would be useful. Students should also be taught to talk about their findings in a systematic way, describing the primary results, explaining their probable scientific relevance, comparing with the relevant literature, evaluating alternate interpretations and recognising limitations. In addition, the quality of written dissertations and the students' capacity to argue their findings verbally would improve [11].

Another important method is to place clinical reasoning in Project defence in Clinical Chemistry. Examinations should require students to relate laboratory findings with relevant biological and clinical principles without making unsubstantiated diagnostic statements. For example, students learning about glucose regulation should know the relationship between insulin action, glucose metabolism and glycaemic measures. Students studying renal function should be able to explain the interpretation and limitations of important biochemical indicators. Students studying lipid profiles should comprehend lipid metabolism and the clinical context in which lipid measures are taken. This approach helps students to see laboratory data as scientific evidence to be interpreted carefully, rather than as isolated number quantities. The International Organization for Standardization's ISO 15189:2022 standard, which establishes requirements for quality and competence in medical laboratories, provides a relevant professional framework for enhancing students' awareness of laboratory quality, reliability and competence.

Academic integrity and student ownership of research should be emphasised throughout all stages of project cycle. Students should keep proper laboratory records, record data collection and analysis, acknowledge help received, and adhere to institutional ethical norms. Supervisors should check relevant records where appropriate and periodically assess students' grasp of their methods and findings. Where digital resources or artificial intelligence are employed, students should adhere to institutional standards and be responsible for the accuracy, originality and integrity of their work. Examiners should be able to differentiate between acceptable academic support and misconduct, and utilise fair and consistent techniques to determine the student's level of knowledge and participation. This would assist maintain the integrity of the research process and strengthen responsible scientific practice [12].

Finally, defence should take place in a supportive but intellectually rigorous context. Examiners should ask clear, relevant questions, provide adequate time for responses, and allow for clarification. Questions should evolve from simple ideas to more complex analytical concerns so that students can demonstrate their understanding step by step. If the answer is not comprehensive, a well-formulated follow-up inquiry may assist evaluate if the problem is due to worry, misunderstanding or a genuine knowledge gap. Providing a helpful examination environment does not mean lowering academic standards, but rather it gives students the opportunity to more properly exhibit their ability while maintaining the integrity and credibility of the assessment process.

Thus, continuous cooperation among students, supervisors, departments, institutional administration and examiners is needed to improve project defence in Clinical Chemistry. The undergraduate research training should include early research methodological instruction, effective supervision, mock examinations, statistical competence, adequate laboratory resources, standardised assessment criteria, scientific writing, clinical reasoning and academic integrity. These measures, once implemented, will boost students' confidence and critical-thinking skills, improve the quality of undergraduate research, and better prepare future Medical Laboratory Scientists for evidence-based laboratory practice and professional duties.

Key Stakeholders' Responsibilities

The effective project defence of final year Clinical Chemistry projects in Medical Laboratory Science depends on the active engagement and cooperation of all stakeholders in undergraduate research. The stakeholders are students, project supervisors, academic departments, institutional management, examiners and research and ethics committees. Each group has different responsibilities that contribute to the quality of research, the preparation of students, and the overall efficacy of the project defence process.

Students are responsible for knowing their own research projects and exhibiting an acceptable mastery of the scientific concepts of their investigations. They should maintain correct laboratory records, follow approved research methods, analyse data ethically and interpret results within the framework of accepted biochemical and clinical principles. Students can also cultivate good communication skills by rehearsing their oral presentations and being ready to address enquiries about their research aims, methodology, results and conclusions. They also need to show academic integrity, provide appropriate credit to sources and make modifications indicated by examiners within the given amount of time[11].
The project supervisors are important in assisting students through the research process. They help students to pick suitable research subjects, prepare research

proposals, select appropriate research procedures, carry out laboratory studies, analyse data and prepare research reports. Regular meetings should be held to monitor progress. Feedback should be prompt and constructive and the research should be of adequate scientific and ethical standards. They should also prepare students for oral defence by spotting any faults in their work, scheduling practice sessions and fostering independent scientific reasoning rather than rote memorisation.

The department is charged with the development of an effective structure for evaluating undergraduate research and projects. It should provide adequate instruction in research methods, prepare for seminars on scientific writing and statistical analysis and conduct mock defences to build up students' confidence and presentation skills. It is recommended that the department adopt uniform evaluation criteria to support fairness, transparency and consistency between examiners. It should also monitor the supervision methods, identify existing deficiencies in students' projects and take actions to improve research quality and academic performance [12].

Institutional management carries a substantial responsibility for providing the necessary resources to carry out effective clinical chemistry research. This includes functional laboratory equipment, sufficient reagents and consumables, reliable energy, suitable storage facilities for specimens, access to scientific publications and necessary research software. The management should also promote upkeep of equipment, staff development and linkages with authorised laboratories and research institutions. Adequate institutional assistance can minimise the time required to complete the study, increase the dependability of the laboratory results and enable students to perform projects with scientific relevance.
Examiners should evaluate students' knowledge of research, methodological skills, analytical thinking and capacity to justify conclusions. They should apply established assessment standards equally, ask clear and relevant questions and assess students on the scientific quality of their work and their knowledge of the research process. Examiners should also comment on shortcomings in technique, interpretation of data, scientific writing and clinical reasoning and provide constructive criticism to assist development. Their assessment should differentiate between real knowledge gaps and challenges due to examination anxiety, but preserving the academic standards required of Medical Laboratory Science graduates [13].
Research and ethics committees also help to improve the quality of undergraduate research by ensuring that applicable ethical and scientific requirements are met before investigations start. Research proposals involving human subjects, clinical specimens, personal health information, or experimental animals should be reviewed by the appropriate committees according to institutional rules and applicable regulations. They should guarantee that adequate ethical approval, informed consent when necessary, confidentiality, biosafety and responsible specimen management are provided. Adhering to these guidelines safeguards research subjects, encourages responsible scientific practice and increases the trustworthiness of the students' findings.

The successful project defence depends on a shared responsibility among all stakeholders. Students should show preparedness and integrity, supervisors need to give proper guidance, departments should establish effective training and assessment systems, institutional management has to provide sufficient resources, examiners must ensure fair evaluation and research and ethics committees are responsible for maintaining scientific and ethical standards. Such duties should be explicitly outlined in departmental research guidelines and disclosed to students before the initiation of their studies. This unified strategy will increase the quality of final year Clinical Chemistry projects, boost the research competency of students and contribute to the development of talented, ethical and scientifically competent Medical Laboratory Science workers [14].

Suggested Framework for Improving Project Defence

The issues of final year project defence in Clinical Chemistry in Medical Laboratory Science require an organised and methodical framework to handle. This framework should offer a clear sequence of actions that lead students from the first stages of preparing for research to the final inspection and implementation of corrections. It should also encourage competent supervision, scientific accuracy, academic integrity and continual improvement of student research.
The first stage is early preparation, and it should start before the students begin their research assignments. Departments should at this time give appropriate training in research methodology, topic selection, proposal formulation, examination of literature and ethical issues. Students should be guided to select researchable questions, write clear objectives, choose appropriate

designs and select realistic laboratory procedures. Ethical approval for data gathering should be acquired where appropriate. Students will achieve a firm grasp of their research duties and avoid problems that may arise during later phases through advance preparation.

The second step is supervised research in which students conduct their researches under the guidance of their project supervisors. This stage should include routine supervision meetings, laboratory training, specimen handling, implementation of quality-control measures, data gathering, and monitoring of research progress. Students should comprehend the scientific basis of their methodology and keep proper records of their study; this is a responsibility of the supervisor. Be prepared to recognise and solve any problems such as scarcity of reagents, equipment failure or problems with data collecting. Good supervision at this point will enhance the credibility of research findings and will prepare students to explain and justify their methodological decisions in defence.

The third stage is a pre-defence evaluation. This is an opportunity to address problems before the official exam. The students' dissertations should be verified for scientific accuracy, proper organization, quality of reference and consistency between research objectives, results, discussion and conclusions. Particular attention should be paid to the suitability of statistical approaches and to the interpretation of biochemical data. Departments should also hold mock oral defences, where students present their research and answer questions from supervisors and peers. Positive feedback from these exercises can help students build their confidence, communication skills and capacity to answer appropriately to examiners' queries.

The fourth stage is the formal examination and project defence. During this phase the examiners should evaluate the students' grasp of their research topics, knowledge of the respective biochemical principles, suitability of the methodology, interpretation of the results and capacity to defend their conclusions. The usage of a common marking rubric would ensure fairness, consistency and transparency in evaluation. Questions should test basic knowledge and critical thinking skills, and give students the opportunity to demonstrate independent knowledge of their research. The examiner should record what they saw, issue marks according to the agreed criteria and give clear advice for improvement.
Fifth stage is correction and quality enhancement. After the examination, the students must rectify all errors pointed out by the examiners within the time period provided by the institution. The necessary corrections shall be satisfactorily performed and verified by the supervisor or designated officers of the department, as per institutional requirements, before the project is finally approved. The department should also assess the examination procedure to uncover reoccurring difficulties such as deficiencies in statistical analysis, inadequate laboratory quality control, improper referencing or insufficient student understanding. These observations should inform improvements to research training, supervision and assessment for future cohorts of students.

The department should also review the effectiveness of the overall framework periodically using student comments, examiner reports, quality of projects, completion rates and repeated weaknesses reported during examinations. These measures might help to evaluate if the initiatives are enhancing students' research competence and the quality of project defences. If recurrent challenges are experienced, extra training, greater laboratory resources, changes in supervision, or adjustments in assessment methods may be required.[15]

Hence, the use of a structured system that includes early preparation, effective supervision, pre-defence assessment, formal examination and post-defence quality improvement can improve final year Clinical Chemistry project defence in Medical Laboratory Science. The framework should be viewed as a process of continual improvement and not a one-off examination process. Regular monitoring and collaboration among students, supervisors, departments, institutional management and examiners can make undergraduate research more rigorous, meaningful and effective in preparing future Medical Laboratory Science professionals for evidence-based laboratory practice.

Implications for Medical Laboratory Science Education

Final year project defences are not just for undergraduate assessment–they have repercussions beyond that Clinical Chemistry graduates are expected to practise in situations where accuracy, analytical reasoning, quality assurance and responsible interpretation of test results are paramount.

A good understanding of research methodology and the

concepts of quality in laboratories will enable students to properly assess novel diagnostic methods, appreciate their analytical limitations, analyse scientific literature and engage in quality improvement initiatives.

Training of graduates in research can also foster postgraduate education, collaborative research, professional development, and evidence-based laboratory practice.

The project defence, however, should not be seen as the only criterion of professional ability. It should be part of a comprehensive education program, including practical laboratory assessment, supervised clinical experience, professional ethics and continued skills development [16].

Conclusion.

Final-year Clinical Chemistry project defence is a vital educational exercise in Medical Laboratory Science, but its effectiveness may be compromised by poor research preparation, poor methodological understanding, poor laboratory resources, statistical challenges, poor interpretation of biochemical findings, poor supervision, examination anxiety and poor assessment practices.

These problems need coordinated answers not placing the full burden on the pupils. Departments should improve the teaching of research technique, provide supervisory assistance, arrange mock defences, provide suitable laboratory facilities, encourage scientific writing and use explicit assessment rubrics. Students, in turn, should be responsible for understanding the research, maintaining correct records, interpreting results cautiously, and displaying autonomous scientific reasoning.

More than just giving marks at the end of the day, the aim of project defence has to be. It should consider whether students can systematically research a scientific subject, critically analyse laboratory evidence, convey findings effectively and realise the limitations of their conclusions. The achievement of these objectives would enhance the quality of undergraduate research and contribute to the production of competent, ethical and scientifically informed Medical Laboratory Science practitioners.

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