Case-by-Collaboration: An Adaptable Soft Skills-Based Educational Model for Health Disciplines

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Abstract

Purpose: The purpose of this study was two-fold and consisted of the development of a skills-based model for Case-by-Collaboration (CBC) and the collection of qualitative data from students and teachers aimed at answering the research question: What skills do individuals (students) apply during the completion of a hypothetical medical laboratory management-based Case-by-Collaboration capstone project? Method: A consensual qualitative research design was selected for this study. Students and their instructors from three Medical Laboratory Science programs located in Texas, New York, and Missouri were recruited. Students were given a case that centers on the fictitious Cheapskate Health Maintenance Organization (HMO). The project culminated when each team presented their proposal to become the sole provider of laboratory testing services to the Cheapskate HMO Board of Directors (BOD). The project was initially designed to be accessed and completed online, where students from different institutions would come together and remotely complete the requirements. Data were collected through in-person observations of the final presentation, semi-structured interviews with students and instructors, and analysis of project documents. Data was coded, and transcripts were reviewed numerous times. Two strategies were employed to ensure the integrity of the study. First, the coded data were examined across the data collection strategies, transcripts containing the data, and the themes identified by a researcher and an outside auditor. Secondly, an audit trail was established to document how the data were collected and analyzed, along with documentation of the thought processes used in the data interpretation phase of the project. Results: The current study analyzed responses from 36 students and 5 instructors across the three data collection sites. Seven themes, in the form of skill sets, were identified in the data analyzed:1) information technology, 2) collaboration/team building, 3) verbal and written communication, 4) clinical reasoning, 5) creativity, 6) managerial, and 7) research/investigative. Conclusion: These results suggest the CBC can develop desirable soft skills. This model can be transferrable and apply to CBCs independent of the studied content. Thus, the CBC is an innovative model to teach soft skills across health disciplines.

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ABSTRACT

Purpose: The purpose of this study was two-fold and consisted of the development of a skills-based model for Case-by-Collaboration (CBC) and the collection of qualitative data from students and teachers aimed at answering the research question: What skills do individuals (students) apply during the completion of a hypothetical medical laboratory management-based Case-by-Collaboration capstone project? **Method:** A consensual qualitative research design was selected for this study. Students and their instructors from three Medical Laboratory Science programs located in Texas, New York, and Missouri were recruited. Students were given a case that centers on the fictitious Cheapskate Health Maintenance Organization (HMO). The project culminated when each team presented their proposal to become the sole provider of laboratory testing services to the Cheapskate HMO Board of Directors (BOD). The project was initially designed to be accessed and completed online, where students from different institutions would come together and remotely complete the requirements. Data were collected through in-person observations of the final presentation, semi-structured interviews with students and instructors, and analysis of project documents. Data was coded, and transcripts were reviewed numerous times. Two strategies were employed to ensure the integrity of the study. First, the coded data were examined across the data collection strategies, transcripts containing the data, and the themes identified by a researcher and an outside auditor. Secondly, an audit trail was established to document how the data were collected and analyzed, along with documentation of the thought processes used in the data interpretation phase of the project. **Results:** The current study analyzed responses from 36 students and 5 instructors across the three data collection sites. Seven themes, in the form of skill sets, were identified in the data analyzed: 1) information technology, 2) collaboration/team building, 3) verbal and written communication, 4) clinical reasoning, 5) creativity, 6) managerial, and 7) research/investigative. **Conclusion:** These results suggest the CBC can develop desirable soft skills. This model can be transferrable and apply to CBCs independent of the studied content. Thus, the CBC is an innovative model to teach soft skills across health disciplines.

Keywords: consensual qualitative analysis, educational advancement, pedagogy, case study

INTRODUCTION
A focus on developing and sharpening discipline-specific skills (also known as hard skills) is of paramount importance as education programs prepare their graduates for the workforce.[1] The healthcare industry is a prime example of the importance of hard skill development. Each member of the healthcare team has a specific job to perform. For example, an athletic trainer must assess an athlete's condition in the event of an injury, determine a treatment plan, and provide follow-up care.[2] Likewise, a medical laboratory scientist is responsible for conducting accurate laboratory tests, the results of which contribute to disease diagnosis, treatment, monitoring, and prevention.[3]

While hard skills are of monumental importance, so are those known as soft skills. These skills are those that are transferrable to all disciplines.[4] Pachauri and Yadav succinctly define soft skills as "personal attributes that enhance an individual's interactions, job performance, and career prospects."[5] Soft skills can involve several domains, including communication skills; thinking skills, and problem-solving skills; teamwork force; life-long learning and information management; entrepreneur skills; ethics, moral and professionalism; leadership skills.[5-11] Soft skills have been shown to be critical to the success of healthcare professionals because soft skills can result in increased engagement, decreased burnout, and increased retention in the workplace.[1,6,12,13] For years, employers and even some educators have been troubled by graduates entering the workforce having no to minimal soft skills.[14] It has been estimated that up to 45% of students have difficulty developing soft skills in their academic program.[15]

Information technology, collaboration/team building, written/verbal communication, and clinical reasoning are four of the most important soft skills for healthcare professionals.[11, 12] For this paper, these skills are referred to as the "Big Four." Members of the healthcare team utilize these skills every day. Using the athletic trainer and medical laboratory scientist examples, information technology facilitates the maintenance of electronic patient records and the conductions of telehealth/telemedicine visits. Collaboration and team building become important in processes such as project management and completion and strategic planning. Communication skills, both verbal and written, are used when communicating with patients, their families, and other health care team members. In instances of an unusual athlete injury or laboratory equipment malfunction, athletic trainers and medical laboratory scientists depend on their clinical reasoning abilities to provide the best care.

Historically, the "Big Four" development was not a major focus at the authors' home disciplines of athletic training or medical laboratory science. The importance of soft skills in the workforce gained popularity, being a topic of great discussion at professional meetings and in domain-specific publications.[11,12,16,17] Speakers and authors have adamantly stated that students and employees must be comfortable using/manipulating each of the "Big Four."[11,12,16,17] The question then came to mind as to how the Big Four could be accomplished within the respective academic program**.**

Soft skills are refined when students transition from didactic learning to clinical competence.[12] Various pedagogical tools exist which may facilitate this refinement, such as clinical exams, standardized patients, journaling, and case studies.[18-20] However, each strategy has limitations, such as subjective assessment, time-consuming for the instructor, and lack of student engagement under real-world situations.[6,18,21] To address these gaps, the lead author developed a case study accessible online, which was designed to provide soft skill practice opportunities. The case requires students to work in teams and complete a set of defined deliverable products. When the case study was under development, it was considered an example of a telecollaborative project (TP). Further exploration of the TP theory and design revealed that the six detailed purposes noted by its founder, Judi Harris, only formally addresses two of the Big Four soft skills (interpersonal exchange and information collection and analysis).[22] The TP pedagogy offers participating students numerous activity structures for completion, including but not limited to keypals (the Internet version of pen pals) and electronic appearances such as correspondence with leaders in the designated field of study. Thus, TPs are not always case-based. TPs are flexible and typically involve students remoting in from different locations to access and work together to complete the project. As the investigation unfolded, it became clear that the developed case study was not an example of a TP.

Two other established models were examined to determine if the developed case fit either. WebQuests, designed by Bernie Dodge (1998), are inquiry-based internet-based activities that may be completed over a short or long period of time.[23] These activities involve information gathering from the Web followed by information analysis and assembly into an understandable and sharable format.[24] The reviewed literature supports the notion that WebQuests are topic-based as opposed to case-based. CaseQuests are different from the case developed here in that they are a *combination* of WebQuest with a case.[25] In this model, students work on teams in assigned roles. Each team is responsible for using technology to determine solutions for the case. Upon thorough review of these three existing models, it became clear that the developed case study and the associated requirements does not fit any of the models. Instead, a new model was born and termed Case-by-Collaboration (CBC).

CBC Model Components
Three primary components make up the CBC model, as illustrated in Figure 1. First, the entire model is based on solving a case study. The cases that may be used in this model are endless. Established cases, as well as new ones, are appropriate. The case study is specific to the discipline and incorporates the desired soft skills. Students form collaborative teams to complete the CBC.
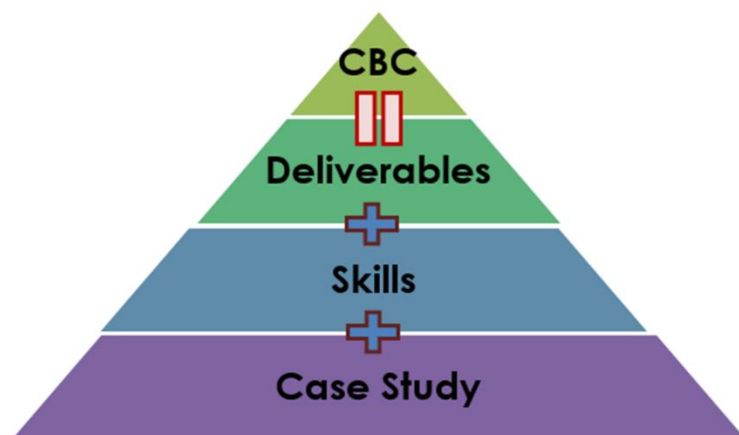
Figure 1. Three Primary Components of the Case-by-Case Collaboration (CBC) Model

Secondly, out of the many skills that may be considered soft, the "Big Four" were initially chosen for inclusion in this model because they fit well into the discipline of the lead author, medical laboratory science. The general overall outcome for the CBC is as follows: Upon completion of the CBC, the successful student can: 1) operate, manipulate, and retrieve electronic data beyond the hard skills in this area needed to be successful; 2) participate and collaborate as an active team member; 3) communicate verbally and in writing; and 4) apply clinical reasoning to solve problems. The goal is to apply the soft skills learned in the CBC to the "real world" setting upon graduation.

The third component consists of deliverables that each student team completing the project must generate. The required deliverables may vary. Written documents, verbal presentations, evidence of technology use via PowerPoint slides and/or other means, and presenting a plausible solution to the issues raised in the case study is required.

The inaugural CBC was developed in the area of medical laboratory management. Provisions for the Big Four soft skills (information technology, collaboration/team building, written/verbal communication, and clinical reasoning) were intentionally incorporated into the case.

Purpose of this Study
The purpose of this study was two-fold and consisted of the development of a skills-based model for Case-by-Collaboration and the collection of qualitative data from students and teachers aimed at answering the research question: What skills do individuals (students) apply during the completion of a hypothetical medical laboratory management-based CBC capstone project?

METHODS
Study Design
A consensual qualitative research design was selected for this study. Qualitative studies provide rich, thick data in the form of words, phrases, and sentences.[26, 27] This format allows researchers to collect data that may otherwise be difficult to quantify.[28] The participants were informed of the research question but not the soft skills being assessed. The soft skills served as the expected findings, also known as quality criteria. The identification of quality criteria can be helpful as it serves as a starting point for data analysis.[26, 27]

Study Participants & Protection of Human Subjects
Through purposeful sampling, undergraduate students, and their instructors from three medical laboratory science programs across the United States in Texas, New York, and Missouri took part in the study. These students were all enrolled in a laboratory management courses with subject instructors at the time of data collection.

In accordance with the Institutional Review Board (IRB) at Saint Louis University (protocol number 24452), the lead author's home institution, all required protocols were followed. All participants were informed of the study, optional participation, and that their grades would not be affected by participation or nonparticipation. Participants were also notified that their identity would be protected, in no way would be purposely breached, and that the only risk associated with participation would be the unlikely event of a breach of confidentiality.

Application of the CBC model - HMO Capstone Project
This case-based, circus-themed project titled "Entering the Center Ring with a Winning Health Maintenance Organization (HMO) Contract Presentation" served as the capstone for the course. The case centers on the fictitious Cheapskate HMO. Chief Executive Officer Mr. Earl N. Meyer-Flask and the Cheapskate HMO Board of Directors are seeking bids from area medical laboratories to provide laboratory testing services for all its locations. The HMO Capstone Project requires students to form fictitious laboratory management teams. Each team is charged with developing a proposal with defined deliverable products in hopes of winning the contract.

Students were given approximately eight weeks to prepare their proposals. The project culminated when each team presented their proposal to the fictitious Cheapskate HMO Board of Directors (BOD) made up of individuals in and around the corresponding medical laboratory training program. Program faculty members and colleagues from area laboratories served as voting members of the Board of Directors (BOD). After all the presentations are completed, the BOD selects the contract's "winner." Upon completion of this project, the students were able to:

1. Given a laboratory setting, perform the research necessary and collaborate with group members to determine and develop an appropriate laboratory organizational structure in the form of a chart.
2. Given a laboratory test, perform a cost per test analysis:
   a. Determining and/or examining the cost/benefit analysis
   b. Considering the instrumentation as well as the instrument usage cost, where appropriate.
   c. Utilizing guidelines and/or parameters given to you by your instructor to determine the cost per test considering overhead costs and making an appropriate profit margin.
3. Identify and describe additional value-added services that your laboratory would legally be able to provide if awarded the Cheapskate HMO contract.
4. Design two marketing brochures, one at a technical level for the Cheapskate HMO Providers and one directed at a non-technical level for the Cheapskate HMO patients introducing your laboratory as the new provider of laboratory services.
5. Develop a PowerPoint presentation that contains all the project components listed in the objectives above.
6. Present this project as a group in the form of a verbal presentation

The project was initially designed to be accessed and completed online, where students from different institutions would come together, be placed on inter-institutional teams, and remotely complete the requirements. Due primarily to timing issues, this format did not work with the study locations and was adjusted to accommodate the institutional needs. Students accessed the project online as planned. Each institution took care of assigning their students to teams. Teams presented their verbal presentations in class. The web pages were set up in a (three-ring) circus theme, complete with a ringmaster. The instructions followed suit. The circus theme was chosen because, like so many other professions, things can get crazy in a medical laboratory and often feels like the circus.

Data Collection Strategies
Four types of qualitative data strategies were purposely created and conducted using pre-determined guidelines during this study at each of the four participating institutions:

1. In-person observations of the project proposal presentations
2. Semi-structured interviews were conducted with student focus groups at each study location
3. Semi-structured interview with the course instructors
4. Analysis of the project proposal documents that accompanied each presentation

The data obtained were typed up for analysis.

Data Analysis

Analysis of these data was accomplished by hand using traditional theme identification looking for evidence of the each of the quality criteria (the "Big Four"), as illustrated in Figure 2. In the form of specific highlight color, a unique code was assigned to each quality criteria. Elliott describes coding data as a process that provides an avenue for researchers to "break down their data to make something new".[29]
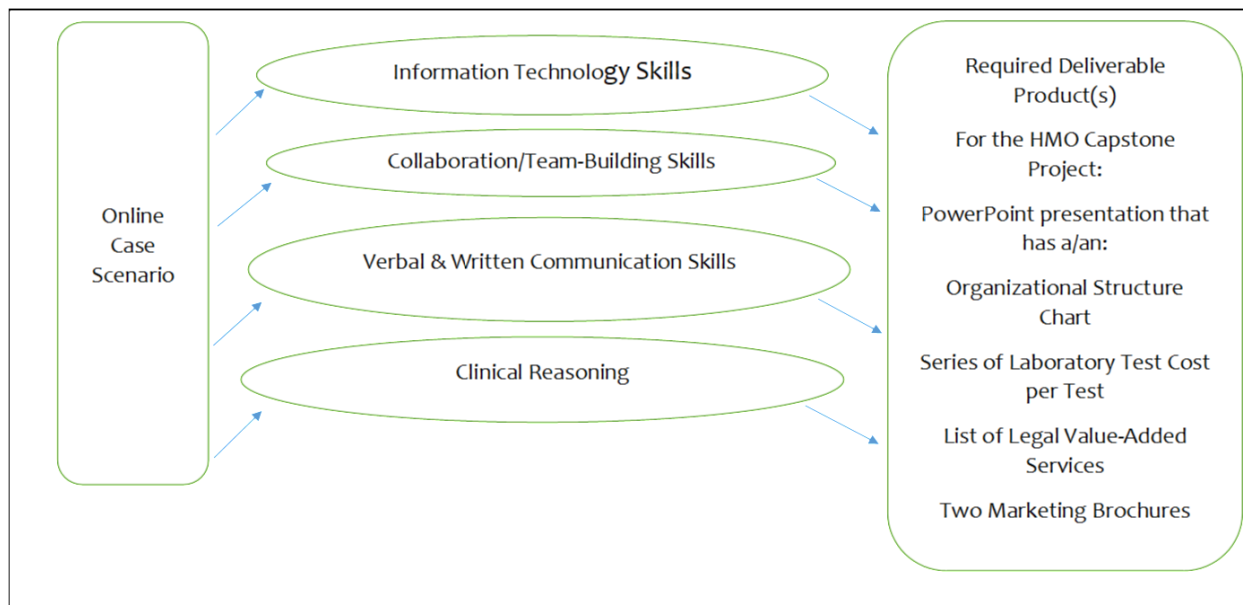
Figure 2. Skills-Based Model for Case-by-Case Collaboration

The transcripts generated by typing up the data obtained were examined in detail for repetitive words, phrases, and descriptions that fit into the established quality criteria. Evidence that supported the quality criteria was coded via highlighting. For data that fit into more than one criterion, coding was accomplished via highlighting and entering notes on the transcripts. As evidence of new themes emerged, each was assigned its own code. The transcripts were reviewed numerous times to ensure that there was evidence to support all identified themes.

The coded data were examined from three different lenses: 1) by data collection strategy, 2) by participating site, and 3) across data collection strategies.

Ensuring Integrity of the Study

Two strategies were employed to ensure the integrity of the study. First, the coded data were examined across the data collection strategies, transcripts containing the data, and the themes identified by the researcher and an outside auditor. The purpose of the review was to look for the same identified themes. Known as triangulation, the data is considered valid when the same themes appear. Carter and colleagues describe triangulation as "a qualitative research strategy to test validity through the convergence of information from different sources."[30]

Secondly, an audit trail was established to document how the data were collected and analyzed, along with documentation of the thought processes used in the data interpretation phase of the project. This document was designed to provide the outside auditor with a deep understanding of the process conducted and a resource as needed during the data audit process.

RESULTS

The current study analyzed responses from 36 students and 5 instructors across the three data collection sites. Seven themes, in the form of skill sets, were identified in the data analyzed:1) information technology, 2) collaboration/team building, 3) verbal and written communication, 4) clinical reasoning, 5) creativity, 6) managerial, and 7) research/investigative.

Information Technology Skills

Information technology skills were observed from the analysis. One teacher alluded to information technology skills when asked about the skills that students applied to complete the HMO Capstone project by saying, "The students had to be able

to use their computer skills to access the information that they needed to actually come up with their completed project." Students at two of the three sites answered "computer skills" when asked about the skills they used to complete the HMO Capstone project. These findings suggest that students used computer navigational skills not only during the presentation but also in the steps leading up to the presentation.

Other information technology skills include those necessary to use the Internet and other software programs. Several teams included a website as part of their presentation with a link to it on their presentation slides. One student indicated the usefulness of using the Internet when responding to a question about the skills used to complete the HMO Capstone project by saying:

> We didn't know what most of these management terms were, so we were kind of hesitant in the very beginning, so we did have to learn. We had to learn, listen to lectures, we had to read, and we had to go on to the Internet and I think we just didn't know this off the top of our heads.

Other responses to this question by students included "Excel," "Desktop Publishing," and "The AHA (American Hospital Association) Website." These findings suggest that students were resourceful and used computer skills beyond PowerPoint to complete this project. One student connected the Internet and Excel to disadvantages of completing this HMO Capstone project by saying: "We used the Internet to do a lot of feedbacks and processes and one of the first things we did was push around an Excel sheet where everybody wrote down their available times."

Collaboration/Team building Skills
Collaboration and teamwork were a recurring theme that emerged in both the student focus group interviews and the one-on-one teacher interviews. The ability of presenters to function as a team through cohesion and unity of team members during the presentation was clearly observed at all three study locations. It was observed that on more than one occasion, team members referred to one of the previous speakers. The students on one team even mentioned the team concept as a positive feature they could offer if they were awarded the contract. The presenters of another team each thanked the previous speakers when it became their time to speak. They often referred to each other by saying, "As XX mentioned, …." These results suggest that students recognized the importance of portraying a unified team atmosphere during their PowerPoint presentations.

Collaboration and teamwork surfaced as an advantage to doing the HMO Capstone project, as noted by one student who stated, "I really think it promoted teamwork amongst all of us." A classmate of this student replied, "Yeah, you're right, I mean [all] of us, we get along really, really well and we work well as a team." Another student considered teamwork an advantage by saying it would be beneficial to know "how to play well with others." One student found teamwork helpful in her reply to a question about her experiences with this HMO Capstone project by stating that "We lean on each other for wording changes and what's going happen at each step, ideas." Teachers mirrored this sentiment when asked about the advantages of the HMO Capstone project. One teacher replied, "I think the advantage to the student is that you get to work in teams, and I think that's so important." When asked to offer words of wisdom to future students who complete the HMO Capstone project, one teacher replied, "I would emphasize the team skills." It is important to note that the HMO Capstone project requires that students work in teams. These findings suggest that students and teachers recognize the importance of applying collaboration/team building skills to successfully complete the HMO Capstone project.

Verbal and Written Communication Skills
The data collection strategies employed in this study allowed for delineation between verbal and written communication skills. In other parts of the data, communication is referred to in general terms. Since the data refers to communication specifically and some generically, these findings are divided into three categories: 1) verbal communication, 2) written communication, and 3) generic communication. Findings and discussion associated with each category follows.

Verbal Communication Skills
Verbal communication skills emerged several times during discussions with both students and teachers. When asked about advantages to completing the HMO Capstone project, one student mentioned verbal communication by stating that "Public speaking is so dreaded by everybody that the more chances you get to do it when it's not too stressful, the better." One of the teachers concurred by stating an advantage as "The fact that they [the students] have to get up and do the [verbal] presentation. I know that most students absolutely hate that but that's key if they're going to go out in the real world and so [the use of] presentation skills [is an advantage to completing this HMO Capstone project]." Another student referred to verbal communication while gathering information for the project. "For me, once I found out that this what I was going to do,

I was excited and had contact with the chemistry supervisor from University Hospital, from billing specialists from the hospital to find out Medicaid/Medicare numbers." Another student recognized verbal, as well as written, communication skills when asked about HMO Capstone project advantages by stating that:

> In getting information just for cost per test analysis and going to the people that I needed to provide me with that information, they were also providing me with other information that was part of the project and so what we would do is if we found out anything [that] we thought would be helpful or beneficial for the other people in the project, we would call them or e-mail them.

These findings suggest that students utilized verbal communication skills throughout the duration, not just during the presentation portion of the HMO Capstone project.

Written Communication Skills
Evidence of written communication skills was found in the observations and document analysis by looking for clear and understandable words, phrases, and sentences on the presentation slides and documents generated for the HMO Capstone project. For example, one team developed this vision statement for their hospital: To be the first choice for health care through excellent service, compassion, and quality. Another team generated the following mission statement: To ensure that all laboratory equipment and services reflect the appropriate and best technology available. Spelling, grammar, and coherent thoughts were also examined as part of the recognition of written communications in all the documents submitted. Overall, the number of spelling grammatical errors was none to minimal and most of the thoughts were coherent. The comments regarding written communications that were noted upon observation and examination of the documents submitted by one team were as follows, "Only a couple of spelling errors were found. Minimal grammatical errors were found. All thoughts seem to be coherent. The documents were clear and easy to understand."

Generic Communication Skills
The generic answer "communication" surfaced when students were explicitly asked about the skills necessary to complete the HMO Capstone project. One teacher mirrored this thought to the same question by answering, "I think they [the students] learned some very broad communication skills, not just interpersonal." These findings suggest that students used communication skills beyond the obvious verbal and written ones.

Clinical Reasoning Skills
The data collected in this study suggests that students applied clinical reasoning skills to complete the HMO Capstone project for this study. This skill set came out particularly strong in the teacher interviews. When asked specifically about the skills students applied, one teacher, without hesitation, alluded to this skill set by replying, "I think they [the students] learned to gather information and then sort of dwell on it for a little bit and let things sink in." Another teacher specifically mentioned these skills by stating that students applied "the critical thinking skills they [the students] have to do." One of the teachers connected these higher-level thinking skills to the process of developing a presentation by stating, "I think that putting together a presentation and just the presentation in general is using higher level skills." Another teacher emphasized the importance of problem-solving skills by saying, "I think that's the big key, actually problem-solving. The hardest thing to do is to identify the problem. Once you identify it, you can pretty well, with the help of your peers, solve it." It was expected that teachers would identify clinical reasoning skills and as noted by the data presented, they did. This is likely because teachers are cognizant of including clinical reasoning activities in their curricula to help meet medical laboratory science program accreditation standards.

Students identified clinical reasoning only after being prompted to do so. When asked if this HMO Capstone project had something to do with higher-level thinking skills, one student replied, "Yeah, I would say that." Another student immediately recognized this as being "critical thinking." One student disagreed with the fact that this HMO Capstone project promotes higher-level thinking skills by stating, "I don't think its higher, it was just new. They make us think a lot."

Creativity Skills
For the purposes of this study, creativity skills are defined as the ability to identify and include items beyond that which was required to complete the HMO Capstone project. Teams from all three data collection sites exhibited creativity skills by coming up with a plethora of items beyond the following four required ones: 1) laboratory organizational structure chart, 2) a series of cost per test analyses, 3) a list of value-added legal services, and 4) two marketing brochures. For example, one team designed their own hospital slogan stating that it was, as noted in the document analysis notes, a place where technology and professionalism combine for success. This team also developed a flyer for a fictitious website and a

laboratory manual that consisted of important laboratory tests that Cheapskate HMO might order. Each test description included sections on testing method, specimen requirements, proper specimen transport, turnaround time information, test reference intervals, and test result interpretations. Two teams included testimonials in their project product, one team included them in the marketing brochures, and the other team showed video testimonials during the team presentation. Examples of other items included in the project product noted in the observation and document analysis notes consisted of: (a) specially designed cookies, (b) name tags, (c) hospital logos, (d) a t-shirt with the laboratory logo on it, (e) cups, (f) pens, (g) mugs, (h) business cards, (i) a vision statement, (j) a mission statement, (k) accreditation certificates, (1) a list of core values, (m) cost per test options, (n) a sample laboratory requisition form, and (o) a sample advanced beneficiary notice.

Creativity skills surfaced during the student focus group and teacher interviews at all three data collection sites. When asked about the advantages of this project, one student alluded to creativity by stating, "It gets us to think [a] little bit outside of just doing our lab work." Another student replied to this question by simply stating "creativity." When asked the same question, teachers concurred with the students. One teacher responded to this question by saying, "When I saw the CLIA [accreditation] certificate, I was impressed." Another teacher answered this question by saying, "They [the students] had lots of creative ideas." One teacher even specified a creative item her students developed in her response by saying, "One group even has business cards. We didn't even ask them to do that!"

Managerial Skills
Defined as skills required to direct the work and people associated with a laboratory, managerial skills emerged as a theme in the student focus group and one-on-one teacher interviews. Students at all three data collection sites identified managerial skills as among the skills applied to complete the HMO Capstone project. These skills particularly came out when students were asked about the advantages of doing this HMO Capstone project. One student replied, "It helped me realize what some of the managers in the lab really have to do on a daily basis." Two other students at the same site agreed. One of them stated, "I think that honestly it could help prepare one of us for possibly management positions in the future." Two students stated "organization" as an advantage while another student replied "time management" as being an advantage.

Teachers at two of the three data collection sites also identified managerial skills. They tended to connect lectures on the various management topics with the application of the content during the completion of the HMO Capstone project. For example, one teacher stated, "Well, I give them [the students] a cost analysis lecture in the fall, and they definitely used that cost analysis, now they had to put it into play." Teachers identified the importance of organizational skills. In fact, this same teacher commented, "I think one of the things they [the students] learned about was how the laboratory is organized." Two of the teachers simply stated "organizational skills" as their response to the question about skills students applied during the completion of the HMO Capstone project. Two other topics included in managerial skills surfaced in the teacher interviews: prioritization and time management. One teacher commented, "Hopefully it [the project] also serves to teach them [the students] how to utilize their time and that they don't have all the time in the world, so you have to prioritize." Likewise, another teacher stated "a little bit of prioritization" as an advantage to completing the HMO Capstone project. These findings suggest that teachers, along with students as previously mentioned, find value in completing the HMO Capstone project from the standpoint of applying managerial skills.

Research/Investigative Skills
Research/investigative skills refer to those skills necessary to find information in numerous ways. These ways include in-person interviews, phone calls, Internet searching, and online communication. Students mentioned these skills at only one of the data collection sites. When asked to identify skills they applied during the completion of the HMO Capstone project, one student replied, "I'd say some research." Another student agreed by saying, "We just had to do some research and the learning of it." A third student concurred by stating, "We had to go out and find information."

Interestingly, teachers from all three data collection sites mentioned research/investigative skills during their interviews. When asked about the advantages of students completing the HMO Capstone project, one teacher answered the question by stating, "the research skills. It's just amazing what they [the students] came up with." This same teacher cited "research" as a skill students applied to the HMO Capstone project. Another teacher agreed with these comments by stating, "I think they [the students] learned to gather information." A third teacher echoed this sentiment by saying, "I think, if you will, [the students used] investigative skills. They sort of had to go out and figure out who is the best person to talk with."

The theme of research/investigative skills also emerged upon examining the observation and document analysis notes. Teams incorporated research/investigative skills while they were not only completing the required components of the HMO Capstone project but also designing some of the extra creative components. For example, one team incorporated

Medicare/Medicaid reimbursement rates into their presentation. Another team developed a Laboratory Manual that consisted of a list of laboratory tests and relevant information for providers to be aware of as they order laboratory tests. For the students to include these items, they had to do some investigative work.

DISCUSSION

Four quality criteria in the form of skills sets were predicted to emerge during the analysis of data collected for this study which was designed to answer the research question: What skills do individuals (students) apply during the completion of a hypothetical medical laboratory management-based Case by Collaboration capstone project? These identified skill sets are: 1) information technology, 2) collaboration/team building, 3) verbal and written communication, and 4) clinical reasoning. Not only did this research confirm that students applied the four skills considered as quality criteria during the completion of the HMO Capstone project, but three additional skills were identified: (a) creativity, (b) managerial, and (c) research/investigative. These results imply that since the following six skills are generic in nature and when the model is followed, they would be applied by students completing any future Case-by-Collaboration no matter what content or topic it is based upon: (1) information technology, 2) collaboration/team building, 3) verbal and written communication, 4) clinical reasoning, 5) creativity and 6) research/investigative. The seventh skill, managerial, is specific to the HMO Capstone project topic. An implication, based on this finding, is that when the model is followed in the future, discipline-specific skills will be applied during the completion or Case-by-Collaboration projects in addition to the six skills identified in this research. Based on these findings, the model for Case-by-Collaboration was revised to include these two additional skill sets, as illustrated in Figure 3.
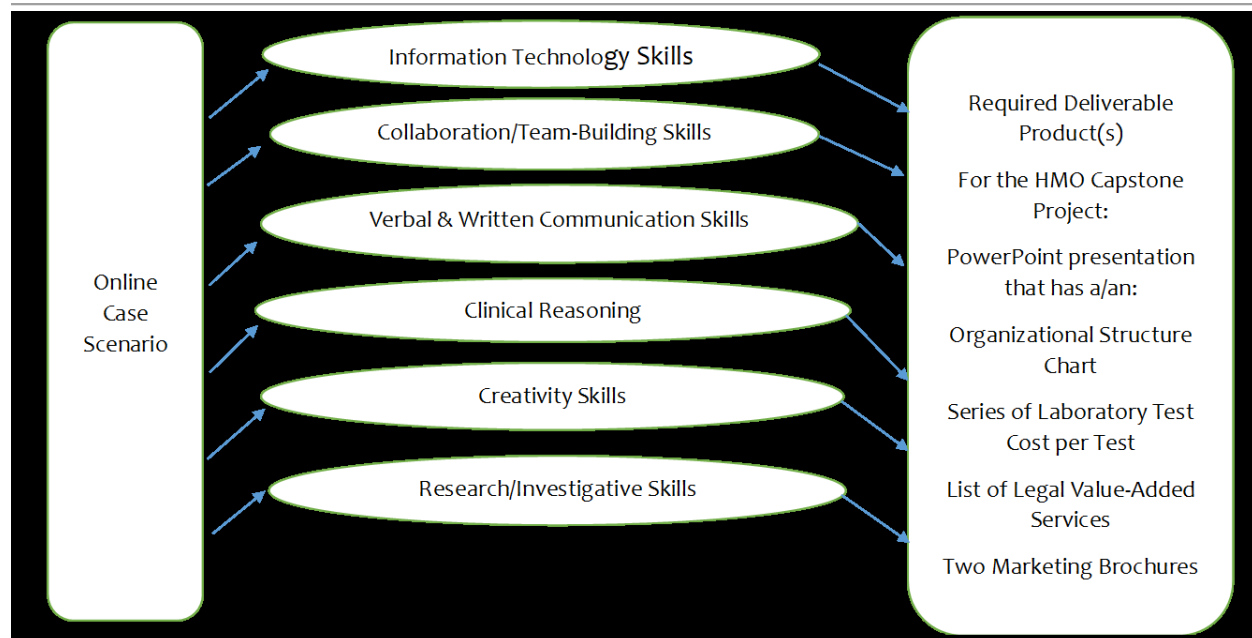
Figure 3. Revised Skills-Based Model for Case-by-Case Collaboration

Information Technology Skills

The results of this study support the recommendation in the literature for the development of new and innovative learning materials that involve information technology skills.[31,32] Case-by-Collaboration allows for students to communicate online with teachers and other students using information technology skills as proposed by Twigg.[31] The incorporation of health information technology skills in healthcare education programs aids in delivering high-quality patient care through the use of electronic health or medical records (EHR or EMR).[33,34] Furthermore, there is a growing need for telemedicine use, yet knowledge is lacking among health care providers.[35] The Case-by-Collaboration model can help students increase their information technology skills through the simulated use of EHR/EMR. Both the use of EHR/EMR and telemedicine can lead to the delivery of positive patient outcomes by enhancing the patient experience by increasing accessibility to health care and health records.

Collaboration/Team Building Skills

The results of this study suggest medical laboratory science programs provide adequate training for students in the areas of collaboration and team building.[36] The literature authored by Clark suggests that creative and innovative opportunities that utilize collaboration/team building are recommended.[37] This research serves as an example of such a creative and innovative model in

which students apply skills in collaboration/team building. Case-by-Collaboration is flexible in terms of its use and may serve as a capstone experience for students.[32] Incorporating other disciplines into the CBC can also increase interprofessional education and interprofessional collaboration among healthcare clinicians. There is an increasing need for collaborative efforts among healthcare specialists using interprofessional practice and collaboration.[38,39] Allowing students to increase collaboration and team building skills can set the foundation to implementing those same practices with other disciplines.

Peer-assisted learning has been shown to be another advantage of incorporating collaboration and team building.[40] Peer-assisted learning can occur in a variety of settings including classroom, clinical experience, and simulation. The benefits of incorporating activities that promote peer-assisted learning include increased skill performance, improvement in self-confidence, comfortability in clinical setting, increases in self-efficacy, and decreased anxiety.[41,42]

Verbal and Written Communication Skills
The HMO Capstone project, an example of the Case-by-Collaboration model, provides an opportunity for students to practice communication skills at a layperson's level.[32] In the HMO Capstone project, students must develop a PowerPoint presentation and associated documents for an audience that likely includes non-medical individuals, namely for Mr. Earl N. Meyer-Flask and the Cheapskate HMO Board of Directors. Coinciding with information technology skills, telemedicine and EHR/EMR are extremely valuable, leading to high patient and provider satisfaction.[35] Verbal and written communication skills are essential factors in the delivery of quality documentation and patient care.

Clinical Reasoning Skills
Clinical reasoning has emerged as a leading emphasis in medical education.[11] Clinical reasoning is displayed through the ability to apply problem-solving and critical thinking to assess a patient's problem and identify a solution for the patient.[10,43] Case-by-Collaboration allows for an opportunity to apply clinical reasoning skills, as evidenced by the results of this study. This new model serves as a vehicle to help students become life-long learners who have the potential of becoming expertise in clinical reasoning.

Clinical reasoning assessment strategies have been difficult to incorporate in healthcare education, especially with new educators.[44] Several methods, including graduated autonomy,[45,46] hypothetic deductive reasoning,[18,47] and case pattern recognition,[48] have been studied. Case-by-collaboration falls in line with case pattern recognition by introducing the students to a new case to evaluate. Many of these strategies to enhance clinical reasoning can come in the forms of case studies, journaling, and role play.[49] To further enhance the experience, incorporating other healthcare are disciplines into the intervention may be warranted.

Creativity Skills
It has been suggested that student creativity skills have been neglected in today's academic education.[50] Creativity is a form of thinking skills that can be developed with proper guidelines, supporting this study's findings.[51] In this study, students were given guidelines in the form of an online case scenario and were guided through a series of instructions to develop a set of products, with creativity being encouraged throughout the process. The findings of Conti and colleagues concur with this study by suggesting that students will become creative when placed in a creative setting.[52] The mastery of the material, no matter what subject, often involves creativity and discovery learning. In such instances, students assume a role.[51,52]

Research/Investigative Skills
Healthcare students utilized evidence-based practice (EBP) to support their learning and identify evidence to support their evaluations or treatments.[53] In this study, students had to use investigative skills to develop the best medical product. Students were presented with a case scenario and were encouraged to ask and answer questions by gathering information and then presenting the final product to their teachers, classmates, and invited guests. The skills required to complete such experiences require students to assume a role, determine a hypothesis (when appropriate), gather information, and present their findings.[53] In the case of the HMO Capstone project, students assumed the role of a laboratory management team vying to win the laboratory services provider contract (this is the hypothesis in this case), gathered information, and verbally presented their findings. The HMO Capstone project afforded the students opportunities similar to those in the healthcare setting, and potentially prepared them for long-term utilization of EBP.

Limitations
There are five limitations associated with this study. First, the selection of the study locations was purposeful based on personal relationships with Medical Laboratory Science Program Directors. As such, there was no attention given to geographic study sites. Second, because of the purposeful locations as opposed to randomly being selected, the data may be biased. Third, students had the option to participate in the study, and thus it was possible that the participant numbers may decrease if students selected not

to participate. Fourth, the number of participants is limited. Finally, Medical Laboratory Science is a specialized discipline, and programs are noted for relatively small class sizes.

Future Directions
The CBC concept can easily be adapted to other disciplines and doing so provides researchers with several avenues of study. In all cases, a case would need to be developed that content specific. One area of research would be writing a case in a creative format, such as a mystery, and conducting a study to see if the same soft skills emerge from the data. Another research opportunity would be to focus on one or two soft skills and perform an in-depth analysis. Researchers could not only identify the soft skills used but determine whether or not these skills are equally weighted as proposed in the CBC Model. Studies that combine writing a case in a creative format along with one of the other opportunities described here could also be done. Conducting additional studies, such as those noted here, would be beneficial in providing additional support for the use and versatility of the CBC Model to showcase the use of soft skills.

CONCLUSIONS
The purpose of this study was to answer the research question: What skills do individuals (students) apply during the completion of a hypothetical medical laboratory management-based Case by Collaboration capstone project? A thorough analysis of the data revealed that students applied all the "Big Four" skills: information technology, collaboration/team building, verbal and written communication, and clinical reasoning. Three additional soft skills were found to be utilized in this study: creativity, managerial, and research/investigative. Upon reflection, managerial skills seem appropriate given the nature of the HMO Capstone Project. It stands to reason the specific soft skills that align with the CBC Project content would be used by the students. These results imply that the remaining six soft skills are transferable and can apply to CBCs independent of the content being studied. Thus, the CBC is an innovative model to teach soft skills across health disciplines.

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