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Clinical Internship Experience of Medical Technology Students: A Case Study

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Abstract

The disruption caused by COVID-19 pandemic changed the landscape of Medical Technology Clinical Internship Program. The 832-hour training period was reduced into cyclical duty. This extreme change in the conduct of clinical internship affecting laboratory competencies of students captured the interest of the researcher to conduct a study that explores the experiences of Medical Technology students during their clinical internship amid the pandemic. A case study design using semi-structured interviews involving two Medical Technology interns evolved seven themes. Findings suggest multiple factors affecting laboratory competencies. Positive factor is the close supervision of medical laboratory staff where they have shown great help to the interns from processing, examination, and reporting of laboratory test results. Negative factors which are the most notable findings of the study were: reduced training longevity caused by the pandemic restrictions imposed among training laboratories for safety purposes, laboratory head capacity which is in excess than what is required per floor area, and irregular number of specimens being processed in different laboratory sections within 24-hour shift. A return to standard hours of clinical internship, extension of duty to a maximum of 12-hour shift, and regulation of laboratory head capacity of the laboratory to prevent crowding are recommended.

Keywords: Medical Technology, Internship, COVID-19 Pandemic, Case Study

1. Introduction

Student internship programs offered by institutions of higher education are an academic component of learning, aiming to provide students with hands-on practical experience while increasing their employability prospects upon graduation (Bawica, 2021). According Prianto et al. (2017), participation in the internship programs had a stronger effect on the quality of life skills of graduates and was identified as the major factor influencing readiness to work.

However, the Coronavirus Disease 2019 (COVID-19) pandemic caused an unprecedented disruption in medical education and healthcare systems worldwide (Alsoufi et al., 2020). Internships for example at healthcare institutions in Singapore had to be canceled, as with health-related internships or clinical attachments elsewhere (Teng et al., 2021). Remarkably, Bugis (2020) reported that most public health organizations continued with on-site internships between March to May 2020 with “limited COVID-19 restrictions” enforced, citing reasons such as reduced workforce capacity, involvement of interns in COVID-19 related work, and how a virtual internship was not agreeable.

In the Philippines, there was an announcement on the gradual reopening of campuses of higher education institutions located under Modified General Community Quarantine (MGCQ) for conduct of limited face-to-face classes citing reason that there are instances that face-to-face delivery of certain courses is

necessary (Commission on Higher Education and Department of Health Joint Memorandum Circular No. 2021-001). Pursuant to the CHED-DOH JMC No. 2021-001 General Guidelines, Medical Technology clinical rotations had been restricted to a two "4/10-day cycle" each month, which means that interns will have four days of duty followed by ten days of quarantine, making it only eight duty days per month and cutting the twelve-month training period equivalent to one thousand six hundred sixty-four (1,664) hours down to five hundred seventy-six (576) hours (UST Purple Gazette, 2021).

This drastic change in the conduct of clinical internship faced by all Medical Technology interns across all higher education institutions in the country captured the interest of the researcher to conduct a study to explore the lived experiences of Medical Technology students during their clinical internship amid COVID-19 pandemic. Although many studies had been conducted on impacts of COVID-19 pandemic on competencies of Medical Technology students in the Philippines, these mostly explored distance learning or virtual clinical internships of students. No study to date has been conducted to understand the unique experiences of Medical Technology students in terms of their technical competencies during the limited face-to-face clinical internship in a cyclical student shifting. Given that the performance indicators under Section 7 of CHED Memorandum Order (CMO) No. 13 series of 2017 imply that Medical Technology interns should demonstrate technical competence and skills in analytical and critical thinking in the laboratory, it is imperative to understand the implications of the implemented cyclical duty. To that end, this case study attempted to explore the clinical internship experiences of Medical Technology students during the COVID-19 pandemic. Thus, the research question, “What were the clinical internship experiences of Medical Technology students during the COVID 19 Pandemic?” was formulated to fill this gap.

2. Methods

Research Design

This study employed a qualitative descriptive case study research design and naturalistic inquiry as the methodology. This design was used in this study to conduct an in-depth exploration of a phenomenon within some particular context, and it undertakes the exploration through variety of lenses in order to reveal multiple facets of the phenomenon (Rashid et al., 2021). Furthermore, the case study design studies one or more individuals in its natural setting with minimal interference from the researcher (Priya, 2021), hence exploring the clinical internship experiences of Medical Technology students during the COVID 19 pandemic fitted to this design as the study utilized two informants.

Informants

The informants were Medical Technology students who were male and female since a sex-informed perspective increases rigor, promotes discovery, and expands the relevance of a research (Edwards et al., 2018). The sampling technique used in this study was purposeful sampling. Informants were selected based on the following criteria: a Medical Technology student enrolled in the second semester of school year 2022-2023, of legal age, and had undergone face-to-face clinical internship at a CHED-accredited training laboratory in the first semester of school year 2022-2023.

Data Gathering Instrument

The research instrument used was a semi-structured and non-intrusive interview questionnaire which underwent validity review specifically through scrutinization of its content by a panel of experts in the field of education. Essentially, expert-judgment procedure was used as a way of assessing the content validity in addition to expert agreement and the precise determination of whether the instrument is valid

or not, and whether it actually measures what is required. Hence, in this study, the questionnaire was assessed in relation to all of the four aspects, namely: content, wording, number, and relevance of the items.

The contents of the interview questionnaire followed the framework lifted from the clinical laboratory areas in which interns were required to train to gain experience as stipulated in CMO 13 Series of 2017. The questionnaire was divided into two parts. Part one as opening question which asked the informants how is it to be a Medical Technology intern in the midst of the pandemic with one follow-up probing question. Part two was divided into nine areas serving as the framework of the interview arranged in the following sequence of laboratory sections: Hematology, Blood Banking, Clinical Microscopy, Parasitology, Phlebotomy, Bacteriology, Histopathology, Immunology and Serology, and Clinical Chemistry. Leading question for each area specifically asked how was the competency of the Medical Technology intern in a specific procedure. This was then followed through with a probing question to ask for more details on a particular answer and in order to clarify a point. This provided the informants with enough freedom on their responses, and offered rich, detailed, first-person accounts of experiences. Prompts were also prepared in case informants found it difficult to respond, and to offer them a range of routes. It was deemed fruitful to follow unexpected turns initiated by the informant's accounts rather than adhering lavishly to verbatim questions as in a standardized survey (Newcomer et al., 2015).

Data Collection Procedure

Data collection began by submitting a letter to the internship coordinator of the school's Medical Technology department to formally ask permission to conduct an interview with the students. After approval was received, two selected informants were given an informed consent form written in understandable language three days before the schedule of interview to give sufficient time to consider participation. The consent form included details of the nature and purpose of the research, the expected duration of the informant's participation, a statement that participation in research is voluntary, information ensuring data protection, confidentiality, privacy, including storage of personal data, the statement offering the subject the opportunity to withdraw at any time from the research without consequences, and the communication of the result of the study.

After the consents had been obtained, an in-person in-depth interview with the informants using the validated questionnaire was conducted. The interview schedule included two parts. Part one was the opening question which asked how was it to be a Medical Technology intern in the midst of pandemic which was followed by one probing question about the participant's answer. Part two was divided into nine areas with each area having a leading question that addressed competency of the informant in a particular laboratory procedure. This was then followed through by two probing questions asking more of what made the informant describe the competency as such and how did the informant deal with the situation. The interview took thirty minutes to one hour per informant. The electronically recorded interviews were transcribed verbatim and translated to English language by the researchers.

Data Analysis Procedure

Strategies employed to analyze data were Categorical Aggregation and Direct Interpretation by Robert Stake (1995). Categorical Aggregation was employed by clustering complex data into categories or classes using "Codes and Coding" technique to ease the search for meaning, while Direct Interpretation was employed in order for the researchers to reach new meanings about the case (Yazan, 2015).

First, reading and re-reading of the interview transcription where the significant responses from the reader, statements, sentences, or quotes were identified in the transcripts through open coding. Coding in its most

basic form is the simple operation of identifying segments of meaning in the data and labelling them with a code in order to turn raw qualitative data into a communicative and trustworthy "story" (Skjott Linneberg et al., 2019). In this study a word or short phrase was used to symbolically assign a summative salient attribute for a portion of data. Second was the identification of significant statements that pertained to the phenomenon and its extraction. Third was the formulation of meanings from the significant statements. Fourth was the formulation of meanings arranged into cluster themes which will evolve into emergent themes wherein as themes developed, verbatim statements by the informants taken from the transcript were listed under the appropriate category in an effort to link the heading with the data from which they emerged. Furthermore, the commonalities and differences in the answers of the informants were examined and attempts were made to identify themes that were unique to each individual and themes that represented the group as a whole. Fifth, integration of findings into an exhaustive description of the lived experiences of the informants. Lastly, the construction of a cohesive narrative which described the fundamental structure of the phenomenon. After analyzing the interviews, the researchers through an oral presentation of findings consulted experts who then provided feedback on the development of codes and supported the themes that emerged from the analysis of data.

Reliability

Specific actions were observed by the researcher to ensure the reliability of the study. Credible data drawn from existing online literature were utilized by the researcher to build the background of the study that yielded a firmly-established research foundation. Furthermore, the researcher consulted advisers and experts in the field for review of the reliability and validity of the research instrument. Additionally, to preserve the objectivity of the findings, biases in the interpretation of data were dismissed by the researcher.

Ethical Considerations

Prior to the start of data collection, approval from concerned academic authorities were obtained. The researcher purposefully secured informed consent from selected informants. The informed consent form explicitly addressed: the background of the study that focused on the competencies of Medical Technology interns amid the pandemic; the data collection protocol; the rights of the participants that specifically conveyed right to withdraw at any time and right to confidentiality through the study in compliance with Republic Act No. 10173; and the sole use of data for academic and research purposes. Informants' identity was protected by assigning each with a pseudonym.

3. Results and Discussion

The interview generated a total of six single-spaced pages of data on the lived experiences of the two Medical Technology interns. Data were analyzed by the researcher and 13 themes emerged. Upon further analysis and feedback from the external auditor who used to ensure rigor, six themes emerged as most salient to the lived experiences of the two informants. These were: (1) Repertoire of laboratory competency of interns, (2) Performance consultation and validation, (3) Repertoire of self-directed skills enhancement techniques, (4) Training longevity, (5) Laboratory head capacity, and (6) Specimen adequacy for hands-on training.

- **Repertoire of Laboratory Competency of Interns**

In line with the question of how is the competency in the routine procedure in each of the sections of the laboratory, the informants responded that they have performed almost all the procedures correctly. Jennie discussed specific routine procedures she and her groupmates accomplished saying: "We have tried

performing the procedure in Histopathology from fixation to staining. We have tried performing all the processes. My readings were all correct. In Blood Banking all my readings were correct". The said affirmation of performing most laboratory procedures in all areas in the laboratory during training was also confirmed by Andrew saying: "I mastered the procedures already. I have no difficulty whatsoever because the procedure is very easy. I think my competency in Histopathology is already excellent". These findings agree with Zabala et al. (2023) that emphasized experiential learning as a practical approach to academic achievement and scientific process skills of students.

However, it should be noted that there are areas in the laboratory that one of the informants failed to show full competence. Jennie explained specific routine procedures that she personally admitted to have lacked competence in her performance saying: "If I will rate my competency in culture and sensitivity testing from 1 to 10, it would only be around 7.5, because I have not been really exposed very often in culture and sensitivity testing. The machine that I only know how to operate is the Minividas. As for the Cobas machine, I am not quite competent. Also, I never tried performing bleeding of donor". This finding coincides with Singaram et al. (2022) highlighting limited knowledge and experience as a subtheme of personal challenges of interns.

- **Performance Consultation and Validation**

Nyabeta (2019) underscored that mentorship during training should be embraced because it will aid students in comprehending their role after completing the training, understanding the role of other core groups in both the laboratory and in the hospital, and realizing their future career paths. In this aspect, the informants confirmed that they received trainings from the laboratory staff. The constant interaction of both informants with their laboratory staff was quite evident in the informants' narratives. Andrew smilingly shared how the laboratory staff are helping them during their training saying: "We can perform the procedures because the staff here are teaching us. And if we have questions or concerns on how to run the test or steps in the procedures, they explain to us how we are going to handle those problems and procedures". He also shared that the Medical Technology staff are always available and entertained questions from all interns in the training laboratory saying: "I usually ask the MedTech in-charge. If I am curious about a specific part that I do not understand, I explain it to the Medical Technologist".

Jennie also expressed the same experience with their laboratory staff saying: "I asked guidance from Medical Technology staff because most of the tests are ran in Cobas machine. Also, there was a time that there was no immediate reaction, I then asked the Medical Technology staff and he told me to just add more to the washed red blood cells to remedy the situation". This consultation and validation done by staff on intern's performance helped confirm the accuracy of the reading as expressed by Andrew saying: "I also ask other staff what are the techniques to do if the stool has contents or none".

It is clear that both informants gained valuable understanding of the laboratory procedures in goal of enhancing their skills and confidence in performing laboratory tests, and that Medical Technology staff played a very important role in this aspect of training. This is contrary to the findings of Sua (2022) that highlighted lack of staff to guide the training as a serious challenge to the study participants.

- **Repertoire of Self-directed Skills Enhancement Techniques**

Self-directed learning is an active learning approach in which the students bear responsibility for their learning outcomes (Bhandari et al., 2020). Interns should not solely rely on what Medical Technology staff will offer to assist the training course. There is a need to personally prepare in order to lessen the difficulty faced during the actual hands-on training. Andrew discussed how he did his self-directed skills enhancement techniques in the case of White Blood Cell Differential Counting which is a procedure under

Hematology section saying: "I already studied before about the morphology of white blood cells so it will be easier for me to identify and to differentiate other white blood cells. My preparation is more theoretical but it is just the same, because I compare it with the prepared blood smear in the laboratory. In preparation, I also watched videos on the internet because they are accessible. Example, I search for white blood cell morphology and I will look at them. And today, there are virtual laboratories that have slides. These are smears that are prepared to test you. It is like a quiz and I assess myself there".

Andrew also explained how the preparation helped him in fecalysis which is a procedure under Parasitology section saying: "It is more like a correlation. It can help. For example, in the physical examination, you can already assess through the color and consistency of the stool if the stool has contents or none". He also discussed that he practices his microscopy skill during shifts where there is nothing much to do by pulling samples from the section and have his readings checked by the Medical Technology staff on duty saying: "If I have spare time and if there is an available sample, I ask permission from the Medical Technologist on duty if I can read it. Then, I let them check if my reading was correct". Furthermore, Andrew explained that in instances where informants were not able to perform microscopy examinations during morning and afternoon shifts, nights shifts are utilized in compensating for missed trainings using specimens that were not yet disposed from the section saying: "So we just read during night shift. We make up for what we missed. If there is no sample, we read the previous samples".

These findings agree with Singaram et al. (2022) who highlighted that self-determination, motivation, positive learning behaviors are self-directed learning enablers and online learning platforms facilitate learning needs and goals.

- **Longevity of Training**

The internship year facilitates the translation of theorical knowledge into practical skills, which in due course may optimize students' clinical competence (Albloushi, 2023). Clinical educators emphasized that there was a decline in the quality of clinical education students were receiving during the COVID-19 pandemic. Three clinical educators in the study highlighted that this was due to the reduced time in a clinical rotation (Phillips et al., 2022). This problem on limited duration for training was also the concern of the informants in the current study that affected one of the informant's level of competencies in every section of the laboratory.

Jennie discussed how it affected her training in Bacteriology section when a follow-up question was asked of what makes her not confident with her competency training in Bacterial Culture and Sensitivity Testing saying: "The time for every rotation is just six days. It is short. Like on the fourth or fifth day you have mastered the procedure already. You are already attached to the procedure and then you cannot continue it anymore. The first time I performed streaking, I was reprimanded by the Medical Technology staff because my streaking was not good. There was really lack of time".

- **Laboratory Head Capacity**

COVID-19 pandemic caused a number of changes in traditional internship programming in hospitals (Balay-odao et al., 2023). In the study of Phillips et al. (2022), it was revealed by one participant that their clinical site limited student admission by 75%. Other participant stated that before the pandemic, their clinical site accepted three students. However, following the onset of COVID-19 pandemic, it was reduced to one student. One participant indicated a rise in requests to take students which is likely a consequence of the diminished number of clinical sites open to accept students during the COVID-19 pandemic resulting to reassignment of students to sites capable of continuing their training.

In the Philippines, this reduction resulted to excessive number of interns in other accepting training laboratories. This was highlighted as one of the factors affecting the informants' training when the informants gave further justification of their experience in the course of enhancing their individual competencies.

Andrew shared the scenario in the laboratory saying: "It is just that we are too many and there is quite a lot of samples to be run". This problem in overcrowding was also the experience of Jennie saying: "There are 6 of us in the Bacteriology section". Further, Andrew described how it affected their training with a slight grin showing a look of disappointment saying: "I think it is experience in reading the specimen. Because that is what is lacking from us. For example, I was assigned before in Clinical Microscopy and there were seven of us assigned in the section. So, it was seldom that we can read the samples". Jennie, on the other hand, in her personal perspective based on what she observed and experienced, explained how full performance of all laboratory procedures be achieved given the ideal number of interns while comparing it to the real situation during her rotation in Clinical Bacteriology section saying: "If it is just me in the section, I can really perform all the procedures. However, we are three from our school and there are also other three from other schools. So, there are six of us and we have to divide the samples".

- **Specimen Adequacy for Hands-on Training**

The quality of teaching and learning experience is determined by the extent of the adequacy of laboratory facilities and that a laboratory is a hallmark feature in science teaching and learning (Pareek, 2023). In the clinical laboratory, number of specimens play a very significant role in honing the skills of an intern. Enough number of specimens will allow more chances of interns to practice and improve their skills in laboratory examination. Andrew affirmed that a higher number of specimens leads to a productive training when asked about how efficient is the training based on samples processed in the laboratory saying: "There are many samples in Clinical Chemistry. Even though we are on a night shift, there are still many samples coming in. They are mostly in-patients so you are more trained". On the other hand, lack of specimens received by the laboratory reduces intern's competency as described by Jennie saying: "We experienced that there are two days straight or three days straight that we did not have samples for bacterial culture".

Conclusion

The current investigation on the clinical internship experiences of Medical Technology students exclusively focuses on the Medical Technology Clinical Internship Program during the COVID-19 pandemic. It helps to understand the situation of interns and how they underwent skills enhancement to achieve competency in the different laboratory procedures. The findings of the study highlight multiple factors affecting interns' laboratory competencies which are both positive and negative. Positive factor is the full supervision of medical laboratory staff on processing, examination, and reporting of laboratory results. Negative factors, on the other hand, are the most notable findings of this study. These were the reduced training longevity due to COVID-19 pandemic restrictions imposed among training laboratories for safety purposes, laboratory head capacity exceeding the required number based on floor area, and adequacy of specimens which is found to be irregular in different sections and within a 24-hour shift.

Recommendations

Based on the findings of the study, the researcher recommends the following:

- Internship program should revert back to the regular number of clinical internship hours to maximize opportunity for interns' skills enhancement;

- Training laboratories should consider allowing affiliating higher education institutions to have their interns serve a maximum of 12-hour duty for students to have a chance of receiving adequate samples in the morning and during afternoon shifts, thereby minimizing problem on inadequacy of samples and increasing interns' opportunity for hands-on training; and
- Training laboratories should set standard head capacity per laboratory section as per floor area capacity in order to avoid crowding inside a section and so as not to hamper opportunities of interns to perform all the laboratory procedures at their maximum potential, particularly in special areas of the laboratory.

4. References

1. Bawica, I.M. (2021). The Effects of Internship Program on the Employability Readiness. International Journal of Academe and Industry Research, 2(3), 86-101.
2. Prianto, A., Asmuni, F., Maisaroh, S. (2017). The Effect of Academic Performance and Involvement in the Internship Program Toward Life Skills and Work Readiness of University Graduates in East Java Indonesia. International Journal of Business and Management Invention, 6(8), 41-55.
3. Alsoufi, A., Alsuyihili, A., Elhadi, A., Atiyah, H., Ashini, A., Ashwieb, A., Ghula, M., Hasan, H.B., Abudabuos, S., Alameen, H., Abokhdhir, T., Anaiba, M., Elhadi, M. (2020). PLOS ONE, 15(11), 1-20.
4. Teng, C.W.C., Lim, R.B.T., Chow, D.W.S., Narayanasamy, S., Liow, C.H., Lee, J.J. (2021). Internships Before and During COVID-19: Experiences and Perceptions of Undergraduate Interns and Supervisors. Emerald Publishing Limited, 12(3), 459-474.
5. Bugis, B.A. (2020). COVID-19 and Internship Opportunities at Health Organizations in Saudi Arabia. The Open Public Health Journal, 13, 779-782.
6. Commission on Higher Education and Department of Health (2020). Amendment of Article IV-B of CHED-DOH JMC No. 2021-001 Entitled "Guideline on the Gradual Reopening of Campuses of Higher Education Institutions for Limited Face-to-Face Classes During the COVID 19 Pandemic [Memorandum]. Commission on Higher Education and Department of Health, Joint Memorandum Circular No. 2021-002.
7. UST Purple Gazette [@UST Purple Gazette]. (2021, March 17). Enroll or LOA: FoP to Pursue Plans on Limited Face-to-Face for Upcoming Medtech Interns [Post].
8. Commission on Higher Education. (2017). Policies, Standards and Guidelines for the Bachelor of Science in Medical Technology/Medical Laboratory Science (BSMT/MLS) Program [Memorandum]. Commission on Higher Education, No. 13, Series of 2017.
9. Rashid, Y., Rashid, A., Warraich, M.A., Sabir, S.S., Waseem, A. (2019). Case Study Method: A Step-by-Step Guide for Business Researchers. International Journal of Qualitative Methods, 18, 1-3.
10. Priya, A. (2020). Case Study Methodology of Qualitative Research: Key Attributes and Navigating the Conundrums in its Application. Sociological Bulletin, 70(1), 94-110.
11. Rich-Ewards, J.W., Kaiser, U.B., Chen, G.L., Manson, JE., Goldstein, J.M. (2018). Sex and Gender Differences Research Design for Basic, Clinical, and Population Studies: Essentials for Investigators. Endocrine Reviews, 39(4), 424-439.
12. Newcomer, K.E., Hatry, H.P., Wholey, J.S. (2015). Handbook of Practical Program Evaluation.
13. Yazan, B. (2015). Three Approaches to Case Study Methods in Education: Yin, Merriam, and Stake. The Qualitative Report, 20(2), 134-152.

14. Skjott Linneberg, M. Korsgaard, S. (2019). Coding Qualitative Data: A Synthesis Guiding the Novice. Qualitative Research Journal., 19(3), 259-270.
15. Zabala, G.M., Dayaganon, A.J. (2023). Competency of Teachers and Laboratory Environment in an Online Setting as Predictors of Science Process Skills of Students: A Convergent Design. Science Education International, 34(3), 202-215.
16. Singaram, V.S., Naidoo, K., Ramrathan, L. (2022). Medical Internship Training During the COVID-19 Pandemic – A Case of 'Sacrificial Pawns' or Not? African Journal of Primary Health Care & Family Medicine, 14(1), 1-8.
17. Nyabeta, R.K. (2019). Undergraduate Medical Laboratory Training in Kenya: A Personal View. Elixir Educational Technology, 126(2019), 52495-52497.
18. Sua, J. (2022). The Effectiveness of Medical Laboratory Trainees' Internship Programs in Improving Technologists' Competence and Operational Strategy for the Healthcare Sector in Kenya. International Journal of Innovative Science and Research Technology, 7(7), 1881-1885.
19. Bhandari, B., Chopra, D., Singh, K. (2020). Self-Directed Learning: Assessment of Students' Abilities and Their Perspective. Advances in Physiology Education, 44(3), 383-386.
20. Singaram, V.S., Naidoo, K.L., Singh, S. (2022). Self-Directed Learning During the COVID-19 Pandemic: Perspectives of South African Final-Year Health Professions Students. Advances in Medical Education and Practice, 13, 1-10.
21. Albloushi, M., Innab, A., Almarwani, A.M., Alqahtani, N., Anazi, M., Roco, I., Alzahrani, N.S. (2023). The Influence of Internship Year on Nursing Students' Perceived Clinical Competence: A Multi-Site Study. SAGE Open, 13(3), 1-10.
22. Balay-odao, E.M., Cruz, J.P., Alsolais, A.M., Bajet, J.B., Alquwez, N., Almansour, A.M., Alotaibi, K.A., Mesde, J., Almoghairi, A., Alrasheadi, B.A., Alotaibi, J.S. (2023). Saudi Nurse Interns' Experiences During the COVID-19 Pandemic: A Thematic Approach. Healthcare, 11(2), 1-11.
23. Phillips, H.L., Latchem, S. R., Crutcher, T., Catalano, T.A., Jator, E.K. (2022). The Impact of COVID-19 on the Laboratory Professionals' Clinical Education: A Qualitative Study. Laboratory Medicine, 54(2), e58-e62.
24. Pareek, R.B. (2023). An Assessment of Availability and Utilization of Laboratory Facilities for Teaching Science at Secondary Level. Science Education International, 30(1), 75-81.