International Journal of Arts, Sciences and Education
Volume 2 Issue 1 | December 2021

ISSN: 2799 - 1091
Page No. 174-198

Virtual Clinical Internship Competencies of Medical Technology Students

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ABSTRACT—Clinical internship is required during the fourth year of the Medical Technology (MT) degree program. This was adapted to a virtual setting amidst the COVID-19 pandemic. Due to the newly implemented strategy, it is important to determine whether the competencies required of the interns at the end of the program were attained. The research employed a descriptive, cross-sectional design conducted through online surveys with a sample of 98 fourth-year MT interns recruited through purposive homogeneous sampling. The survey contained 5-point Likert scales concerning their perception of their developed competencies, divided into 4 domains, based on learning outcomes, performance indicators, and objectives of the MT degree program and its internship. The Clinical Internship grade was also collected. Using IBM SPSS, the average was calculated for each domain per respondent as direct scores and the percentages, mean, standard deviation, and Spearman correlation coefficient were also computed. Results showed that the interns agree to the moderate extent that they attained the expected competencies after the virtual clinical internship and majority obtained a Clinical Internship grade higher than 2.00. Only Domain 2 ("the development of their well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities") was correlated with the grade of the respondents. These suggest that the virtual clinical internship was effective in the attainment of expected competencies of MT interns to a moderate extent, implying that the program implementation can still be improved to achieve a higher degree of attainment.

Keywords—medical technology, clinical internship, virtual learning, perceptions, competency development

I. INTRODUCTION

A. Background of the Study

Bachelor of Science in Medical Technology is a health science program that aims to develop competent medical technologists to fulfill the demand for healthcare workers particularly in performing various laboratory tests by utilizing innovative technologies (Valdez et al., 2012). It is an outcome-based education consisting of professional courses intended to be applied by the students before and after leaving their respective institutions. Most courses are a prerequisite of a higher-level subject taken by the student as they move up to another year level. As for the professional subjects, these include Hematology, Clinical Chemistry, Microbiology, Parasitology, Blood Banking/ Immunohematology, Serology/Immunology, Clinical Microscopy, Histopathology & Cytology, Laboratory Management, and Medical Technology Laws and Bioethics (Commission on Higher Education [CHED], 2017).

In the fourth year of B.S. Medical Technology, a 12-month clinical internship training program is conducted as stipulated in the curriculum provided by the CHED Memorandum Order (CMO) No. 13 implemented last 2017, known as the "Policies, Standards, and Guidelines for Bachelor of Science in Medical Technology/Medical Laboratory Science (BSMT/MLS) Program." Students participating in the training program will have the opportunity to experience working in the different sections of a clinical laboratory.

Due to the role of medical technologists in providing reliable results for patient diagnosis, students of this course must be carefully evaluated. Competence in Medical Technology requires scientific knowledge, skills in critical thinking, problem-solving, and situation analysis in a clinical laboratory setting. In

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particular, the CMO No. 13 s. 2017 lists four specific objectives which details competencies that the interns are expected to develop by the end of the course. These are namely, "the enhancement of their knowledge, skills, and attitudes needed for a member of the healthcare delivery team who with precision and accuracy performs the clinical laboratory procedures needed to help the physician in the proper diagnosis, prevention, and treatment of diseases; the development of their well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities; the development of their critical thinking skills that will enable them to participate in research endeavors/activities and respond to challenges of the profession; and their development as human and competent medical technologists who are committed to serving the health needs of patients in both local and international communities." Additionally, the performance indicators under Section 7 of CMO No. 13 s. 2017 implies that medical technology interns should demonstrate technical competencies; skills in analytical and critical thinking, leadership, and research; ethical practice; participation in community-oriented activities; engagement in improving the healthcare management system and lifelong learning activities; and the effectiveness in teaching and communication skills in the laboratory.

However, due to the COVID-19 pandemic and national quarantine restrictions preventing the conduct of face-to-face school activities, the Medical Technology Clinical Internship program has shifted to a virtual setting which employs distance learning strategies. Distance learning is an alternative form of education utilizing online and digital platforms as a mode of instruction in lieu of in-person and hands-on lessons. Instead of the traditional practical training in the clinical laboratory setting, interns were provided and tasked with simulations and online activities to compensate.

Distance learning is not a new concept as its earliest form can be traced back to the use of the postal service in 1840. The use of communication technology, such as radio and television, has also played a pivotal role in distance learning. Furthermore, the introduction of computers and the Internet have revolutionized distance learning as it paved the way for online-based learning (Florida National University, 2019). Online learning is a form of distance learning wherein instruction is delivered through digital devices to support learning (Mayer, 2018). It continues to exist up until the present time, and as a result, different online platforms for education, such as BlackBoard, were developed. Due to the continuous utilization of online learning, distance learning has been implemented in various educational institutions worldwide, particularly in higher education, which can be synchronous or asynchronous learning. Another integral part of online learning is the use of virtual learning environments, which according to Trafford and Shirota (2011), is a collection of software tools used for academic purposes that utilize the World Wide Web.

Distance learning may offer multiple advantages such as increased access to learning and training opportunities, improved cost-effectiveness of educational resources, flexibility in schedule, and utilization of web-based learning environments such as virtual workspaces, especially for internship students, that increase technological proficiency of both students and instructors. Despite the increased use of this learning method, traditional learning still plays an important role in the growth of the student, particularly for those who will undergo an internship or fieldwork. Hands-on experience that is provided by traditional learning helps learners to cultivate critical thinking, as well as sharpen skills that are essential in the workforce (Xia et al., 2019).

Distance learning as a supplemental learning device to face-to-face classes can help increase the examination scores of students. Olivier (2016) discerned in his study that students were able to perform better in their examinations after attending an online discussion forum than students who did not attend. In the online discussion forum, students were able to give and discuss their ideas with one another and their professors. This enabled them to confirm or correct their understanding of concepts further through extending the discussion. In the same study, it was also seen that there was no significant difference in examination scores between students who attended a face-to-face exam preparation session to those who did not attend. This implies that online discussion forums may be a better avenue for distance learning. But some factors may have affected the result of this study such as a low percentage of students attending the

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face-to-face sessions, or the unavailability of internet access to students from rural areas. This reflects the uncertainty of the actual impact of distance learning as a supplemental learning device universally.

Regarding distance learning as a method of learning by itself, a study (Nogueira Gossenheimer et al., 2017) compared the impact of complete distance learning and traditional face-to-face learning in a pharmaceutical care course. Of the two groups that were observed, the one that utilized distance learning through virtual, asynchronous recorded lectures performed better than the other group. The implication is that distance learning using virtual modules is a satisfactory mode of delivery in a pharmaceutical care course. This can be evidence that the success of virtual distance learning can be translated to skill-based medicine-related courses although the study did mention that the success may be related to the fact that students were required to participate greatly throughout the semester. Another study similar to this (Klibanov et al., 2018) presented the opposite results, with this study utilizing interactive videoconferencing. The students of the face-to-face campus performed better than those from the distant campus. This implies that the impact of distance learning for students is generally different depending on the implemented mode of delivery and instructions.

Within the current situation, a recent study from the Adelson School of Medicine in Ariel University (Sandhaus et al., 2020) observed that medical students perceive remote online learning as satisfactory although their conclusions are based on the implementation of remote online learning. The study did mention that it was limited in scope but the changes in the form of medical education imposed by the pandemic may indicate future changes to medical education regardless of the pandemic.

In general, evidence has shown that current forms of distance learning yield positive results, but there is still a difference in their implementations and methods. This, and the many factors affecting students' access to distance learning, complicates studies determining its universal impact.

With the application of distance learning, the Virtual Clinical Internship program was developed. As this is a strategy new to the implementation of the internship program, it is therefore important to determine whether or not the competencies required of the Medical Technology interns by the end of the program are being attained.

The purpose of this study was to determine the effectiveness of virtual clinical internships in the attainment of the Medical Technology Clinical Internship competencies based on CMO No. 13 s. 2017 Objectives, by obtaining the perceptions of the fourth-year medical technology interns at a university in Manila. The subpoints under the first objective of the study were obtained from the said CMO verbatim.

B. *Objectives of the Study*

This study specifically aimed to:

1) Determine the perception of the medical technology interns on:
    a) The enhancement of their knowledge, skills, and attitudes needed for a member of the healthcare delivery team who with precision and accuracy performs the clinical laboratory procedures needed to help the physician in the proper diagnosis, prevention, and treatment of diseases;
    b) The development of their well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities;
    c) The development of their critical thinking skills that will enable them to participate in research endeavors/activities and respond to challenges of the profession;
    d) Their development as human and competent medical technologists who are committed to serving the health needs of patients in both local and international communities.

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2) Correlate and determine the magnitude of association between the students' Clinical Internship 1 grades and their perceived attainment of the Medical Technology competencies.

C. *Scope and Limitations of the Study*

The study aimed to investigate the attainment of clinical internship competencies of students in their fourth year of Medical Technology education at a university in Manila as they underwent virtual learning for the fulfillment of the objectives of the Medical Technology Internship Program (MTIP) as ordered by the CHED. Only students enrolled in the first term (first six months of the program) of the clinical internship program (Clinical Internship 1) for the academic year 2020-2021 were surveyed. The clinical internship course was the primary basis of the evaluation, disregarding the other professional and non-professional courses included in the curriculum of the fourth-year medical technology students. Sections of the laboratory wherein the interns rotated during the program include Bacteriology, Blood Banking, Clinical Chemistry, Clinical Microscopy, Hematology, Histopathology & Cytology, Molecular Biology, and Diagnostics, Parasitology, and Serology and Immunology. Because the viability and effectiveness of virtual clinical internships in the attainment of these competencies were the focus of this research, previous traditional or on-site learning strategies were not examined.

D. *Significance of the Study*

The results of the study are beneficial to the community considering that education plays an important role in the growth and progress of every aspect of society, particularly in the healthcare field. The demand for high-quality medical care justifies the need for ensuring the competence of future health care providers. The study could be of importance to the following:

The CHED. Being the government institution tasked with designing the Medical Technology curriculum, including the Clinical Internship Program, this paper can serve as a reliable source of information in assessing educational policies in place, specifically during distance learning. Results showed the effectiveness of the modified Clinical Internship Program based on the first-hand experiences and evaluation of virtual internship graduates. This allows the Commission to make the necessary revisions to improve the program and curriculum accordingly, in the event that distance and virtual learning continue for the following years.

Medical Technology Schools. The outcome of the study helps academic administrators in identifying the needs of medical technology students who are currently taking their final year of Medical Technology education online. This allows them to assess the quality of learning and skills-based training that their students are receiving. In addition, inadequacies in the existing system of remote education and intern concerns can respectively be amended and addressed.

College Professors. As prime movers in facilitating learning, the results of the study may help them come up with more effective strategies and approaches to provide students with the same level of theoretical and practical instruction, regardless of the mode of delivery. Furthermore, the information presented may prompt them to better realize the significance of their role in preparing the students for their practice as future healthcare providers.

Future Medical Technology Interns. The findings of this paper address the concerns of current virtual medical technology interns and initiate changes in the internship program for the benefit of future fourth-year medical technology students.

Future Researchers. The ideas presented in this study may serve as reference material in conducting new research or in establishing the validity of existing knowledge and other related findings. This study can also be used as a basis for further studies on the attainment of student’s competencies based on their perceptions.

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II. LITERATURE

A. *Medical Technology Education in the Philippine Setting*

Medical technologists, also known as clinical laboratory scientists, are professionals who perform a wide range of tests in the laboratory, paving the way for physicians to determine the health status of their patients. In addition, they aid in developing and evaluating new test procedures, conducting quality control, educating other laboratory professionals, and overseeing the work within the laboratory. According to the Philippine Medical Technology Act of 1969 (n.d.), prior to being a medical technologist and being able to fulfill the responsibilities mentioned, one must be able to earn a bachelor's degree in Medical Technology.

The BSMT is a four-year program comprising general education and professional courses, as well as a one-year clinical internship. The attainment of the degree varies from one country to another. In the study conducted by Valdez (2012), some qualities of the existing Medical Technology program in the Philippines were highlighted. These qualities include, firstly, the straight four-year program of BSMT—which indicates that there is no certificate or diploma awarded in the first two years. The second one is the congestion of semestral units owing to the general education courses that need to be taken at the tertiary level. Some courses already taken during basic and secondary education are still further discussed in college. Another quality is the clinical internship that takes one year with more than 1000 contact hours in affiliating hospitals, while review courses are not integrated into the training program. The internship includes rotational duties in different sections of a laboratory. Lastly, after completion of the program, graduates may apply for the licensure examination given by the Professional Regulation Commission (PRC) administered twice a year during March and September.

Moreover, the Medical Technology program has undergone drastic changes in the last decades, and scientific as well as technological advancement will give rise to further modification. Hence, being able to adapt to a rapidly evolving environment and having the disposition to continuously update knowledge, as well as skills, seem to be the most important factors in producing competent medical professionals (Mocarelli, 1994).

1) *Clinical Internship Program*

a) *The Six-Month Internship Training Program*

The clinical internship for fourth-year medical technology students was previously six months long in compliance with CMO No. 14 s. 2006. Under the memorandum, the required total number of exposure hours in the laboratory is 1,786; which is subdivided into Research (54 hours) and seven sections of the clinical laboratory: Clinical Chemistry (392 hours), Clinical Microscopy and Parasitology (338 hours), Microbiology (258 hours), Hematology (228 hours), Blood Banking (204 hours), Histopathologic Technique and Cytology (208 hours), and Immunology and Serology (104 hours). However, with the primary goal of improving the quality of Medical Technology education and satisfying the needs of future medical technologists; the policies, standards, and guidelines constantly adapt to changes.

b) *The One-Year Internship Training Program*

The clinical practicum is taken for a year with several contact hours in the hospital clinical laboratory without review courses (Valdez, 2012). According to the CMO No. 13 s. 2017, the contact hours are subdivided into nine sections: Clinical Chemistry (300 hours), Analysis of Urine & Body Fluids & Parasitology (200 hours), Microbiology (250 hours), Hematology (300 hours), Blood Banking (200 hours), Histopathologic Technique & Cytology (100 hours), Immunology & Serology (220 hours), Laboratory Management (40 hours), and Phlebotomy (54 hours), which totals to a number of 1664 hours. For every week, the intern should be able to render 32 internship duty hours. They should not be assigned to a 24-hour duty and they must be given two days off with one day allotted for the Medical Assessment Program and Seminar in the respective institutions.

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2) Course Plan of Medical Technology Interns

Curriculum development and instructional management serve as effective tools for meeting the present and future needs of local and national communities (Valdez, 2010). The objective of the training period of medical technology interns is to combine both theoretical and practical knowledge, to refine their skills before they graduate. Furthermore, the approach of having an internship before graduation is highly regarded by healthcare employers.

There are different formats of curricula for Medical Technology, but they all have the same requirements, a baccalaureate degree, and practical training. The 2+2 program is divided into two courses, pre-professional and professional courses. Pre-professional courses, also known as general education, are taken up in their first two years whilst practical training, professional lectures, and clinical laboratory experience will be taken up in their last two years. The 4+1 program requires a baccalaureate degree with an additional year solely for lectures and practical experience. Lastly, the 3+1 program which is implemented in the Philippines offers three years of theoretical learning and practical training with the last year spent in an affiliated hospital for their laboratory experience (Bashawri et al., 2002).

Though the curriculum for the graduating batch of 2020-2021 was not changed, their course plan has been modified to virtual learning. The modified course plan is composed of the following: (1) scope of training, (2) the training plan, and (3) assessments. The training plan includes the intended learning outcome, general topic, specific topic, intern's activities, and the time frame. It also includes a training module that contains the learning material scheduled for a certain day, which is deployed either through Blackboard or Google Meet. The assessments, on the other hand, are broken down into two categories: class standing—which is subcategorized to the intern activities—and the comprehensive examination. The purpose of these components is to create an alternative laboratory experience the interns should have attained in their affiliated hospitals in a normal setting and to establish their competencies before leaving the institution.

B. Competencies of Medical Technology Interns

Competence is defined as a necessary attribute of professionals. It is characterized by knowledge, skill, and acumen in one's field of practice (Valdez, 2010). With the continuous development and increasing global competition in the healthcare field in recent years, medical education has placed greater emphasis on competence-based learning. Competence is developed through education and training in both theoretical and practical aspects. As such, the method by which competence-based education is administered has been studied to evaluate its significance on the outcome. Finally, as it cannot be directly measured, learning objectives are set and performance indicators are used to evaluate the student's overall competence.

1) Competency-based Medical and Health Education in the International Setting

In a study by Trujillo Maza et al. (2016), blended learning (bLearning) supported by digital technology in competence-based medical education (CBME) was evaluated for its effectiveness in helping medical students achieve target competencies. First, key documents, namely the course program, final papers, and students' reflections, were examined. Second, semi-structured interviews were conducted with two students, two teaching assistants, and two instructors. Meanwhile, focus groups were done with three teaching assistants and two groups of four students. Third, an online survey was deployed to complement the collected data. The main points analyzed in the program evaluation were the methodology, modality, assessments, competencies, instructor's role, and student's role.

Results showed that Learning facilitated the transformation of the course design and promoted flexibility and autonomy in students' learning process. Using a PBL-OP (Problem-Based Learning Organized by Projects) approach, the students developed target CBME core skills such as "cognitive, technical, integrative, contextual, relational, affective and moral competencies. Surveys also displayed that most students believe they have acquired the skills listed in their course syllabus (Trujillo Maza et al.,

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2016). Self-regulated learning and digital or technological self-efficacy are the themes found (Talosa, Javier, & Dirain, 2021) as a learning opportunity with the current learning modality.

The study's evaluation of bLearning, which employed digital technology modes of teaching, is relevant to the present study which focuses on distance and virtual learning as a viable means of competence-based education. Furthermore, the use of specific indicators based on expected learning outcomes stated in the syllabus to gauge the students' overall competence, is similar to how the current research intends to reference the Objectives of the Medical Technology Internship Program and Performance Indicators of the BSMT program indicated in CMO No. 13 s. 2017, as well as the CILOs for the MTIP, in creating its questionnaires. Finally, the proposed respondents and method of data collection in the present study are comparable to the one employed by Trujillo Maza et al. (2016).

In another study by Scalese et al. (2008), indicators for competency evaluation were based on four levels, namely, knowledge, applied knowledge, performance, and action. Additionally, the method of instruction assessed was simulation technology in medical education, similar to the present study's evaluation of the virtual clinical internship. Results showed that using simulation for testing purposes generally offered a high degree of reliability and consistency among students unlike the variability inherent in physical clinical encounters.

2) Competencies of Medical Technology Internship Students in the Philippine Setting

Research conducted by Valdez (2010) provided a framework for the evaluation of the competencies of career-entry medical technology graduates which will serve as a basis for the enhancement of the clinical internship program. The model standard competencies were categorized into professional responsibility; professional laboratory skills and safe work practices; critical thinking, problem-solving, and decision making; communication, teamwork, and interactive skills; instrumentation and computer skills; leadership and management; and training responsibilities. The survey results revealed that professional laboratory skills and safe work practices were the most demonstrated competency by the graduates, followed by professional responsibility, leadership, and management. It was speculated that the aforementioned top three competencies were most demonstrated by the graduates due to what they have learned during the clinical internship orientation regarding their professional responsibilities and possible liabilities both to the medical technologist (revocation of license, legal issues) and the patient if errors are committed in the conduct of their profession. It was then concluded that with the attainment of all competencies indicated by the standards model, there is a need to improve the internship training program to achieve these competencies to the fullest extent through constant mentoring, implementation, and evaluation, and monitoring of the program and interns with basis on the model standard competencies developed by the researcher as a recommendation.

a) CHED Objectives of the Medical Technology Internship Program

A study conducted by Valdez et al. (2012) evaluated the degree of attainment of the six-month Medical Technology internship program objectives according to CMO No. 14 s. 2006 by surveying the graduates of the internship program and the chief medical technologists (CMT) tasked with supervising them during the duration of the program. Results from the survey revealed that the objectives of the program were attained to a moderate extent according to both the graduates and the CMTs. Certain objectives such as the enhancement of the knowledge, skills, and attitudes needed for a member of the healthcare delivery team who with precision and accuracy performs the clinical laboratory procedures needed to help the physician in the proper diagnosis, treatment, and prevention of diseases (Objective 1) were validated through the results of the performance evaluation from written and practical examinations. The attainment of Objective 3 or the development of critical thinking skills that will enable them to participate in research endeavors/activities and respond to the challenges of the profession was validated by evaluating the research outputs produced by the graduates, particularly those that involve data collection in the clinical laboratory. It is important to note that the study conducted involves graduates

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who were able to undergo the internship training program in the actual hospital/clinical laboratory setting and not through online means.

C. *Distance Learning*

The concept of distance learning is not new. Some journals and articles simply defined distance learning as a bridge between students and educators separated by physical distance and time, or both. Distance learning has offered opportunities, such as flexible learning, to individual and group learners owing to its main approach that focuses on opening access to education and training. The continuous utilization of distance learning has been emphasized by the development of Internet-based technologies, and with this, the most widely used distance learning mode over the past decade, particularly in higher education, is e-learning (Leontyeva, 2018).

1) *Distance Education in the Philippines*

Distance learning in the Philippines is in its primary stage, together with its other neighboring countries such as India, Pakistan, and Thailand (Jamandre, 2011). The University of the Philippines Open University (UPOU) has offered a Distance Education (DE) Program ever since its establishment in 1995 with a primary goal of providing educational opportunities for Filipinos in higher education using the approaches of distance learning. A study conducted by Jamandre (2011) reviewed and evaluated, through combined studies and articles, how the university executes quality assurance, an assessment of the relevance, effectiveness, quality, and sustainability of offered programs, and how it provides an effective mediated learning experience for its students in higher education levels focusing on the core components, which are quality of distance education, administrative service, faculty development, and student feedback.

Results showed both improvements and challenges faced by the institution. In the context of the quality of distance education, the main challenge of both students and educators is the utilization of technology in real-time instruction since UPOU heavily depends on technology, and the institution needed a "reliable and sustainable infrastructure support system" but they lacked IT experts. Despite this, the perception of Ph.D. students on the effectiveness of education programs to personal growth, cognitive development, and professional advancement showed a satisfactory result. In terms of administrative services, it was mentioned a low satisfaction of students from the administration's support services as they experienced some enrollment problems due to the challenges in the number of staff and faculty that provide services to the increasing population of UPOU. The decline of financial support for the institution has also affected the services and technological support of UPUO. For the faculty development, one professor expressed his concern regarding the non-compliance of deadlines of the academic calendar which affect the grade submission. He also added that students enjoy more face-to-face interaction. Lastly, it appeared that there is a low satisfaction from the students' perception of support services, particularly on tutor services. Furthermore, there was no difference between face-to-face and online learning in terms of the needs in the "pre-enrollment stage" and the "starting a course or program stage" as they needed registration procedures, information and orientation regarding the course and other materials. It was also stated that the primary support for the students is the feedback on examinations. One study indicated that "time, learning attitudes and knowledge of technology affected the application of the technology in distance learning."

2) *Distance Education for Health-care related Programs*

In the field of healthcare, distance learning has often been utilized as a supplemental learning device. A study by Williams (2006) on the effectiveness of distance education in allied health programs concluded that students who had work experience and professional knowledge had greater achievement gains comparable to those who were in traditional classroom settings. Furthermore, the study stated that distance education courses were most effective when it was supplemented with student – to – student interactions and instructor feedback. From this, it can be said that meaningful interactions and collaboration between

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students and instructors are the key elements to student success for distance education courses within allied health programs.

In a study conducted for internet-based learning in health professions, there was an emphasis on the interventions that were implemented on the effects of the learners. These interventions were internet-based instructions, learning environment, practice exercises, cognitive interactivity, discussion, tutorial, synchronous and asynchronous communication, internet conferencing, repetition, and duration. When compared with no interventions, internet-based learning with interventions was associated with large positive effects. The effects of internet-based learning with minimal interventions were generally small (Cook et al., 2008). Another study by Wong (2010) reviewed what was effective and for whom in internet-based medical education. It was seen that primary studies often reported that learners greatly valued courses that allowed them to interact. The theory of Laurillard's Conversational Framework was made an explanation for the data as it is a theory built on the assumption that a learner learns by entering a dialogue with others in virtual or face to face. It was also concluded that success was not entirely dependent on the course but a function of the course-context interaction, meaning one group of learners might perceive a technological-based course to be very useful while another group would not.

D. Theoretical Framework of the Study

The study finds its basis on Hiltz et al.'s (as cited in Lee et al., 2001) three aspects of the virtual learning environment (pedagogical theories from educational research, media effect theories from communications research, and group interaction/social theories from social psychology and sociology), focusing on the two theories utilized by Lee et al. (2001) which they termed the instructional aspect (theories from educational research) and the interactive aspect (group interaction/social theories) of the virtual learning environment. The instructional aspect involves the provision of study materials and educational resources via the internet while the interactive aspect emphasizes the methods in which the student becomes actively involved in the online collaborative learning process through the means of case studies and group discussions utilizing chat rooms, instant messaging, or forums as well as one-on-one email communications between the student and the teacher for clarifications or asking of questions. With these two aspects, students' perceptions of their competencies may be understood to assess their readiness in the virtual learning environment.

E. Conceptual Framework of the Study

The study focused on determining the perceptions of the medical technology interns on the development of their competencies during the virtual clinical internship at a university in Manila. It was based on the two aspects of the virtual learning environment, as stated in the study of Lee et al. (2001); which are the instructional aspect and the interactive aspect. The perceptions of the respondents on the subject matter served as dependent variables that may be affected by how the virtual clinical internship program was conducted. Fig. 1 shows the conceptual framework used in the study.

III. METHODOLOGY

A. Research Design

The study used a descriptive method, specifically a cross-sectional design, to come up with an overall view on the development of the competencies during the virtual clinical internship as perceived and experienced by the respondents. In this method, the researchers determined the development of the competencies of the fourth-year medical technology students by measuring the perceptions of the respondents on the subject matter. Additionally, the final grade of the students for Clinical Internship 1 was collected. Grades are the means by which the university

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Volume 2 Issue 1 | December 2021
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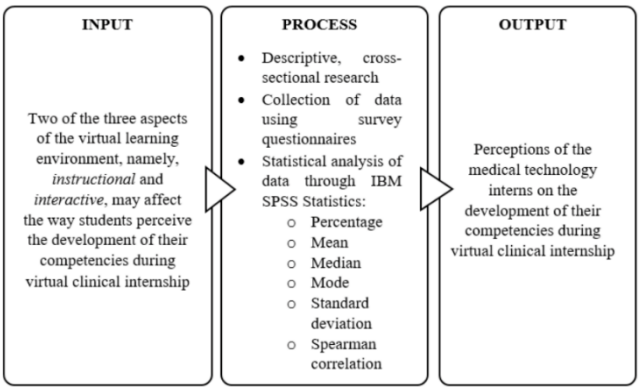

Fig. 1. Conceptual framework of the study

evaluates its students, whereas, the perceptions on their attainment of competencies are the students' evaluation of themselves. As such, these two variables were correlated to show whether the two assessments conformed with each other and if the grades demonstrated their perceived attainment of Medical Technology competencies. These results allowed the researchers to describe the effectiveness of the virtual clinical internship during the first semester of the school year 2020-2021 at a university in Manila.

The researchers gathered data by administering a structured questionnaire on a 5-point Likert-type scale with different statements regarding the expected competencies of the fourth-year medical technology students during their first semester of virtual clinical internship. Purposive sampling was applied in selecting respondents. The respondents answered the questionnaire, which comprised an English version and a Filipino version, through Google forms. Prior to this, the researchers communicated with the university's Medical Technology Internship Coordinator to endorse the administration of the research questionnaire. Thereafter, the researchers obtained the list of the names and email addresses of the fourth-year medical technology students from a member of the university's Organization of Medical Technology Interns (OMTI). Each student received the Google form link of the questionnaire. Responses were coded and randomized for statistical treatment. The statistical analysis of collected data showed the general picture of the perceptions of the respondents on their attainment of expected competencies. The perceived attainment of the competencies of the respondents was then correlated with their grades for Clinical Internship 1 using the Spearman correlation coefficient. This enabled the researchers to determine the magnitude of the association between the two variables.

As a cross-sectional study, the researchers utilized the information obtained to determine the prevailing perceptions among the respondents, which enabled them to infer and describe the extent of the attainment of competencies in general. The researchers then evaluated the results to determine the effectiveness of the current system of the internship program at a university in Manila.

B. Sampling

The method of purposive homogeneous sampling is employed to select participants from the fourth-year medical technology interns at a university in Manila. Purposive sampling is a non-probability sampling that involves the use of judgment of the researcher in selecting a sample that is most useful or suits the purposes of the study. Moreover, homogeneous sampling is a form of purposive sampling that focuses on candidates that share similar traits or characteristics (Etikan et al., 2016). This form of purposive sampling is utilized since the inclusion criteria of the respondents was that they were fourth-year medical technology interns enrolled in the academic year 2020-2021 at a university in Manila. The exclusion criteria were fourth-year medical technology students who did not take the virtual clinical internship, medical technology students of lower year levels, and medical technology students who were

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not enrolled in the university where the study was conducted. If the respondents wished to withdraw from the study at any point, they may have done so.

Following the Medical Technology Internship Coordinator's endorsement for the administration of the survey questionnaire, the Google form link containing the consent form and structured questionnaire, either in English or Filipino, was sent to every fourth-year medical technology student via their email addresses which were obtained from a member of the OMTI. The participants were first asked to choose their preferred language for answering the questionnaire. After which, they were tasked to answer the consent form as it is an essential part of the research to ensure whether or not the participants are willing to participate in the study. If the respondent chose "yes", they were redirected to the next sections which asked for their personal information and grades for Clinical Internship 1. If "no", the survey ended. Subsequently, the respondents who consented proceeded to the questionnaire proper which they answered based on their perspectives. The researchers collected the answered questionnaire forms for analysis and interpretation.

The sample size was computed using the formula below (Fig. 2).

$$n = \frac{(N)(X)}{(X + N - 1)}$$

Where:
$X = [(Z_{a/2})^2(p)(1\text{-}p)] / (e)^2$
$Z_{a/2}$ = 95% confidence interval = 1.96
e = 8% margin of error = 0.08
p = 50% response distribution = 0.5
N = population size = 259
$X = [(1.96)^2(0.5)(1\text{-}0.5)] / (0.08)^2 = 150.0625$
$n = [(259)(150.0625)] / (150.0625 + 259 - 1)$
n = 96

Fig. 2. Sample size calculation formula

C. *Data Collecting Tools*

The initial step of data collection was the development of a research instrument to measure the perceptions of the fourth-year medical technology students on the development of their competencies during the virtual clinical internship. The researchers utilized a structured questionnaire on a 5-point Likert-type scale as the research instrument for the study. According to Roopa and Rani (2012), structured questions are definite, concrete, and predetermined, and presented in the same wordings and order to all respondents. Hence, a fixed set of responses, graded on a continuum, was created. The Likert scale is a psychometric scale commonly involved in research to measure the opinions or attitudes of the respondents toward a given subject. In this study, the respondents were asked to rate their degree of agreement with the given statement on a scale of 1-5: 5 - Strongly Agree, 4 - Agree, 3 - Neutral, 2 - Disagree, and 1 - Strongly Disagree.

The researchers adapted the questionnaire from the study conducted by Valdez et al. (2012) titled The Six-Month Internship Training Program for Medical Laboratory Science Education: An Initial Evaluation. The contents of the current questionnaire were based on the following: (1) CMO No. 13 s. 2017 Objectives of the Medical Technology Internship Program; (2) Section 7. Performance Indicators of CMO No. 13 s. 2017; and (3) the university's Course Intended Learning Outcomes (CILOs) for the Medical Technology Virtual Clinical Internship Program A.Y. 2020-2021 First Semester (Clinical Internship 1). The Performance Indicators and CILOs were used verbatim, as the actual questionnaire items presented as Likert scales. Meanwhile, the CMO 13 s. 2017 Objectives of the Medical Technology Clinical Internship Program, which were also the basis for the subpoints under the present study's first objective, were used to classify them. The Performance Indicators, except indicator no. 1, are classified under the second, third,

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and fourth subpoints of objective 1, whereas the CILOs and performance indicator no. 1, are under the first subpoint of objective 1. The questionnaire determined the perceptions of the respondents regarding the development of their competencies during the virtual clinical internship. In addition, the respondents' grade for Clinical Internship 1 was also obtained to determine if they accurately reflected their perceived attainment of Medical Technology competencies. The questionnaire was answered either in English or Filipino, with the Filipino translation done by the researchers and validated by a Filipino instructor.

The questionnaire had eight (8) sections. Section 1 allowed the respondent to choose what language (English or Filipino) they would like to answer the questionnaire in. Section 2 comprised the informed consent form. Section 3 was for the personal information (Name, Section/Block, and Email Address) of the participant and section 4 is where the respondents were asked to enter their Clinical Internship 1 grade for the academic year 2020-2021. Sections 5 to 8 were dedicated to the Likert scales. The questionnaire could be answered for 15-25 minutes.

The Likert scales were divided into four (4) domains. These four (4) domains were based on the four subpoints under the first objective of the study. The first domain, representing the first subpoint, included section 5 of the questionnaire. The second domain, representing the second subpoint. included section 6 of the questionnaire. The third domain, representing the third subpoint, included section 7 of the questionnaire. The fourth domain, representing the fourth subpoint, included section 8 of the questionnaire. Finally, section 4 of the questionnaire was a variable needed for the second objective of the study.

D. Research Procedures

The research included human subjects as its target of observation; hence, the proposal was first sent to the Ethics Review Committee for approval before the implementation of the experiment. The respondents involved in this study were fourth-year medical technology students who took their MTIP in a virtual setting. A 5-point Likert-type scale questionnaire from the study of Valdez et al. (2012) regarding "The Six-month Internship Training Program for Medical Laboratory Science Education – An Initial Evaluation" was modified to accommodate the following: (1) CMO No. 13 s. 17 Objectives of the MT Internship Program; (2) Section 7. Performance Indicators of CMO No. 13 s. 2017; and (3) CILOs of the MTIP of a university in Manila.

The survey questionnaire was divided into sections. Section 1 provided the title of the study, the basis of the survey questionnaire, and an option for the respondent to choose what language (English or Filipino) they would like to answer the survey in. Section 2 contained the informed consent form which the respondent must read and understand before proceeding to the next section. Once they have read the informed consent, they must tick "Yes" to participate. If they ticked "No," they were redirected to the end of the survey. In Section 3, personal information such as name, section, and email address was asked. Section 4 was solely for the respondents to input their Clinical Internship 1 grade. Section 5 was entitled as "Enhance the knowledge, skills, and attitudes needed for a member of the healthcare delivery team who with precision and accuracy performs the clinical laboratory procedures needed to help the physician in the proper diagnosis, prevention, and treatment of diseases," which is the first objective of CMO 13 s. 17 of the MTIP. Under this category, the CILOs within the Clinical Internship 1 course were listed and are sorted by subject such as Bacteriology, Blood Banking, Clinical Chemistry, etc. Sections 6, 7, and 8 were entitled as "Develop among students a well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities," "Develop critical thinking skills that will enable them to participate in research endeavors/activities and respond to challenges of the profession," and "Develop human and competent Medical Technologists/Medical Laboratory Scientists who are globally competitive and committed to serve the health needs of patients in both local and international communities," respectively. Under the last three sections were the performance indicators of the BSMT program as stated in CMO 13 s. 17. Due

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to the pandemic, the survey was conducted online via Google Forms with the link disseminated to the fourth-year medical technology blocks of the AY 2020-2021.

All responses were collated in a spreadsheet for further analysis by the researchers.

Fig. 3 shows the flowchart representation of the data gathering procedure that was implemented in this research.

E. Ethical Considerations

In conducting this research, careful consideration has been made in assuring that the methods in which the study is carried out and the participation of the respondents adhere to the highest standard of ethical principles and practices. Because human subjects were the primary target of observation of the researchers, approval of the Ethics Review Committee at the institutional level was fundamental before proceeding with the study. Voluntary participation was an essential component, and this was established with potential respondents having the option to not partake in the study or to opt-out at any time, due to any reason, and with no negative consequences while the study was being conducted.

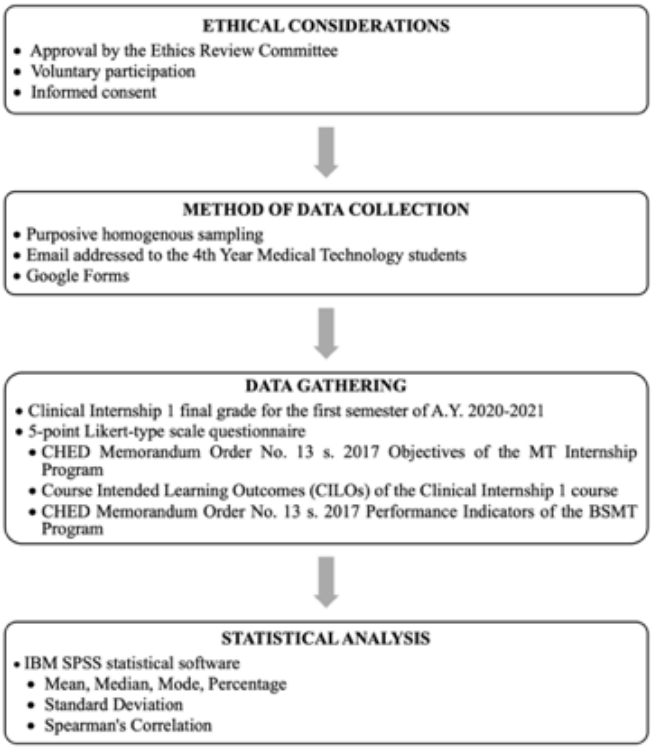

Fig. 3. Diagrammatic workflow of the study

Respondents were to read and understand the informed consent form that was disseminated before the answering of the survey questionnaire to ensure that they were fully aware of the implications of their participation in the study and their rights and responsibilities as a respondent. The form consisted of statements regarding the research overview, objectives of the study, procedure, compensation, benefits and risks, voluntary participation, and confidentiality. The nature of participation of the respondents was limited to answering the survey questionnaire for 15-25 minutes. Respondents did not incur any costs during their participation and monetary compensation was not provided. The benefits of the participants involved in the study included aiding in the determination of the effectiveness of virtual clinical internships as a means to attain Medical Technology Internship competencies and in the development of

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recommendations on how to improve the virtual clinical internship in the future. There were no risks for the participants involved.

Since personal information such as the respondent's name, section, and email address were collected, strict confidentiality was maintained, and the data collected could only be accessed and analyzed by the researchers. This complies with Republic Act No. 10173, otherwise known as the "Data Privacy Act of 2012". Should the participant wish to review their responses to the survey questionnaire, an automated email was sent by the Google server containing a summary of their responses upon the completion of the Google form. Once the research has been completed, respondents could request a digital copy of the finished research paper for their perusal by contacting the principal investigator through email (stated in the informed consent form).

F. *Data Analysis*

The answers from the survey questionnaire were collated in a spreadsheet connected to Google Forms. The data were used to assess the perceptions of the medical technology interns on the development of their competencies and were statistically treated using the software IBM SPSS statistics.

Descriptive Statistics was used to summarize the data collected. First, the answers under each domain were averaged per respondent as direct scores. Then, each respondents' average score was used to compute the percentage, mean, and mode per domain. These determined the students' perceptions of their attainment of the four main competencies. To assess the overall perception of their attainment, the mean scale ranges and their corresponding verbal interpretations shown in Table 1 were used. Additionally, the standard deviation was used to determine the overall distribution and variation of the responses.

For inferential statistics, the Spearman correlation coefficient (Fig. 4) was used to determine the correlation between the respondents' perceived attainment of competencies and their grades for Virtual Clinical Internship. The x-variable is perception, represented by individual respondents' average score per domain, while the y-variable is their Virtual Clinical Internship grade.

IV. FINDINGS AND DISCUSSION

The different final grade points for Clinical Internship 1 with their respective percentages are displayed in Fig. 5. The grade point 1.75 had the highest percentage of respondents, comprising 33.7% of the sample size, while the grade points 2.75 and 3.00 had the lowest percentage of respondents, with each of them constituting 1.0%

TABLE I. MEAN SCALE RANGE AND THE CORRESPONDING VERBAL INTERPRETATION

Mean Scale Range	Verbal Interpretation
4.21-5.00	Strongly Agree (Great Extent)
3.41-4.20	Agree (Moderate Extent)
2.61-3.40	Neutral (Less Extent)
1.81-2.60	Disagree (Lesser Extent)
1.00-1.80	Strongly Disagree (Did Not Agree)

$$\varrho = 1 - \frac{6\Sigma d_i^2}{n(n^2-1)}$$

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Where:
ρ = Spearman's rank correlation coefficient
d_i= difference between the two ranks of each observation
n = number of observations

Fig. 4. Spearman correlation coefficienct formula

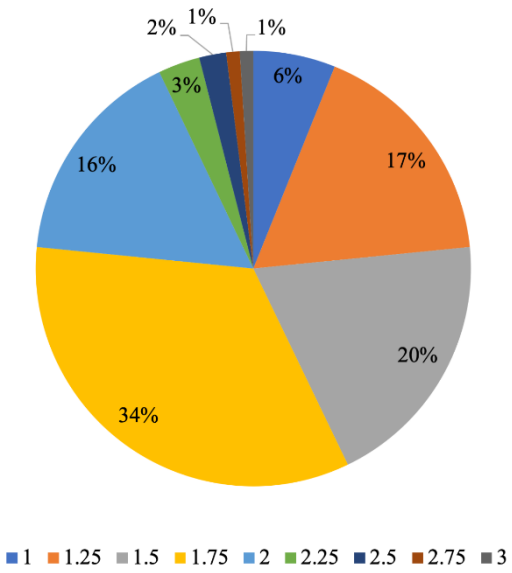

Fig. 5. Percentage distribution of the Clinical Internship 1 final grades

of the sample size. Moreover, 76% of the respondents have a final grade higher than 2.00, which indicates that most of them had an overall good academic performance as per the grading system of the university. The university uses a 5-point numerical grading system with 1.00 as the highest, 3.00 as the passing grade, and 5.00 as the lowest. Thus, all of the respondents obtained a mark that is equal to or higher than the passing grade.

Table 2 displays the important statistical measures of the final grade points of the respondents for Clinical Internship 1. Presented are the mean of the final grades (1.6633), followed by the median (1.7500), and the mode (1.7500). The standard deviation (0.37324) is also shown in the table.

Results showed that many of the students achieved a grade higher than 2.00, which is considered good. However, not all of the students were able to get such a grade. The varying grades of the students may be attributed to the advantages and disadvantages of virtual learning. Some students may perceive virtual learning as more beneficial, while others do not. In a study conducted by Al-Balas et al. (2020), 55.9% of the medical students reported the multiple advantages of distance learning, which include time-saving, the flexibility of class, and improved interaction with instructors and classmates. On the other hand, major disadvantages include low quality of

TABLE II. STATISTICAL MEASURES OF THE CLINICAL INTERNSHIP 1 FINAL GRADES

Statistical Measure	Value
Mean	1.6633
Median	1.7500
Mode	1.7500
Standard Deviation	0.37324

teaching and poor interaction with instructors, which were reported by 48.3% and 62.1% of the respondents, respectively. In the current study, the perceptions of the students on the development of their

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competencies during the virtual clinical internship were obtained through a 5-point Likert-type questionnaire, but the factors affecting the development of competencies during the virtual clinical internship were not included.

Table 3 displays the mean, median, mode, and standard deviation of each CILO and performance indicator categorized under Domains 1 to 4. Most mean values obtained fall under the range of 3.41 to 4.20 which means that the students agree to the attainment of most of the CILOs and performance indicators to a moderate extent. PAR_CONCEPT under Domain 1 presented the highest mean value at 4.38 which falls under the range of 4.21-5.00, implying that the students strongly agree to the attainment of the specific CILO of identifying the important concepts in Parasitology after the virtual clinical internship. Inversely, the lowest mean value of 3.06 was presented in BAC_RDNA under Domain 1. This value falls under the range of 2.61-3.40 which means that the students are neutral about, or agree to less extent with, their attainment of the specific CILO of explaining how bacteria can be identified using 16S rDNA sequences. The most frequent median and mode values are 4.00 and 4, respectively. Meanwhile, the highest and lowest standard deviations of 0.722 and 1.035 were seen in the CILOs, BAC_BIOTESTS, and BB_WEBINAR, respectively.

Data in Table 4 show that the mean scale scores of the four domains all fall within the range of 3.41-4.20, indicating that the students agree to a moderate extent that they have developed the required competencies and the objectives of the virtual clinical internship were attained. Notably, Domain 2, which represents the students' perception of "the development of their well-rounded personality with a healthy outlook and

TABLE III. STATISTICAL MEASURES OF THE CILOS AND PERFORMANCE INDICATORS

Domain	CILOs and Performance Indicators	Mean	Median	Mode	Standard Deviation
1	BAC_ISOLATION	3.92	4.00	4	0.846
	BAC_MEDIA	3.74	4.00	4	0.877
	BAC_MANAGE	4.03	4.00	4	0.779
	BAC_MICRO	3.92	4.00	4	0.742
	BAC_GRAM	3.91	4.00	4	0.874
	BAC_COLONY	3.85	4.00	4	0.854
	BAC_CHARTS	3.99	4.00	4	0.831
	BAC_BIOTESTS	3.88	4.00	4	0.722
	BAC_BIOMETHOD	3.91	4.00	4	0.761
	BAC_REACT	3.68	4.00	4	0.857
	BAC_RDNA	3.06	3.00	3	0.940
	BAC_AST	4.04	4.00	4	0.811
	BAC_AMRESIST	4.03	4.00	4	0.957
	BB_SAFETY	4.29	4.00	5	0.746
	BB_BASIC	4.18	4.00	4	0.778
	BB_GROUPS	4.09	4.00	4	0.826
	BB_OTHERS	3.83	4.00	4	0.874
	BB_DONATE	3.88	4.00	4	0.841
	BB_SEPARATE	3.66	4.00	4	0.837
	BB_COMPAT	3.95	4.00	4	0.830
	BB_AHG	3.93	4.00	4	0.865
	BB_ABSCREEN	3.96	4.00	4	0.836
	BB_WEBINAR	3.57	4.00	4	1.035
	CC_SAFETY	4.11	4.00	4	0.860
	CC_GENERAL	3.87	4.00	4	0.768
	CC_AUTO	3.57	4.00	4	0.862
	CC_DETER	3.71	4.00	4	0.897
	CC_ASSURE	3.64	4.00	4	0.853

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Domain	CILOs and Performance Indicators	Mean	Median	Mode	Standard Deviation
	CM_ASSESS	4.26	4.00	4	0.737
	CM_CONCEPT	4.29	4.00	4	0.813
	CM_GUIDE	4.09	4.00	4	0.813
	CM_PATHOLOGY	3.99	4.00	4	0.855
	CM_OPPORTUNITY	3.99	4.00	4	0.806
	CM_DISCREPANT	3.96	4.00	4	0.849
	CM_DIFFER	3.94	4.00	4	0.859
	CM_CREATE	3.82	4.00	4	0.778
	CM_AUTO	3.78	4.00	4	0.856
	CM_INDICATION	3.92	4.00	4	0.870
	CM_HANDLING	3.97	4.00	4	0.843
	HEM_BASIC	4.22	4.00	5	0.844
	HEM_AUTO	3.53	3.00	3	0.910
	HEM_ROUTINE	3.79	4.00	4	0.828
	HEM_MIX	3.61	4.00	4	0.845
	HEM_LAP	3.41	3.00	3	0.951
	HEM_APPLY	3.69	4.00	4	0.890
	HC_SAFETY	4.09	4.00	4	0.826
	HC_DIAG	3.84	4.00	4	0.782
	HC_ACCESS	3.86	4.00	4	0.825
	HC_HISTO	3.88	4.00	4	0.828
	HC_CYTO	3.70	4.00	4	0.899
	HC_ADVANCED	3.43	3.00	3	0.963
	MOL_SAFETY	4.01	4.00	4	0.855
	MOL_CONCEPT	3.72	4.00	4	0.906
	MOL_IDEAL	3.81	4.00	4	0.916
	MOL_GUIDE	3.65	4.00	4	0.851
	MOL_ISOLATION	3.54	4.00	4	0.943
	MOL_AMPLI	3.46	3.00	3	0.921
	MOL_DEVISE	3.48	3.00	3	0.888
	MOL_ASSURE	3.55	4.00	4	0.921
	MOL_PCR	3.72	4.00	4	0.917
	PAR_QA	4.26	4.00	4	0.722
	PAR_CONCEPT	4.38	4.50	5	0.739
	PAR_PREANA	4.21	4.00	4	0.777
	PAR_PRAC	4.11	4.00	4	0.811
	PAR_IDPROTO	4.17	4.00	5	0.825
	PAR_DEMOPROTO	4.08	4.00	5	0.893
	SI_BASIC	3.90	4.00	4	0.818
	SI_COVID	4.01	4.00	4	0.806
	SI_INTERPRET	3.77	4.00	4	0.906
	SI_ASSURE	3.65	4.00	4	0.875
	PERF_COMPET	3.68	4.00	4	0.781
2	PERF_ETHICS	4.03	4.00	4	0.913
	PERF_COMM	3.88	4.00	4	0.900
	PERF_LEARN	3.94	4.00	4	0.859
3	PERF_THINK	3.80	4.00	4	0.919
	PERF_RESEARCH	3.86	4.00	4	0.931
4	PERF_INFO	3.73	4.00	4	0.926
	PERF_TEACH	3.87	4.00	4	0.833

TABLE IV. MEAN SCALE SCORE AND VERBAL INTERPRETATION FOR EACH DOMAIN

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Domain	Mean Scale Score	Verbal Interpretation
1 (Objective 1a)	3.87	Agree (Moderate Extent)
2 (Objective 1b)	3.95	Agree (Moderate Extent)
3 (Objective 1c)	3.83	Agree (Moderate Extent)
4 (Objective 1d)	3.80	Agree (Moderate Extent)

oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities", showed the highest mean scale score at 3.95. Meanwhile, Domain 4, which represents their perception of "their development as human and competent medical technologists who are committed to serving the health needs of patients in both local and international communities", showed the lowest mean scale score at 3.80.

The results of the present study may be due to the nature of distance learning and the virtual clinical internship program emphasizing assessments of knowledge and simulations of procedures to compensate for the lack of practical and hands-on training only achievable in the actual clinical laboratory setting. However, the fact that the students moderately agreed to the attainment of all four CMO objectives, represented by the domains, implies that distance learning through the enriched virtual mode was generally perceived by the interns to be a viable means to conduct Medical Technology clinical internship. Although, agreeing to a moderate extent only, also suggests the need to improve the implementation of the virtual clinical internship for the better attainment of competencies such as those listed under domain 4 which, incidentally, had the lowest mean scale score.

A similar study by Valdez et al. (2012) revealed comparable results. Their study also showed that their respondents agreed to a moderate extent that the objectives of the internship program were achieved. This similarity supports the idea that both face-to-face and virtual modes of clinical internship can adequately facilitate the development of required medical technology competencies. However, it is also worth noting that the mean scale scores obtained by Valdez were significantly higher than the domain scores obtained by the current study. Specifically, their scores were: 4.37 for CMO objective 1, 4.35 for CMO objective 2, 4.32 for CMO objective 3, and 4.39 for CMO objective 4. Many factors, in theory, may be attributed to this difference in the mean score despite the same interpretation. First, the 2012 study adopted the CMO No. 13 series 2017 Medical Technology Clinical Internship objectives as items for their questionnaire, whereas the present study used them as its main objectives and domains to categorize the CILOs and performance indicators appearing in the questionnaire. The CILOs for Clinical Internship used in the present study were also restructured to fit the virtual mode of delivery. Second, their study used a different mean range scale for the interpretation of the mean scale score. Third, their respondents were part of a face-to-face clinical internship while the respondents of this study were part of a fully virtual clinical internship. Lastly, their study evaluated a six-month internship program while this study evaluated a 12-month internship program.

The magnitude of association between the Clinical Internship 1 grade of the students and their perceived attainment of the competencies required in the Medical Technology program were determined by correlating the grade and the mean scale score for each domain using Spearman Correlation. In Fig. 6, the Spearman Correlation coefficient is -0.101 and this value indicates that there is no correlation between the mean scale score for Domain 1 and the final Clinical Internship 1 grade of the students. The mean scale score for Domain 1 consists of the Course Intended Learning Outcomes for each section of the laboratory (Bacteriology, Blood Banking, Clinical Chemistry, Clinical Microscopy, Hematology, Histopathology & Cytology, Molecular Biology & Diagnostics, Parasitology, and Serology & Immunology) as well as

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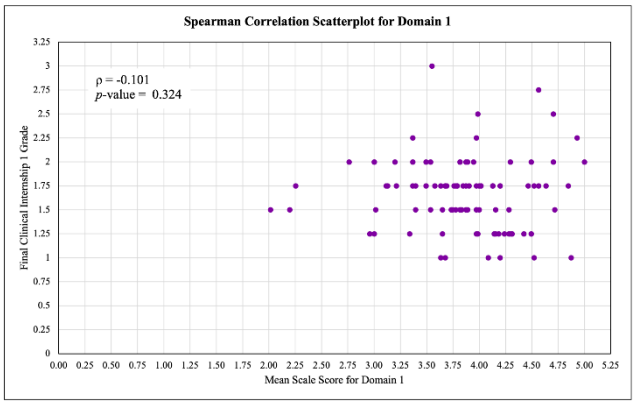

Fig. 6. Spearman correlation scatterplot for Domain 1

Performance Indicator 1 (PERF_COMPET). Due to this, we can infer that there exists no correlation between the interns' final Clinical Internship 1 grade and their perceived attainment of the Medical Technology competency regarding the enhancement of their knowledge, skills, and attitudes needed for a member of the healthcare delivery team who with precision and accuracy performs the clinical laboratory procedures needed to help the physician in the proper diagnosis, prevention, and treatment of diseases (Objective 1a). In fact, Babas(2020) highlighted no relation between students competencies to their academic performance.

Fig. 7 exhibits the correlation between the mean scale score for Domain 2, composed of Performance Indicators 2-4 (PERF_ETHICS, PERF_COMM, and PERF_LEARN), and the final Clinical Internship 1 grade of the interns. The Spearman Correlation Coefficient is -0.229 which indicates a weak negative correlation between the two variables. From this, we can conclude that there exists a weak negative correlation between the interns' final Clinical Internship 1 grade and their perceived attainment of the Medical Technology competency regarding the development of their well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities. It is important to note that the weak negative correlation is interpreted as the interns' perceived attainment of the Medical Technology competencies for Domain 2 increasing as the numerical value of their final Clinical Internship 1-grade decreases because the grading system of the university follows a reversed 5-point grading system in such a way that the lower the numerical value of the grade (lowest: 1.00, highest: 5.00), the higher the actual grade of the student is.

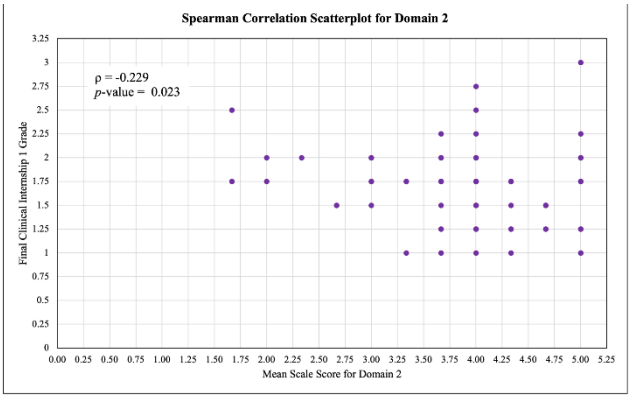

Fig. 7. Spearman correlation scatterplot for Domain 2

Based on the scatterplot (see Fig. 8), the Spearman Correlation Value of Domain 3 is -0.117 which indicates no correlation between the two variables. The x variable, Mean Scale Score for Domain 3, consists of two components: Performance Indicators 5 and 6 with SQ codes PERF_THINK and

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PERF_RESEARCH, respectively. Hence, it can be deduced that there is no relationship between the perception of the intern with regards to the development of their critical thinking skills that will enable them to participate in research endeavors/activities and respond to challenges of the profession (Objective 1.c) and their final Clinical Internship 1 grade.

As for the Mean Scale Score of Domain 4, it is composed of two performance indicators: 7 (coded as PERF_INFO) and 8 (coded as PERF_TEACH). In this figure (see Fig. 9), the Spearman's Correlation Value resulted to a -0.001 concluding that there is no significant correlation between the final Clinical Internship I grade of the MT intern and their development as human and competent medical technologists who are committed to serving the health needs of patients in both local and international communities (Objective 1.d).

Out of the four domains (see Table 5), Domain 2 showed a weak negative correlation whilst the other three domains displayed no significant correlation between the two variables, namely, the Mean Scale Score for each domain (x-variable) and the Final Clinical Internship 1 Grade (y-variable). This implies that solely Objective 1b which is "the development of their well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities", was demonstrated by the students' final Clinical Internship 1 grade, but only marginally. Additionally, it suggests that the students' perception on their attainment of the performance indicators grouped under Domain 2, namely, to "demonstrate interpersonal skills, leadership qualities, and ethical practice of the profession", "participate in community-oriented activities", and "engage in life-long learning activities", somewhat agree with the school's assessment of their performance.

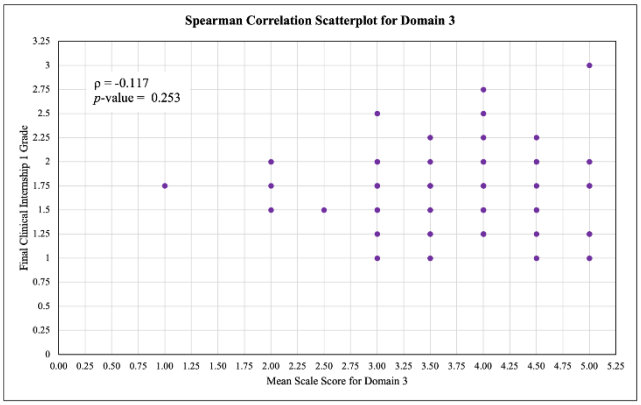

Fig. 8. Spearman correlation scatterplot for Domain 3

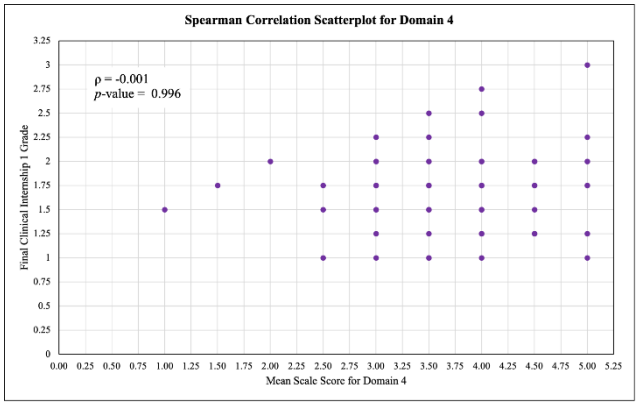

Fig. 9. Spearman correlation scatterplot for Domain 4

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TABLE V. SPEARMAN CORRELATION VALUES FOR EACH DOMAIN

Domain	Spearman Correlation Value (ρ)	ρ Interpretation
1 (Objective 1a)	-0.101	No correlation
2 (Objective 1b)	-0.229	Weak negative correlation
3 (Objective 1c)	-0.117	No correlation
4 (Objective 1d)	-0.001	No correlation

V. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

A. *Summary*

According to the CMO no. 13 s. 2017, the Medical Technology program requires a 12-month clinical internship training. During this period, fourth-year students are supposed to work in the different sections of a clinical laboratory to obtain knowledge and skills and to demonstrate competency in providing reliable results for patient diagnosis. However, the 12-month training had to be modified to fit the distance learning caused by the COVID-19 pandemic. Thus, the study aims to determine how the MT clinical interns for the academic year 2020-2021 perceive the development of their competencies during their virtual clinical internship through a 5-point Likert scale survey questionnaire, wherein the researchers hypothesized that the fourth-year MT students have attained their competencies throughout the virtual clinical internship.

The survey questionnaire was divided into sections that correspond to four domains which represent objectives 1.a., 1.b., 1.c., and 1.d. Respondents were selected through purposive homogeneous sampling and the survey questionnaire was disseminated through email in the form of a Google form link. The data was then statistically treated to obtain the mean, median, mode, and standard deviation of each item, and the mean scale score within each domain was calculated and interpreted with a mean range scale. Spearman correlation of the average answer of each respondent and their final grade for their clinical internship was also calculated for each domain. The mean scale scores of all domains are within the "Agree with moderate extent" range (3.41-4.20), with the value of the mean scale score of Domains 1, 2, 3, and 4, being 3.87, 3.95, 3.83, and 3.80, respectively. For the spearman correlation, only Domain 2 was found to correlate with a coefficient of -0.229 ($p < 0.05$) which can be interpreted as a weak negative correlation.

B. *Conclusion*

The results presented in this study revealed that the fourth-year medical technology students perceive that they have attained the expected competencies during the virtual clinical internship based on CMO No. 13 s. 2017 Objectives. Based on these perceptions, the study determined that the virtual clinical internship was effective in the attainment of said competencies to a moderate extent which also suggests the need for improvement in the virtual clinical internship program so that a higher degree of attainment of these competencies is achieved. The majority of the medical technology interns that took part in the study demonstrated a final Clinical Internship 1 grade higher than 2.00, indicating that most of them had an overall good academic performance during the virtual internship. Most of them also agreed, to a moderate extent, that they have attained majority of the Course Intended Learning Outcomes and performance indicators of the Clinical Internship program, implying that (1) they developed enhanced knowledge, skills, and attitudes needed for a member of the healthcare delivery team who with precision and accuracy performs the clinical laboratory procedures needed to help the physician in the proper diagnosis, prevention, and treatment of diseases; (2) they developed a well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities; (3) they developed a critical thinking skills that will enable them to participate in research endeavors/activities and respond to challenges of the profession; and (4) they developed to be human and competent medical technologists who are committed to serve the health needs

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of patients in both local and international communities. However, out of the four domains presented in the study, only Domain 2 has shown a weak negative correlation with the students' Clinical Internship 1 grades, whereas Domains 1, 3, and 4 have shown no significant correlation. This means that only Objective 1b, or the development of a well-rounded personality with a healthy outlook and oriented towards intelligent, ethical, and active participation in professional as well as community welfare activities, was reflected in the final Clinical Internship 1 grades of the students, albeit only marginally.

C. *Recommendations*

Based on the findings and conclusions of the study, the following recommendations are made:

1) Institutions of higher education must assess the development of competencies among medical technology interns based on learners' perceptions to continuously improve the implementation of virtual clinical internships and to enhance their professional training in general. Specifically, for the university in Manila used as the current study site, the areas of improvement that may be considered include the attainment of the CILO, BAC_RDNA under Domain 1, and the attainment of Domain 4.
2) College professors and medical technology interns should work closely together to identify potential gaps in the performance of the latter. This can help the professors come up with more effective strategies and new learning methods that will further develop the knowledge and skills of the interns, especially in a virtual setting, bridging the gap between the actual and expected competencies of the future medical technologists.
3) Further investigation should be performed to expound on the presence or absence of any correlation between the Clinical Internship grades of the fourth-year students and their perceived attainment of the CMO No. 13 s. 2017 Objectives of the Medical Technology Internship Program, taking into consideration the virtual implementation of the internship program.
4) Other criteria for the determination of Medical Technology internship objectives, besides university CILOs and CMO No. 13, s. 2017 performance indicators, may be worth considering.
5) Future studies should consider using survey questionnaires which would account for the entire span of the 12-month clinical internship training program as the current study only included CILOs for the clinical internship rotation that was performed during the first term (first six months) of the fourth year of the BSMT program.
6) Further studies should be conducted with a wider scope as this study was limited to a university in Manila.

ACKNOWLEDGMENTS

The researchers would like to express their deepest gratitude to the following individuals and institutions whose help was invaluable to the completion of the study:

To Asst. Prof. Gregorio L. Martin I, RMT, MSMT, MPH, PhD., whose expertise and guidance became pillars of knowledge that steered the study in the right direction.

To Assoc. Prof. Florence Co Navidad, EdD, MSMT, RMT, RN, for assisting in the statistical analysis of data.

To Asst. Prof. Maria Gina M. Sadang, MSMT, RMT, for endorsing the study and survey questionnaire.

To Mr. Reginald P. Arimado, for his guidance and recommendations in performing the statistical analysis required in the study.

To Ms. Estela Gwen Y. Gaddi, LPT, for proofreading the Filipino translation of the survey questionnaire used in the study.

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To Ms. Diana Ross F. Gamil, LPT, MA, for proofreading the research paper.

To Dr. Julius Eleazar D.C. Jose, MSMT, MA and Dr. Maria Luisa R. Olano, PhD, for their recommendations on how to best improve the study after the oral defense.

To the Faculty of Pharmacy Review Ethics Committee, for reviewing and approving the research proposal which allowed the study to be conducted.

To the Fourth-Year Medical Technology Interns (Batch 2021), for sharing their generous time and effort to partake in the study.

To the Department of Science and Technology-Science Education Institute, for their financial assistance.

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