

A Qualitative Analysis of Collaborative Online Learning Module Discussion Groups

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THESIS

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DEDICATION

This thesis is dedicated to my husband, Jon L. Schindler and to my children, Katie, Tommy and Colleen Schindler. They are my big rocks.

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LIST OF ABBREVIATIONS

COLM	Collaborative online learning module
ED-2	Educational objective 2
EBM	Evidence based medicine
LCME	Liaison committee on medical education

SUMMARY

A qualitative study was undertaken to provide a richer understanding of how students engage and learn in a collaborative on line learning environment in order to inform future curriculum planning.

Collaborative online learning modules (COLM) were created using Armstrong's education planning framework, to deliver content in a third year medical school surgery clerkship. (Armstrong and Parsa-Parsi, 2005) The technique of constant comparative analysis associated with grounded theory was used to explore discussion threads from a years' experience with a COLM module to better understand how students learn in this unique environment. Coding was performed in an open and iterative fashion, allowing revision of existing themes and development of new themes until saturation was reached. Just under 2300 discussion group comments were analyzed by two investigators. Focus group data for the same group of students was reviewed as a form of triangulation.

The authors identified three general themes with associated sub-themes: 'students identify learning issues', 'students resolve learning issues' and 'students collaborate'. Students engaged in COLMs consistent with the education framework which guided its development. They tended to limit discussions to lower order learning issues and to focus on solving the case specific problem in the COLM. Students learned in the COLM environment by reflecting on previous experience, identifying learning issues, reasoning out some issues and investigating others. Collaborative learning included social interactions, organizational activities, and

commenting on each others' comments. Collaboration was not always effective in improving learning and at times seemed to reinforce errors.

Findings support Armstrong's planning framework but provide insight for improvements. (Armstrong and Parsa-Parsi, 2005) The authors suggest strategies for future curriculum planners to promote learning and meaningful discussion when planning future COLM. The authors believe that qualitative analysis is a useful method of evaluation and improvement for new curricula.

I. INTRODUCTION

A. **The Study Problem**

As medical school clerkships are shortened and the amount of information to be learned increases, educators are seeking novel strategies to more efficiently teach tomorrow's doctors. More and more frequently, clerkship directors are turning to the web as a new mode of curriculum delivery. On-line discussion groups are one teaching method that has been suggested as an appropriate way to deliver a learner-centered curriculum. Such discussion groups are also potential vehicles for delivering curricula to residents and for continuing medical education. Little is known about how adults learn in this unique environment. A richer understanding of how students engage in this learning environment is needed to guide future educational planning.

B. **Purpose of the Study**

Collaborative on line learning modules (COLM) were created at the Feinberg School of Medicine to provide alternative experiences to achieve clerkship objectives where clinical experience was lacking. COLMs are a method of curriculum delivery which utilize asynchronous discussion groups to solve defined clinical problems. Others have described the use of similar online teaching methods in medical education (Wiecha, et.al, 2003; Gonzalez and Salmoni, 2008; Salmoni and Gonzalez, 2008), but how students actually learn in this collaborative online environment is not well understood. Quantitative measures such as exam scores or satisfaction surveys, using ratings, may provide information about the effectiveness of a program, but such analysis does not optimally guide future development of similar curricula or lend insight about the learning processes engaged in through the COLM curriculum. The purpose of this study was to better understand how students learn in COLMs, using qualitative analysis to

develop a rich understanding of the learning processes. . On-line discussion group discourse was analyzed using the technique of constant comparative analysis associated with grounded theory. (Strauss and Corbin, 1990) The purpose of the analysis was to identify themes related to on-line learning processes, thus leading to a greater understanding of these collaborative learning processes. These themes were then used to suggest guidelines for future COLM curriculum development.

C. **Brief Statement of Need and Significance**

Although this curriculum was introduced in a third year surgery clerkship, the need to supplement clinical experiences exists in all fields of medicine and at the level of medical students, residents, fellows and practicing physicians who must continue learning throughout their careers. This study focused on evaluation of a specific COLM module, but provides insight that may be helpful in planning any online discussion-based curriculum. Results from this study can be used to plan future curricula in surgery and other clinical fields. The flexible nature of this instructional method also makes it a potentially useful method for interdisciplinary education and team training and this study provides important perspectives for designing curricula. Our improved understanding of how students learn in this environment guides how and where this teaching method should be applied in the future.

With the 100 year anniversary of the Flexner report, the Carnegie Foundation has called again for reforms in medical education to address what they describe as two revolutions in academic medicine in the intervening 100 years. (Flexner, 1910; Irby et al., 2010) Those revolutions are the rise of biomedical research and the transformation of clinical practice into

mega-business. The new Carnegie Foundation report highlights the effects of these revolutions and the resulting challenges in educating future physicians. Amongst the contemporary needs and challenges for curriculum reform identified in the report are the lack of learner-centeredness, excessive emphasis on mastery of facts, less and less faculty time to teach, and poor correlation between knowledge and experiential learning. The COLM curriculum was designed as an instructional method with the potential to address these issues. The recommendations from the Carnegie Foundation include flexibility in achieving outcomes, creating opportunities for collaborative learning, and cultivating habits of inquiry and improvement. Thus, this project comes at an important time and has significance in addressing an identified need in medical education. The significance of this work includes the potential for COLM, or similar instructional methods, to be used with other learners. Greater understanding of how students learn in this modern collaborative learning environment should increase the effective use of these methods.

D. **Operational Definition of Terms**

Collaborative Online Learning Modules (COLM): Interactive, on line asynchronous discussion groups developed based on Kolb's learning cycle. (Kolb, 1984) These modules consist of a brief presentation followed by a specific problem presented to a small group of students. Students are expected to utilize the discussion group to collaboratively solve the problem, as well as respond to any additional questions generated by the group.

E. **Review of Relevant Literature**

The Liaison Committee on Medical Education (LCME) Standards for Educational Objectives includes standards relating to learning objectives. (LCME, 2011) Educational Standard 2 (ED-2) requires that each clerkship define learning objectives and then evaluate student experiences to ensure they have adequate experiences to achieve those objectives. In the absence of such experiences, the standard requires that alternative experiences be provided to allow students to achieve objectives. The collaborative on line learning modules that are the focus of this work were designed to achieve this standard and address the larger issue of supplementing clinical experiences in medical professional training programs.

The use of online learning, also referred to as e-learning, computer based learning, web-based learning or a multitude of other terms, has virtually exploded over the last decade. Reasons for this are numerous and include potential advantages related to delivery of information and improved learning outcomes. Advantages related to delivery include the potential to provide content over distances or multiple sites, to standardize content delivered, to update content frequently, and to track use of educational materials. Improved learning, in theory, may occur due to the ability to individualize content, take advantage of multi-media, add links to additional content, provide opportunities for more active and collaborative learning, and give real time feedback. (Ruiz, et al., 2006)

Unfortunately, many online teaching programs may not be effective in achieving these potential advantages. Alur found that most medical teaching websites were not designed to be consistent with principles of learning. (Alur et al., 2002) As numerous authors point out (Ruiz et al., 2006; Alur et al., 2002; Cook and Dupras, 2004; Friedman, 1996), simply putting content

on the web is not likely to result in greater learning. In 2002, Chumley-Jones performed a literature review of the web based learning evaluation literature in medicine, dentistry and nursing. (Chumley-Jones et al., 2002) Specifically, they focused on what facets of web based learning had been evaluated, the evaluation strategies used, and the findings of these studies. Seventy six (76) studies were reviewed. The majority were described as descriptive, leaving only 35 evaluative studies for analysis. While evidence supported knowledge gains in relation to web-based learning, few studies had controls and therefore web-specific benefits could not be determined. Those studies that did have a control, where students focused on identical content in non web-based instruction, showed no difference in knowledge gains between groups. Their conclusion was that web-based delivery of content results in similar but not superior knowledge gain when compared with traditional delivery approaches. When compared to no intervention, web based programs have shown benefits in knowledge gain and confidence (Kemper et al., 2002; Cook et al, 2008).

When studying learner attitudes about web-based instruction, Chumley-Jones found that studies comparing web-based learning to other education methods suggest a preference for web-based learning, but that technical issues tend to be the primary determinant of learner satisfaction. (Chumley-Jones et al., 2002) One study found that instructional method was the only variable predicting favorable evaluation of a course. The author concluded that sound pedagogy was the most important feature regardless of the delivery method. (DeBourgh, 1999)

As a result, several authors have provided guidance for creating online learning programs. Cook suggests adapting Kern's approach to curriculum development for medical

education. (Cook and Dupras, 2004; Kern et al., 1998) He identified ten key steps in the development of a successful web-based learning program. He also enumerated the technical considerations that are important for successful implementation of e- learning, including the development of content in coordination with web design. He stressed the importance of encouraging active learning and attention to the principles of adult learning. (Cook and Dupras, 2004; Kern et al., 1998)

Adult learning principles have been well described. Malcolm Knowles coined the term “androgogy” and described qualities of adult learners that can be used in educational planning. (Atherton, 2005; Imel, 1995; Kaufman, 2003) Adult learners are self directed, use experience as a resource for learning, prefer problem oriented instruction, and are intrinsically motivated. Kolb described the importance of experiential, active learning and the importance of learning in context to increase knowledge acquisition and retention. (Kolb, 1984) He described a four stage ‘learning cycle’ and four learning styles or preferences. Subsequent work has focused on learning styles in medical students and practicing physicians. (Cook, 2005) While some authors have suggested that educators should assess the learning styles of their learners, Armstrong has suggested a different strategy for educators who are providing instruction to groups. (Armstrong and Parsa-Parsi, 2005; Cook, 200x) She describes an educational planning framework that addresses all learning styles, in sequence. This framework was used to develop the Collaborative Learning Modules that are the focus of this project.

On-line learning has previously been described as intended to supplement or, in some cases, replace clinical experiences. (Chumley-Jones et al., 2002; Wiecha et al., 2003; Wiecha and

Barrie, 2002; Leong et al., 2003; Mehta et al., 1998). Wiecha described a study using a web-based bulletin board to teach communication skills to first year medical students. He found that students rated the course positively and reported increased understanding of course concepts.

Though this was a case study involving only nine students, his qualitative analysis supported the themes of superior concept acquisition and a recognized benefit of the online teaching method when compared to face to face teaching. (Wiecha et al., 2003).

Chumley-Jones', in their review of the literature, examined published studies involving asynchronous discussion groups as a mode of online learning, but the authors determined there was insufficient evidence to determine effects.(Chumley-Jones et al., 2002)

Evaluation of online learning, using quantitative methods, may not capture all of the benefits (or problems) associated with these methods of instruction. Furthermore, quantitative outcomes, such as test scores, alone frequently do not provide enough information to guide future curricular planning. Few qualitative studies have been used to examine these instructional methods. A recent meta-analysis revealed only 56 qualitative studies of Internet based learning in medical education up to 2006, and only 2 and 16 studies in 1996 and 2001, respectively. (Cook et al., 2008) As the use of these methods expands, this study will be a significant contribution to the literature.

Collaborative learning is based on the assumption that learning takes place in a social context. This can be accomplished in a variety of ways including group discussions, problem solving as a group, creating products or performing tasks in groups. There is a comprehensive

literature in the field of collaborative learning which is based on several learning theories, including Koftka's social interdependence theory and the cognitive development theory of Piaget. (Yates, 2006) Johnson performed a meta-analysis of cooperative learning literature, reviewing over 900 articles. One hundred and sixty four (164) studies were identified which evaluated the impact of a specific method of cooperative learning on student achievement. Johnson found that all methods of cooperative learning improved student achievement when compared to competitive or individualistic learning. Johnson did note, however, that only about a quarter of these were studies involving adult learners. (Johnson et al., 2000) Johnson concluded that educators can feel confident in using cooperative learning methods to improve learning outcomes.

Thus, in addition to applying the adult learning principles of active learning, using prior experience and learning in a context, the COLM intervention was planned around a collaborative learning approach. The primary focus of this study was to further evaluate *how* students learn in this environment. There have been numerous studies describing collaborative on-line learning in medicine. (Kemper et al., 2002; Wiecha et al., 2003; Curran-Smith and Best, 2004; Romanov and Nevgi, 2007; Wiecha et al., 2002; Salmoni and Gonzalez, 2008; Gonzalez and Salmoni, 2008) Several of these studies focused on on-line discussion groups. Wiecha has discussed this as a new approach to continuing medical education (CME) and suggested that online learning discussion groups were well accepted by learners and resulted in changes in behavior of participants. (Wiecha and Barrie, 2002) As noted above, he also utilized this approach to teach medical students interviewing skills. (Wiecha et al., 2003) He performed an analysis of student discussions; however, this was a very small study and most likely did not reach saturation.

Curran-Smith utilized a discussion group on line learning environment to introduce a change in practice to Emergency Room physicians, with some success. (Curran-Smith and Best, 2004)

Curtis and Lawson have described qualitative analysis of discussion groups in a Bachelor of Education curriculum utilizing collaborative behavior codes described by Johnson and Johnson. (Curtis and Lawson, 2001; Johnson and Johnson, 1996). Johnson and Johnson described the collaborative behaviors of planning, contributing, seeking input, reflecting and social interaction. They described subcategory behaviors within each of these behavior categories as well. (Johnson and Johnson, 1996) Although we considered using these behaviors and subcategories to code our data, we found they did not entirely fit the data set and choose to create our own codes. No qualitative study of on line discussion groups, using numbers large enough to reach saturation, was found in the medical education literature.

As stated above, qualitative methods have been used infrequently in the surgical education literature and can be poorly understood by those not familiar with these methods. (Tavakol et al., 2006) They are felt by some to be less scientific than quantitative methods. (Colliver and Verhulst, 1996) A well designed and implemented qualitative analysis of collaborative on line learning in medicine will add significantly to the surgical education literature, to our understanding of this method of teaching and learning, and to our understanding of the value of qualitative methods when conducted with appropriate rigor. (Harris, 2002, Strauss and Corbin, 1990, Glaser and Strauss, 1967) An improved understanding of how students learn and participate in this unique setting will not be captured by quantitative data alone. Future educational planning will benefit from a more in depth understanding of how COLMs function

and how students interact within COLMs. This study will add to the literature by utilizing appropriate methods to analyze qualitative data from a large group of online discussions held over a one year period. No study of similar proportion was identified in the medical education literature to date.

II. METHOD

A. Design

The constant comparative method associated with grounded theory was used to analyze discussion threads from a years' experience with a COLM module to better understand how students learn in this unique environment. Pilot data analysis previously performed (Schindler 2006, unpublished data) was used to guide initial coding. This coding was performed in an open and iterative fashion, allowing revision of existing themes and development of new themes. Since the data was retrospectively analyzed, member checking was not possible, but analysis of focus group data for the same group of students was used as a form of triangulation.

Two researchers independently evaluated discussion threads. Codes were initially identified based on pilot COLM analysis. The two investigators analyzed the comments for the first quarter to identify themes and then reviewed the themes and discussed appropriateness of the previously identified themes and new themes. Based on this analysis, new themes were identified and these were then utilized by both investigators to analyze the second quarter of data. The same process was repeated and revised themes were then utilized to analyze comments for the third and fourth quarter. Upon completion of the fourth quarter analysis and discussion, and analysis, a final set of themes was identified. These themes were then utilized to re-analyze the entire data set from summer to spring. Any final discrepancies in analysis were discussed until consensus was reached. Themes were identified through this process of constant comparative analysis. Inter-rater reliability was examined following the final analysis by the two investigators. Quantitative analysis included measurement of inter-rater reliability and frequency of each specific themes and sub-theme in the data set. Qualitative analysis resulted in a

framework describing the data set and allowing formation of recommendations for the future. Examples of comments representing themes and sub-themes were identified to assist with description of the data.

B. **Description of Study Setting and Subjects**

This study examined discussion groups from a 12 week multi-specialty surgery clerkship at a large private medical school. All students in the third year surgery clerkship participate in an online learning module as part of their standard course work and have done so since 2008. Students were told that the modules count only towards their clerkship participation grade, but that they would otherwise not be graded on this module. They were told that faculty would read and moderate the discussion threads. Over the course of one year, 4 separate clerkships, with an average of 40 students per clerkship participated, for a total of 166 students. The students were assigned to groups of 5-7 students which remained intact for the entire two week COLM. This yielded 54 separate discussion group threads for analysis (27 from each week).

C. **Description of Module**

A full description of COLM development is presented as Addendum A. For the purposes of this study, comments in discussion groups from a pilot COLM module were analyzed. The Blackboard course management system was used as a platform for the discussion groups. The pilot COLM module was developed to address the most common clerkship learning objective for which clinical experiences were not available for students during the surgery clerkship: writing admission orders. The two week module consists of four components: a brief PowerPoint module; a digitally recorded focused history and physical exam, Discussion Forum A and

Discussion Forum B. The PowerPoint module introduces a mnemonic for writing admission orders followed by a quiz. The digitally recorded focused history and physical exam is with a patient who has diverticulitis. At the end of the video, students are charged with a task – to write admission orders for the patient. For Discussion Forum A, students are assigned to an asynchronous, on-line discussion group of five-seven students. Each student is instructed to post their own sets of orders and to then discuss any challenging management issues or discrepancies with the group. At the end of the week, one member of each group must then submit, on the group's behalf, a complete set of orders. Students are encouraged to use an evidence based approach to management of the problem and to answer any questions that come up in the course of discussion. They are encouraged to raise any issues or concerns with their group for discussion. For Discussion Forum B, during the second week, the students are given another case (a patient with a venous stasis ulcer) and are asked to repeat the admission orders task. The discussion threads from each group's Forum A and Forum B discussions were available for analysis.

D. Data Collection

Data proposed for analysis was collected as part of routine student assessment and clerkship evaluation. All data was de-identified prior to analysis and student names were replaced with unique identifiers. Institutional review board exemption was obtained prior to data analysis at the institution where the student clerkship took place. The institutional review board at the University of Illinois at Chicago deemed the study of de-identified data as not human subjects' research.

E. **Data Analysis**

The comments from an initial set of pilot COLM discussion groups were analyzed as part of a previous project (Schindler 2006, unpublished data). Subsequently the COLM modules were instituted as a standard part of the surgery clerkship. The discussion threads for an entire year of COLM modules are the data set analyzed in this study.

1. **Quantitative analysis**

Quantitative analysis was performed on the entire data set, analyzed using the final themes/codes

Inter-rater reliability (Krippendorff's Alpha) (Hayes, 2007) for the two investigators that independently coded the data was calculated. Any remaining discrepancies were resolved through discussion until consensus was reached. A comment was allowed to be classified in more than one theme when both investigators felt that this was appropriate.

The themes were then analyzed to determine the distribution of comments related to each of the main themes: Identifying Learning Issues, Resolving Identified Learning Issues, and Collaborative Learning.

Within themes, frequency of sub-themes was also determined. The quantitative contributions of individual students were also calculated by determining the mean and median number of comments per student as well as the range.

2. **Qualitative analysis**

A full description of the initial COLM pilot analysis is attached as Appendix B. In the previous analysis, the principal investigator sought to identify recurrent themes within the data, both within and across discussion groups. Through this process,

themes were identified, revised, collapsed and expanded until the investigator felt that the themes accurately represented the data from the pilot study. Themes identified in the pilot study were used as a starting point for the coding in this analysis. Themes from the initial discussion group included Experience, Identifying Problems', 'Solving Problems', and 'Non-contributor'.

For the current study, discussion threads for the entire year's data were divided into summer, fall, winter and spring quarters. On-line discussion group threads were printed and de-identified for analysis. The threads were broken into individual comments by the primary researcher. Comments were numbered sequentially from 1-2302 beginning with summer quarter and ending with spring. Each comment had a unique number which was the primary unit of analysis. In addition, the source of the comment was recorded (with each student having a unique identifier), as was the group number and quarter to which it belonged. Researchers began by analyzing the first quarter threads (summer). Each comment was coded using the themes, with associated labels (codes) developed in the pilot study analysis and adding the option for new themes. When a comment could be classified with more than one code, multiple codes were recorded. After completing the analysis of the summer comments, the investigator and co-investigator met to discuss the themes. At this time the initial set of themes were revised. New themes were added in an attempt to sort out comments within each of the previously developed themes and there was discussion between the two investigators to reach consensus. The fall quarter discussions were then analyzing using the new set of themes. Again, the investigators met to discuss the themes. It became evident that the major themes centered on how the

students approached the problem of identifying learning issues, how they attempted to solve the learning issues, and how they worked or did not work together in this environment. The investigators then reduced the number of themes to 11 with the option to further analyze the comments once they were classified or categorized into these themes. After analyzing the discussion for winter and spring using the final set of themes, no new themes were identified and the investigators were satisfied that saturation had been reached.

Two investigators then used the final set of themes to independently analyze the full data set. Results were compared and where there were discrepancies, they were resolved by discussion between the coders at a final meeting so that each comment was assigned a single code (or set of codes if the comment fit more than one code) that was agreed on by both investigators. At this meeting a final discussion about the themes and sub-themes took place and a framework was developed to describe the data.

3. **Focus groups**

Focus groups were conducted at the end of each COLM by a clerkship coordinator who did not participate in any evaluation of the students. Comments were audio recorded and then transcribed and participants were de-identified on the transcripts. Only the person conducting the focus group had access to the tapes, in order to maintain student anonymity and a free discussion in the focus groups. Printed focus group transcripts were analyzed by the primary investigator as a method of triangulation to see if they supported the identified thematic framework or if they suggested any new themes not seen in our data set.

III. RESULTS

A. Quantitative Results

One hundred and sixty six (166) students were assigned to COLM modules in 54 groups. The discussion threads had a total of 2282 comments (a number of duplicate comments were removed from the initial 2302) for a mean number of comments per group and per student of 42 and 14, respectively. The range of comments per student was 0 to 49. The initial posting of orders was completed by all students. The orders themselves were not included as comments unless the student added a comment to the order. Five students contributed no comments to the discussion groups. The median number of comments per student was ten.

The relative proportions of comments relating to each theme are included in the discussion of the qualitative results. The majority (50%) of the comments were related to resolving identified learning issues.

As noted above, two investigators independently coded the entire data set using the final set of codes. The inter rater reliability was calculated using Krippendorff's Alpha. Krippendorff's Alpha is a measure for assessing the agreement achieved when multiple raters describe a set of objects of analysis in terms of the values of a variable. For the two investigators was Krippendorff's Alpha = 0.9220. Remaining differences were adjudicated by discussion such that each comment was assigned a final code (or set of codes if more than one code was needed to describe the comment) agreed on by both investigators.

B. Qualitative Results

1. Conceptual framework

Initial analysis of pilot data resulted in 13 themes which had some consistency with Armstrong's planning framework. Subsequent data analysis and discussion resulted in initial expansion (to 20) and subsequent contraction of themes such that the final set of themes contained 11 themes. The final eleven themes are listed in Table 1.

FINAL THEMES
1. IDENTIFY LEARNING ISSUES 2. REFLECT ON OWN EXPERIENCE 3. ASK ANOTHER PROVIDER 4. RESOLVE LEARNING ISSUE WITH NO EXPLANATION 5. USE REASONING TO RESOLVE LEARNING ISSUE 6. LOOKED FOR EVIDENCE BUT NONE FOUND 7. LOOKED FOR EVIDENCE WTH NO SOURCE MENTIONED 8. RESOLVED LEARNING ISSUE WITH EVIDENCE FROM LITERATURE 9. SOCIAL COMMENT 10. COMMENT ON ANOTHER STUDENT'S COMMENT 11. ORGANIZING LOGISTICS

Table 1: Final themes

A final set of three major themes was identified and a framework developed to explain what the investigators learned about how students learn using COLM (Figure 1). The three major themes included in the framework of how students learn using COLM included: 'students identify learning issues' (one theme), 'students resolve identified learning issues (seven sub-themes), and 'students collaborate' (three sub-themes). The distribution of comments was as follows:

Students identify learning issues. (25% of total comments)

Students resolve identified learning issues. (50% of total comments)

Students collaborate (24% of total comments)

These major themes were felt to encompass the important information identified in the data, and to be useful in planning future on-line curricula. The remainder of the analysis will address each major theme and how it can inform future curriculum planning.

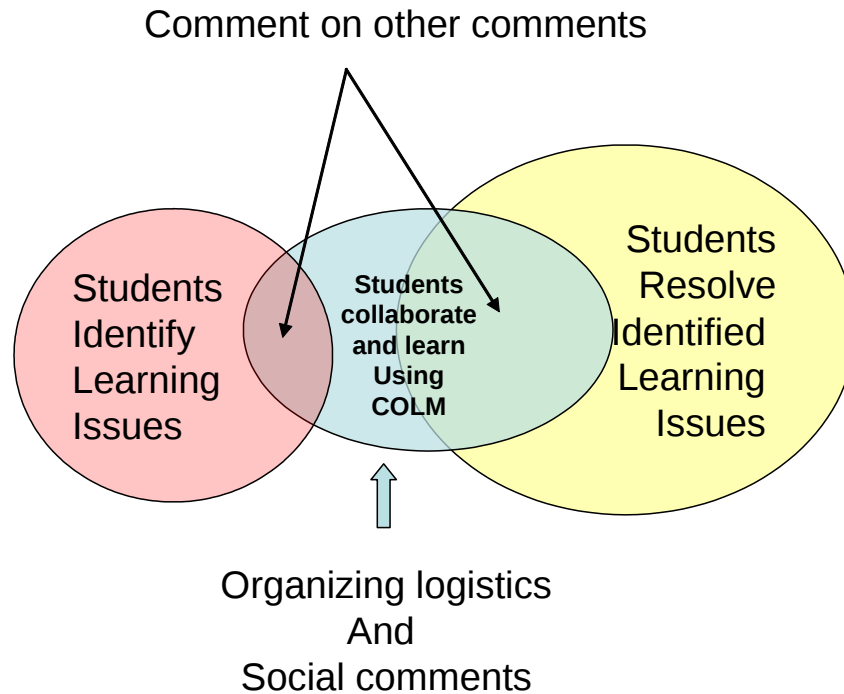


Figure 1: Framework for how students learn using collaborative online learning modules

a. Students identify learning issues

The final data set included a subset of comments called ‘identifying learning issues’. This comment set included comments that identified issues that were unknown or confusing, or that students disagreed upon. Those comments were then further analyzed by the primary investigator and discussed with the co-investigator. Of the 2282 comments, 27 % were coded as ‘identifying learning issues’. This significant percentage of comments not surprising given that the students were instructed to identify areas of uncertainty. In looking at the specific learning issues identified, they crossed the spectrum of content and included issues related to diagnosis, evaluation and management. A surprisingly high proportion of the student discussion focused on lower order learning issues rather than higher order issues such as clinical

reasoning. Specific examples would be “We don’t know his dose of atenolol,” or “Do you need to write an order for serial exams or do you just do them?” There were a number of issues that clearly were factual knowledge deficits. The module was helpful in identifying gaps in factual knowledge for the students. Many of the same simple fact-related questions came up again and again

A modest proportion of comments in the area of uncertainty included higher order learning issues such as identifying questions of clinical decision making. Examples include: “Are antibiotics needed here?”, “Should the patient be taken off aspirin if he might need surgery?”, and “Should the patient be NPO?” Students were able to identify areas of confusion in clinical decision making and seemed to be able to articulate their questions well. They often stated what they did know and what they did not know or understand. An interesting finding was that almost all of these identified issues were case specific. For example, students would ask “Does this patient need antibiotics?” rather than “When are antibiotics indicated for a leg ulcer?” Only rarely did students identify a more general learning issue. As a result, their strategy for learning was not often designed to generalize learning beyond the case at hand.

b. Students resolve their identified learning issues

Approximately 54% of comments were coded with ‘resolving learning issues’ codes that were further divided by the students’ approach to solving the problem. Student approaches ranged from reflecting on their own experience, asking another provider, using reasoning or common sense, and looking to the literature for evidence. Occasionally they would state an answer with no reason given. The proportion of each approach is reflected in Figure 2.

As is evident, students tended to rely more on reasoning and ‘common sense’ than looking for evidence to support their answer to the learning issue. Sometimes this was appropriate, but at times, their reasoning led to a conclusion that was contrary to available evidence. For example, one student commented, "I still think heparin is reasonable given her past history of a DVT and the worry that this ulcer could be a result of another DVT or venous stasis." Although the student thought it was ‘reasonable’ to start heparin, there are actually evidence based guidelines available and this patient did not have an indication for heparin.

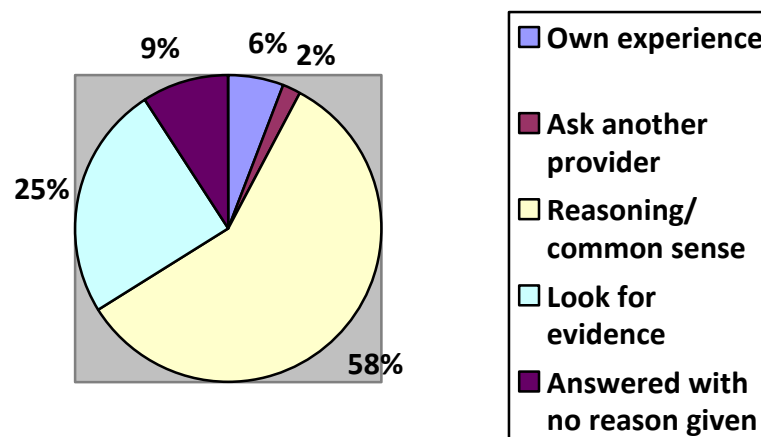


Figure 2: Distribution of comments reflecting approach to resolving identified learning issues==

Comments supported students’ tendency to trust their own experience to make decisions even when their experience was quite limited or not clearly evidence based. For example, a student commented, “We use dilauded on my service, so I would give him dilauded

for pain”. They occasionally asked a resident or faculty member about an issue they did not understand. This was not prohibited in their instructions. It was clear that they have complete trust in the providers they interact with. For example, a student said, “I ran this scenario by my team, and they think it's definitely an abscess”. In fact, the patient did not have an abscess.

Students did seek evidence to support clinical decision making about 25% of the time when trying to resolve a learning issue. They were most likely to try to answer case specific clinical question, rather than using the literature to try to address a very general learning issue. In some cases they identified a specific paper describing a patient that was like the one in the case presented. In other cases they went to guidelines or reviews, but extracted only the case specific recommendation rather than trying to learn a principle to apply to future cases.

When seeking evidence to solve learning issues, the students went to a variety of sources. The most commonly identified sources were Up to Date, Cocharane Review, and reference manuals, followed by specific papers in refereed journals. There were few discussions about the quality or appropriateness of an identified source. Students did occasionally choose inappropriate sources such as Wikipedia or a poorly designed or non-applicable study.

c. Students collaborate and learn using COLM

The final set of themes included a variety of types of collaboration. In total, about 23% of the total comments codes included some type of student collaboration. This

included for 'organizing logistics', 'comment on another comment', and 'social comments', all of which were considered part of the collaborative learning theme.

It was clear that some students took the lead to organize other students: either by engaging in a discussion about how to tackle the problem, doling out assignments, or summarizing all student comments and areas of discrepancy. These skills were essential to facilitate learning with and from each other. Students were able to do this quite effectively and displayed skills in ensuring that their colleagues contributed to the workload.

On occasion, the collaborative process hindered learning. For example, a student comment read "'Do we need to get both a blood culture and a wound culture? For now, I put both up there because most of you guys did. Of course, I still have no idea if this is the right way to do it.'" In such cases, students settled on consensus rather than pursuing a correct answer based on evidence.

The most truly collaborative learning was evident when students commented on each others posts. These comments could be simple concurrence with a colleague, but also included thoughtful questioning about why a student suggested a particular answer. This was then often followed by equally thoughtful explanation. For example, after evaluating conflicting recommendations on diet, one student commented "Our recs on diet are great, because one of the other things I found on diet was how important it is to supplement and encourage it in situations of poor perfusion, because that would only decrease oxygenation to tissue further for a patient to be malnourished". It was in these discussions that students truly seemed to be teaching and learning from each other.

There were also comments that served primarily social purposes. At times they were amusing, often encouraging, and only rarely inappropriate. Social comments did seem to engage the group in the learning process. There were few students who used these social comments as their primary (or in some cases only) contribution and there were five students in total who did not contribute any comments to the discussion thread.

2. Focus groups

The analysis of discussion group transcripts was done retrospectively and the data was de-identified so member checking was not possible. As a method of triangulation, the primary investigator did analyze four focus group transcripts.

The focus groups were conducted after each quarter with a convenience sample of 5-7 students per quarter. The facilitator was a clerkship coordinator and the focus groups were transcribed such that they were completely de-identified. The facilitator conducted these focus groups as part of program evaluation, but many of the questions provided information which allowed for triangulation.

Students were asked about how their group approached the tasks for the module, how they identified learning issues, and how they worked together as a group.

Students confirmed that they did identify learning issues by trying to write the admission orders and identify areas of uncertainty. They also identified additional learning issues when members of the group came up with different answers for their admission orders. A student commented, “One of our group members basically looked over everyone’s admission orders after everyone handed them in

and said “Ok, here is what we agree on and here is what we don’t agree on,” and we would discuss the things we didn’t agree on. Everyone commented on what we didn’t agree on and argued for why they wrote what they did and backed it up.” When asked about resolving discrepancies or finding answers to their learning issues, analysis of the focus group transcripts identified each of the approaches that were identified in this study: reflecting on their own experience, consulting another, more experienced provider, looking for evidence, and just using common sense. For example, one student said about personal experience, “If we’ve seen a resident use it here then we decided to use it.”. Another said “Some people went to their resident or preceptor.” The focus groups confirmed that some students went to the literature for evidence, considered a variety of sources, and even discussed the quality of their sources. A student commented, “In the end, I guess we all weighed each source and what each person had to say to come up with the best thing.” Others confirmed that at times, the students did not search for the best answer. A student commented, “I don’t think I used what we learned in IDM (Introduction to Clinical Decision Making). It is basically common sense. You have to use some decent reputable source, not some housewife’s opinion.” The students confirmed using sources ranging from textbooks to Google to Up to Date.

Analysis of student focus group discussion demonstrated that students valued the opportunity to learn collaboratively. For example, a student commented, “It kept me a little more honest in terms of if I disagreed with somebody I needed to give them some kind of reason why I thought they were wrong as opposed to just

moving on with my life. In some sense the collaboration helped me figure out why I was doing what I was doing.” The focus groups varied in how they described the collaborative learning. Some groups described dividing up work and reporting back. Others reported having the entire group work on all the learning issues and try to find evidence to support their answer. The students recognized the value of skillful organizers. A student commented, “No one was assigned that task; people took it on themselves which ended up working out fine. People seemed to automatically step into the roles they were most comfortable in.” Most groups reported that they did collaborate but that some members contributed less than others.

Students complained about some of the technical aspects of the module, but appreciated the social aspects of collaboration. A student commented, “I thought it was the only way to get together with our crazy schedules. It felt more engaging (than lecture) as well. It holds your attention more.”

The focus group transcripts also provided some insight for future planning. Students recognized their inexperience and lack of confidence with clinical decision making. While a set of ‘correct’ orders were posted after their orders were due, students wanted feedback on their groups’ admission orders. They recognized that sometimes there can be more than one correct answer and they wanted to know if their answers were also correct and if not, why. A student commented, “In the end when you read the master answer key, your answers may still be different, but you had no opportunity to figure out why they are different or if your answer is completely wrong or partially wrong. Is it possible to have

the groups meet with a clinician at the end of class on a Friday afternoon? I feel like I came out of the entire experience feeling like I now know how to type up an admission order and I know how to look up stuff that I knew how to look up before, but I didn't learn how to go about making clinical decisions, so that would've been helpful.”

IV. DISCUSSION AND CONCLUSIONS

Collaborative online learning modules (COLM) were developed to achieve learning objectives in content areas where clinical experiences were lacking. This study elucidates how students learn using these modules. The themes that were identified in the discussion groups revealed that students are able to identify learning issues and employ varying strategies to try to resolve these issues. Strategies employed by students vary, with some being more appropriate and effective than others. Students were able to successfully collaborate to solve clinical problems and to identify and resolve learning issues.

A. Relationship with Armstrong's Model

The COLM modules were designed based on Armstrong's recommendations for educational planning, an adaptation of the KOLB learning cycle. (Armstrong and Parsa-Parsi, 2005; Kolb, 1984) Armstrong provided recommendations for educational planning and suggests that students should go through the stages of Kolb's learning cycle, in sequence, to optimize learning for multiple learning styles.(Armstrong and Parsa-Parsi, 2005) The themes and subthemes that were identified in this analysis suggest that the discussion forums, as implemented, actually were consistent with the recommendations in Armstrong model. The

authors question, however, how successfully the students navigated each of Armstrong's stages. The sub-theme of 'reflecting on own experience' in this study is consistent with Armstrong's 'Activate Prior Knowledge'. Students were not instructed to discuss their own previous experience, but clearly brought their clinical experiences into the discussion when relevant. Unfortunately, students sometimes were content to rely on their clinical experience rather than seek evidence to solve a problem. In those cases they did not seem to progress fully through the cycle. The theme of 'students identify learning issues' is consistent with Armstrong's category 'Developing New Concepts'. Students identified their own learning issues and were able, part of the time, to try to develop generalized understanding or principles that could be applied to future problems. Students tend to focus on case specific issues and would benefit from broadening their new concepts to future problems by generalizing the learning issue. Armstrong's third recommendation related to 'Testing Hypotheses'. Students participating in COLM were able to evaluate their own answers by consulting the literature and reasoning out the answers with their colleagues. When done well, this is one of the benefits of the collaborative process. One negative aspect of the collaborative process was seen when students tested their hypotheses with each other and allowed consensus to bring them to a faulty conclusion. Students were provided with correct answers to compare to their final answers at the end of each module. This feedback was intended to allow them to close the loop and begin again, applying what they learned in Week One to the work in Week Two. Students did not demonstrate this action in the modules and in fact denied reading the instructors' comments during the focus groups. As such, they did not integrate the new knowledge into their 'prior knowledge' for the second week. One recommendation for curriculum planners is to schedule a review session after completion of a

module. This would allow students to apply their new knowledge in the second week module, in what Armstrong describes as “Synthesis and Extension”.

B. Collaborative Learning

The investigators were interested in the entire process of how students learn using COLM, including but not limited to, how they collaborate. Johnson and Johnson have described behaviors seen in collaborative learning and Curtis and Lawson found that many of these behaviors are also seen in online collaborative learning.(Johnson and Johnson, 1996, Curtis and Lawson, 2001) Although the authors considered applying Curtis and Lawson’s published coding scheme in this analysis, the codes did not adequately describe several important aspects of COLM. The authors sought to understand how students approach learning in this environment and not only how they collaborate. As analysis of comments progressed, it became clear that an important issue for these modules relates to how students approach resolving learning issues, including how they identify resources. As such, Johnson and Johnson’s ‘contributing’ codes (help giving, feedback, exchanging resources, sharing knowledge, challenging others, and explaining or elaborating) failed to describe the students’ learning strategies adequately.(Johnson and Johnson, 1996) The authors, therefore, formulated themes that would encompass sub-themes corresponding to their approach to ‘resolving learning issues’ (using prior experience, seeking help from another provider, reasoning out the answer, going to the literature). ‘Reasoning out the answer’ was one of the most common approaches used by students to resolve learning issues. This fits most closely with Johnson and Johnson’s theme ‘explaining’. The authors felt there was a substantial and important difference that required a specific theme. In explaining, students are described as supporting their own position. The theme, ‘Reasoning out

the Answer', was intended to capture the fact that students were using reasoning *rather than data* to come to a conclusion. At times their reasoning was accurate and at times it was flawed.

While reasoning can be an appropriate strategy, in some cases evidence would have provided a better solution to the problem. The authors felt this was an important area to consider in future COLM development. Students would benefit from more instruction and practice in determining when reasoning is appropriate and when evidence should be sought. Similarly, students should be cautioned about relying on anecdotal experience or other providers who may not base their practices on evidence.

Some collaborative behaviors, such as 'organizing logistics' and 'social comments', seen in this study correspond well with those described by Johnson and Johnson as 'planning' and 'social interactions.'

C. **Implications for Future Curriculum Planners**

Lessons learned from this study suggest strategies for curriculum planners to use to promote more effective strategies for the learners. The module, as designed, was effective in achieving the desired goals of identifying learning issues, but students would benefit from focusing on more complex learning issues and spending less time on purely factual gaps in knowledge. Strategies could be implemented to minimize the time spent on simple issues. Students would further benefit from defining broader learning issues that could be applied to future cases. The discussion groups did demonstrate that students participating in COLM can utilize appropriate collaboration and evidenced based strategies to solve clinical problems. The analysis also demonstrated that they often default to less robust strategies such as relying on common sense, or on previous (sometimes inappropriate) experience or advice of other

providers. They also sometimes fail to identify appropriate sources for guidance. Despite a fairly robust curriculum on evidence based medicine, students tended to quote easily accessible sources with little discussion of the quality of the evidence they provided. While the argument could be made that these students were very busy on their clinical clerkships and therefore sought to find the answer most expediently, this approach actually simulates the conditions of a busy clinical practice quite well. The authors were left to wonder: If students don't examine the quality of the evidence when participating in monitored discussions in close proximity to their EBM curriculum, will they do it when they are actually in practice? Future curriculum planning should encourage more consistent application of evidence based medicine.

There is always a risk in group work that someone will fail to contribute. Some students are more intrinsically motivated and curious than others and this is likely to impact how students engage in these modules. In this study students were graded only for participation and quality of contributions were not considered. In the future, grading rubrics could be considered to provide some external motivation for quality contributions from all students.

As a result of this study, the authors suggest the following strategies for future COLM curriculum planners include:

1. *Encourage students to broaden the learning issue* such that the learning will apply to future cases as well as the case at hand. For example, rather than trying to find out if this particular case has an indication for DVT prophylaxis, the learning issue might be to define appropriate indications and dosing for DVT prophylaxis after surgery or to develop an algorithm for DVT prophylaxis.
2. Require that students not only submit an 'answer' to the case, but also *have students explain their decision making process*. This will encourage students to

apply evidence based strategies and rely less on pure reasoning, devoid of empirical evidence, or common sense.

3. *Pilot each case* and review student discussions to identify unanticipated knowledge deficits (lower order facts that simply need to be remembered) and then *incorporate the factual knowledge deficits into the initial didactic portion* (in this case the power point and quiz). This will allow student discussions to focus on the more challenging clinical issues.
4. *Plan a review session* at the completion of each module to allow a faculty facilitator to review the case and the correct answers and to address any specific student questions.
5. *Consider peer grading of participation and teamwork* to encourage desired collaborative actions.
6. *Discuss various sources of information* (own experience, colleagues, reasoning, literature) *and their appropriate application to clinical decision making.*

STRATEGIES FOR CURRICULUM PLANNERS USING COLM
1. Encourage students to broaden learning issues. 2. Require students to explain their decision making process. 3. Pilot each case and then include unexpected knowledge deficits in the didactic phase. 4. Plan a live review session or chat at the completion of the module. 5. Consider peer grading of participation and teamwork. 6. Discuss sources of information and their appropriate application to clinical decision making.

Table 2: Strategies for curriculum planners using COLM

D. **Study Limitations**

This study has offered insight into how students learn in the collaborative on- line environment but it clearly has some limitations. The study examined the discussion threads from only a single COLM module at one institution and some findings may be content or institution specific. Member checking was not possible as this was a retrospective study; however focus group analysis did seem to confirm the themes and framework identified in this analysis. Despite these limitations, the author believes that the findings are useful for curriculum planners utilizing on-line discussion groups in varied clinical settings and for a variety of learners at different levels. Future analysis will examine the effectiveness of the proposed strategies for curriculum planning.

APPENDICIES

Appendix 1: Full Description of COLM Development

Kern's six-step approach to curriculum development for medical education, with attention to modifications suggested by Cook, was utilized in developing the COLM (Kern, 1998, Cook, 2004)

Step One: Problem Identification: All students graduating from medical school need a basic level of understanding of surgical problems and diseases, regardless of their chosen field.

Through our student logs, we have identified the problem that all students do not currently have sufficient patient experiences to achieve the objectives adequately.

Step Two: Needs of Targeted learners: Further refinement of needs was based on evaluation of log data identifying those objectives for which experiences are frequently not available in the current clerkship. Based on log data, we identified writing Admission Orders as one objective that many students did not achieve. This was chosen as the content area for the first COLM. Students in the clerkship already have computer skills and familiarity with the Blackboard program, which facilitated successful introduction of the first COLM.

Step Three: Goals and Objectives: Goals and objectives will be developed for each on-line COLM case. In addition to content related objectives, we endeavored to include the competency based objectives developed by the medical school when creating these specific case goals and objectives. For example, utilizing evidence based medicine is suggested for each module. This addresses the Feinberg SOM competency of Continuous Learning and Quality Improvement.

Step Four: Educational Strategies:

Instructional Method: Blackboard (a web based learning system) is used to support on line discussion groups which focus on real-life, case-based problems. Cases begin with a video clip of a patient history and physical exam, to be viewed on-line. This video segment allows the students to see an expert physician take the patient's history and perform an appropriate, focused exam based on the patient's chief complaint. The case is followed by case goals and objectives, instructions to the group, and questions to facilitate the group discussion to assist students in achieving the goals and objectives. Students are asked specifically to support their answers with literature and to discuss the quality of the data found (evidence-based practice). Each group assigns a discussion leader weekly to summarize the discussion and post a set of final answers

for the group. Students can log on at their convenience during the week, so working on this program should not disrupt their schedules unduly. Each discussion group lasts two weeks to give students some flexibility and ends with instructor comments. At the end of Week One, the instructor posts feedback on the first weeks' discussion and additional data and questions to facilitate achieving the desired objectives.

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	Case posted w/ instructions	Students divide roles and assign leader for each week	Students post to discussion group	Students post to discussion group	Students post to discussion group	Group leader posts group answers	
2		Instructor posts feedback, more clinical information and questions; Students begin with new leader and roles	Students post to discussion group	Students post to discussion group	Students post to discussion group	Group leader posts groups answers	Instructor reviews group answers and posts feedback

Table 1: Outline for individual case schedule

Teaching/Learning: The web-based on-line curriculum module has been planned using a concrete planning framework based on the David Kolb's experiential learning theory reflected in Figure 1.(Kolb, 1984) It is designed to have students go through each quadrant of learning style to accommodate all learning style preferences.. It is further designed to capitalize on the advantages of collaborative learning. Explanations follow for student/faculty activities within each of the four stages. These are based on recommendations for educational planning published by Armstrong (Armstrong 2005). These recommendations are:

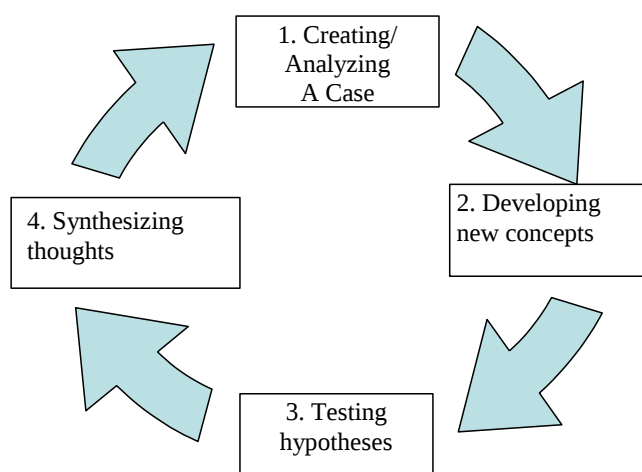


Figure 1. Format for Development the Collaborative On-Line Learning Modules (COLM)

1. **Activate Prior Knowledge**

A short presentation is included at the beginning of the module to activate prior knowledge from earlier medical school experiences. Students are assigned to small groups and asked to review the case and the carefully constructed open-ended questions accompanying the case. The questions are created to activate reflection by the students to determine what they already know about the provided patient problem. The Admission Orders COLM module consists of four components: 1. a brief PowerPoint didactic module introducing a mnemonic for writing admission orders, with specific examples of each component. 2. A digitally videotaped focused history and physical exam of a patient with diverticulitis. 3. Discussion forum A: The

students are instructed to post their own sets of admission orders for the patient and then to discuss any challenging management issues or discrepancies with the group. At the end of the week, one member of the group must submit, on the group's behalf, a complete set of orders. Students are encouraged to use an evidence based approach to management of the problem and to answering any questions that come up in the course of the discussion. They are encouraged to raise any issues or concerns with their group for discussion. 4. Discussion forum B: During the second week, the students are given another case (a patient with a venous stasis ulcer) and are asked to repeat the admission orders task.

2. **Develop New Concepts**

Development of new concepts is stimulated through reading and researching answers to the questions provided, as well as those the small group generates. For the Admission Orders COLM, at the end of the video, students are charged with a task to write a set of admission orders for the patient. They are asked to identify any difficulties in doing so or questions that come up while attempting this task. They are asked to post a set of orders and questions to the discussion forum.

3. **Test Hypotheses**

Testing hypotheses is accomplished through case discussion among student team members as they seek solutions to the simulated patient problem. During the discussion students can list suppositions, pose hypotheses, and make predictions – many and most of which may be revised as information is gathered. This exchange will help provide a basis for construction of meaning and enable them to list their best guesses, their hunches, and their conjectures. In the Admission Orders COLM, students are asked to discuss differences in their order sets, uncertainties and areas of controversy. Students are encouraged to use an evidence based approach to management of the problem and to answering any questions that come up in the course of the discussion

4. **Synthesize and Extend**

Each team selects a student leader who is responsible for drafting a summary of the team's recommendation on how to address the patient problem. A designated faculty member is responsible for reviewing each team's patient care plan and for providing feedback. As noted by Armstrong and colleagues, this written "commitment" on how the student patient care team concluded they would proceed, and the feedback received, becomes the "prior knowledge" that

is the baseline on which the students reflect when the learning cycle, which is really continuous, is begun again. (Armstrong 2005) In the admission orders COLM, student groups must develop a single best set of orders based on their discussion and submit them to the instructor for comment. In the second week of the module they are given another case and the task to write orders. The knowledge gained from the first case now becomes part of their prior knowledge and they return to the first stage of the cycle.

5. **Implementation:**

Initial development was the “Admission Orders” COLM based on the log data suggesting this need. In the future, additional COLM modules will be developed to address other content areas.

Create instructional Materials: A standardized patient and faculty member were used to digitally record the history and physicals for the Admission Orders COLM. As suggested by Alur, a clinician expert, web-designer and medical educationalist participated in designing the COLM. (9) A student orientation program was developed to introduce clerkship students to the purpose and logistics of the curriculum.

Faculty development: This project requires an entirely new teaching method, unfamiliar to most if not all of our faculty, but one that is clearly an important method for the future of medical education. It requires ongoing faculty development to train faculty to develop, facilitate and interpret or ‘grade’ these on-line cases.

Step 6: Evaluation and feedback: The effectiveness of the COLM module is being evaluated using four levels of evaluation as described by Kirkpatrick (Kirkpatrick, 1959): 1. Participant Reactions, 2. Assessment of Learning, 3. Assessment of Behavior Change, and 4. Health Care Outcomes. The focus of this study is the qualitative analysis of discussion groups which may shed light on each one of these areas. A separate analysis of quantitative outcome measures is also planned.

Appendix 2: Results of analysis of Pilot Data

Four themes (with sub-themes) were identified: 1. *Integration of Previous Experience* (No experience, Experience), 2. *Identifying Issues of Uncertainty* (Diagnosis, Management, Evaluation) and 3. *Solving Problems* (Reasoning out the Answer and Getting Support from the Literature.) The final theme was *Non-contributor*.

Themes are described below, with specific quotes to support and explain them. The percentage of groups that included each theme, and the average number of comments relating to each theme per group is shown in Table 1.

Themes

Integration of Previous Experience: Student comments reflected their efforts to include reflection on their own experiences while trying to solve this clinical problem. Some questions raised by students reflected their difficulty in addressing the problem without previous experience, or asked for someone with clinical experience to give an opinion. Others described how previous experience influenced their decisions. Seven of eight focus groups (88) included comments that related to previous experience with the clinical problem. Groups averaged 1.9 comments per discussion forum related to this theme. Sub-themes identified were comments related to lack of experience and those that referred to reflection on experience. Examples:

No experience:

“Has anyone actually seen one of these?”

Experience:

“Based on what I have seen with a diverticulitis patient, I would definitely agree with NPO”

“I have seen venous stasis ulcers in clinic and this looks like one”

Identifying Uncertainties: The student discussions demonstrated many areas where students were unclear about what was going on or what should be done. Each of the discussion groups included comments that fit this theme. The average number of comments that addressed this theme per discussion group was 3.9. The comments reflected uncertainties in diagnosis, management and evaluation of the given patient problems. These expressions of uncertainty were sometimes presented as questions to the group, or as statements of uncertainty about what to order to write or how to write it. Other times the expressions of uncertainty were comments, questions or disagreements about another student's order. Examples:

Diagnosis:

"Any idea of the cause of this ulcer?"

"I am slightly doubtful because I don't see the brownish discoloration I would expect"

Management:

"If he is NPO, should we switch him to IV meds?"

"Should we add ulcer prophylaxis?"

"I am not sure he needs those IVF if he is not NPO or hypovolemic"

Evaluation:

"Would we want to get a CT scan?"

"Do we need to get coags now?"

"I am not convinced that the other causes of foot ulcers are likely enough to warrant being worked up"

"Do we need to do something to rule out osteo?"

Solving Problems: Students' discussions seemed to focus most heavily on solving the problems that they identified. All discussion forums addressed this theme and by far the average number of comments per discussion forum was highest (14.9) for this theme. They addressed the problems they identified in

several ways. At times they used their prior experience and knowledge to reason out the answer. At other times, they went to a source to look it up.

Reasoning Out the Answer: This was the sub-theme with the most student comments. Students tended to be very supportive of each other, but if they disagreed with a statement by another student they explained their reasoning. They seemed to be able to come to a group consensus on most issues through this process.

Diagnosis:

“Most likely this is uncomplicated diverticulitis: no peritonitis, no perf, abscess or fistula”

“The history and the location make me think it is probably venous”

Management:

“I would use a lower threshold to notify the house officer. Tachycardia could be a sign of worsening pain which could mean a complication”

“I think it would be better to hold his aspirin in case he deteriorates, and there is no history to say that aspirin is essential for him”

“I wouldn’t give an antipyretic since it could mask worsening”

Evaluation:

“We need to follow-up with a colonoscopy to rule out neoplasm”

“Since we are considering diabetes, I think we should check blood sugars”

Getting Support from the Literature: Students seemed to go to a resource to get answers when they were unsure of what to do. There were few or no comments that discussed the quality of the source that they went to. The most commonly cited source was Up to Date (UTD). Other sources quoted included E-medicine, texts, review articles, pharmacy databases, and specific clinical research articles. Examples:

Diagnosis:

“I looked at UTD: this is most likely uncomplicated diverticulitis”

Management:

"UTD says that venous ulcers tend to be colonized and that routine antibiotics can be harmful"

"E-medicine suggests using morphine for pain control"

"I found an article that says that pentoxifyline may work well in conjunction with compression therapy"

Evaluation:

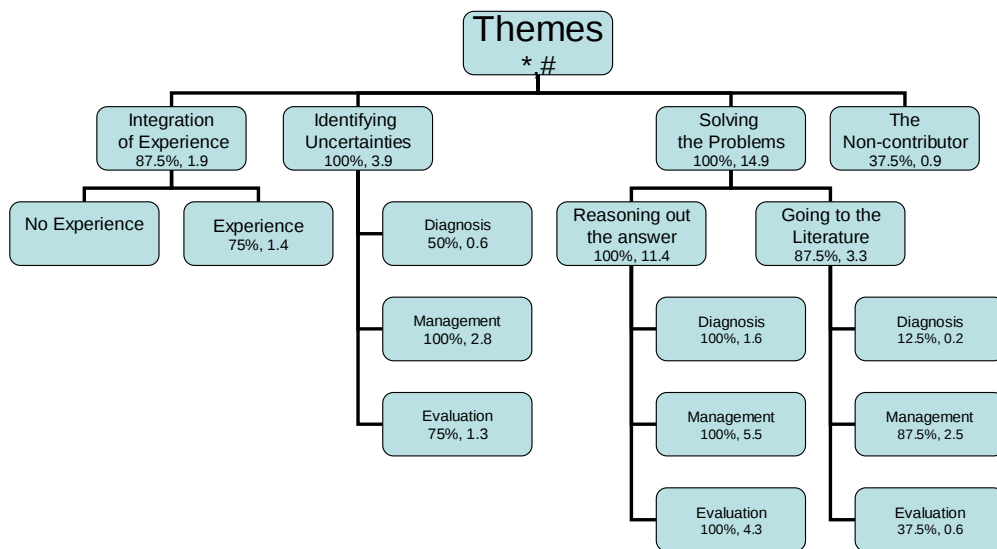
"One source says that if the culture is positive, we should get a plain film to rule out osteo"

"According to this article, the CT should be done with oral contrast"

Non-contributor: The last theme was that of the non-contributor. Occasionally students made a posting that really did not contribute anything meaningful to the discussion. This did not happen often. Three of eight discussion forums included a comment placed in this theme and the average number of such comments per discussion forum was less than one. In most cases, when such a comment was posted, it was the only posting for that student. Example:

"Your order set is pretty good, basically the same I came up with"

"I agree with everything, yeah teamwork!"



* = % of groups that addressed that theme
 # = average number of comments per group relating to that theme

Table 1: Themes

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VII. VITA

NAME	Nancy Schindler, MD, FACS	
EDUCATION		
Undergraduate:	Case Western Reserve University Cleveland, OH Chemistry and Psychology <i>Magna Cum Laude</i>	BA, 1989
Medical school:	Case Western Reserve University School of Medicine Cleveland, OH	MD, 1993
Graduate:	University of Illinois at Chicago	MHPE, not yet complete
Residency:	Northwestern University / McGaw Medical Center General Surgery Chicago, IL	7/93 – 6/98
Fellowship:	Pennsylvania Hospital Vascular Surgery Philadelphia, PA	7/98 – 6/99

AWARDS, HONORS, DISTINCTIONS

Education awards:	Resident Teacher of the Year Award, Northwestern Medical School, 1998 Surgical Education Research Fellowship, 2000-2002 Academic Achievement Award, Outstanding Educator Award, ENH, 2001 Academic Achievement Award, ENH, first prize 2002 American Medical Women's Association Gender Equity Teaching Award, 2002. Academic Achievement Award, ENH, 2003 Excellence in Teaching Award, Northwestern Medical School Department of Surgery, 2002. Excellence in Teaching Award, Northwestern University Medical School Department of Surgery, 2003 Academic Achievement Award ENH, first prize for Education, 2004
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Academic Achievement Award ENH, 2005
 Excellence in Teaching Award, Feinberg SOM, Department of Surgery, 2005
 Academic Achievement Award ENH, 2006
 Association for Surgical Education Teacher of the Year Award, 2006-7
 Academic Achievement Award ENH, 2007
 Feinberg School of Medicine Outstanding Teacher Award, 2007
 Feinberg School of Medicine Dean's Award for Teaching Excellence, 2008

Additional Awards: Alfred S. Maschke Award (for excellence in the art and practice of medicine), 1993
 Mastin Scholarship, 1992-1993
 Resident's Day Research Award, Honorable Mention, Northwestern Memorial Hospital, 1998
 Delaware Valley Vascular Society Research Award Second Prize, Fall 1998
 New York Vascular Fellows Research Competition, 1999 First Prize
 Patient Loyalty Winning Practice Award, ENH 2005
 Society for Vascular Surgery Women's Leadership Retreat, April 2008
 US News and World Reports Top Doctors, Vascular Surgery, 2011

PROFESSIONAL SOCIETY MEMBERSHIPS

American College of Surgeons, Fellow
 American Medical Association
 Chicagoland Endovascular Surgery Society, secretary 2000, president elect, 2001, president 2002
 Association for Surgical Education
 Society for Vascular Technology
 Association of Women Surgeons
 Chicago Surgical Society
 Society for Vascular Surgery
 Midwest Vascular Society

TEACHING: Clerkship Director, Surgery Clerkship, Feinberg SOM
 Develop and administer 12 week Multi-disciplinary clerkship
 Orient faculty to clerkship
 Faculty development for clerkship
 Curriculum Development:
 Developed curriculum for new surgery clerkship
 Chair, Planning and Improving Sub-Committee of Feinberg SOM

Curriculum Committee:

Projects include developing integrated radiology curriculum, developing competency based curriculum for Feinberg SOM

Student Teaching:

Give 6 vascular surgery lectures per year to clerks
Ethics Conference for surgery clerks 4 per year
Informed Consent interactive session 4 per year
Preceptor for approximately 10 students per year
Coordinate student remediation
Teach first year anatomy lab

Resident Teaching:

Co-coordinator for grand rounds
Residents as Teachers course; yearly workshops on feedback, One-minute teacher, Role of Residents in teaching medical students
Orient residents to student clerkship
Preceptor for 4-6 residents per year
Resident core curriculum lectures in vascular
Team Education Coordinator, Vascular Surgery
Resident recruitment

Fellow teaching:

Vascular fellowship clinic/ OR preceptor
MERITS fellowship in medical education
Co-director, Curriculum and Evaluation Course

Student Advising:

Loyal Davis Surgical Interest Society Faculty Advisor
Coordinator for student advising, surgery
Individual advisor to approximately 3 medical students per year

Mentoring:

Sheil Catholic Center Medical Career mentor
Association for Women Surgeons student mentor
AMWA student mentor
Northwestern Department of Surgery Resident mentor

Faculty Development:

Teaching Effectiveness Program Director, University of Chicago Department of Surgery

RESEARCH GRANTS:

Augusta Webster Grant for Educational Innovation
“Collaborative On-Line Learning Modules”
Funded by: Northwestern University Feinberg SOM
\$25,000 per year for 3 years
September 2005-2008
Association for Surgical Education CESERT Grant

PI: David Rodgers: An Investigation of Intra-operative Conflict Management of Surgeons

Site Coordinator, NorthShore University Health System, 2008

University of Chicago GMEC:

“Pilot Curriculum for Teaching Residents Single Incision Laparoscopic Surgery (SILS): A patient safety initiative”

\$25,000 per year for two years, 2010-12

SCHOLARLY BIBLIOGRAPHY:

Original Peer-reviewed articles:

Schindler N, Babrowski T, Desai T, Alexander J. “Case Report: Resection of Intracaval Leiomyomatosis Using Abdominal Approach and Venovenous Bypass” *Annals of Vascular Surgery*, in press.

Rogers D, Lingard L, Boehler M, Espin S, Klingensmith M, Mellinger J, Schindler, N. “Teaching operating room conflict management to surgeons: clarifying the optimal approach”. *Medical Education* 2011; 45:939-945.

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Schindler N, Calligaro KD, Lombardi J, Dougherty MJ, Raviola C, D'Orazio E. "Has Arteriography Gotten a Bad Name? Current accuracy and morbidity of diagnostic contrast arteriography for aortoiliac and lower extremity arterial disease." *Ann Vasc Surg* 2001, 15(4):417-20.

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Schneider JR, Droste J, Schindler N, Golan JF, "Carotid endarterectomy in octogenarians: comparison with patient characteristics and outcomes in younger patients." *Journal of Vascular Surgery*, May 2000: 31:927-35.

Calligaro KD, Veith FJ, Valladares JA, McKay J, Schindler N, Dougherty MJ, "Prosthetic patch remnants to treat infected arterial grafts." *Journal of Vascular Surgery*, February 2000;31(2):245-52.

Dougherty MJ, Calligaro KD, Schindler N, Raviola C, Ntoso A, "Endovascular versus surgical treatment for thrombosed hemodialysis grafts: A prospective randomized study." *Journal of Vascular Surgery*, December 1999: 30(6):1016-1023.

Schindler N, Vogelzang RL, "Superior Vena Cava Syndrome: Experience with Endovascular Stents and Surgical Therapy." *Surgical Clinics of North America*, June 1999;79(3):683-94.

Schindler N, Vogelzang R, Matsumura J, Sarna A, Nemcek A, Pearce W, "Superior vena cava syndrome: Experience with endovascular stents and surgical bypass." Abstract, American Venous Forum, 1999.

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Book Chapters:

Schindler N, Hemmer PA, Ciottti M. "Directing a Clerkship Over Geographically Separate Sites" in *Guidebook for Clerkship Directors*, Ruth Marie Fincher, Ed. Alliance for Clinical Education, 2006.

Schindler N "Varicose Veins" in *ACS Surgery*, Pearce W, ed., In Press.

Schindler N. "Transmetatarsal amputation" in *Northwestern Surgery*. Bell R, ed., Landes Bioscience, 2005.

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Schindler N. "Above knee amputation" in *Northwestern Surgery*. Bell R, ed., Landes Bioscience, 2005.

Schindler N, Pearce W. "Acute Mesenteric Vascular Occlusion" in *Surgical Decision Making*, 5th Edition, McIntyre RC, Stiegmann GV, Eiseman B, eds., Elsevier and Saunders, 2004.

Schindler N, Calligaro KD, "Management of Aortic Graft Infections" in *The Handbook of Aortic Surgery*, Ballard J, ed., Landes Bioscience, 2000.

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Book Reviews:

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Case Reports: Schindler N, Calligaro KD, Dougherty MJ, Diehl J, Modi KH, Braffman MN. "Meiloidosis presenting as an infected intrathoracic subclavian artery pseudoaneurysm treated with femoral vein interposition graft." J Vasc Surg 2002, 35: 569-72.

PRESENTATIONS:

Peer-Reviewed Presentations:

Schindler N. "Valuable Teachers should be valued" Presented at the Association for Surgical Education , Boston MA 2011.

Schindler N, DeSai T, Babrowski T. "Intravenous Leiomyomatosis treated with Veno venous bypass" Presented at the Peripheral Vascular Surgery Society" Steamboat CO, 2011.

Salabat M, Leung D, Denham W, Robiscek A, Schindler N, Ujiki M. "Ventral Hernia recurrence is higher inpatients with a history of abdominal aortic aneurysm." Poster presented at SAGES, 2010.

Schindler N. "Pilot Curriculum for Teaching Residents Single Incision Laparoscopic Surgery" Poster presented at University of Chicago Medical Education Day 2010.

Schindler N "The Resident Personal Learning Plan: one step toward lifelong learning" Association for Surgical Education Meeting, San Antonio, TX 2010.

Corcoran J, Schindler N, Downing S, DaRosa D "Can students at risk of failing a surgery clerkship be identified at midterm? Association for Surgical Education meeting, San Antonio, TX, 2010.

Schindler N "Description and Impact of Standard Setting for a Surgery Clerkship" Poster Presentation at Medical Education Day, University of Chicago Pritzker School of Medicine 2009.

Schindler N, Corcoran J, DaRosa D "Understanding How Students Learn Through Instructional Technology" Poster Presentation at the Association for Surgical Education, April 2008.

Schindler N, Corcoran J, DaRosa D "Description and Impact of Standard Setting for a Surgery Clerkship" University of Illinois Health Professions Summer conference July 2008.

Schindler N. Moderator, “Vascular Access and Vascular Trauma”, Northwestern Vascular Surgery Symposium, December 2006.

Schindler N, Corcoran J, DaRosa D “Description and Impact of Standard Setting for a Surgery Clerkship” Poster Presentation at the Association for Surgical Education, March 2006.

Schindler N “Informed Consent on Trial”, Presented at the Association for Surgical Education, March 2006.

Schindler N, Calligaro K, Dougherty MJ, “Infected subclavian artery pseudoaneurysm” Presented at the Society for Clinical Vascular Surgery Meeting, March 2001.

Schindler N, Bonebrake J, “Endovascular Aneurysm Surgery” Presented at the Association for Operating Room Nurses, March 2001.

Schindler N, Dougherty MJ, Calligaro KD, “Primary tumor of the common iliac vein treated with resection and prosthetic bypass” Presented at the Eastern Vascular Society Meeting, May, 2000.

Schindler N, Caligaro KD, Lombardi J, Dougherty MJ, Raviola C, D’Orazio E, “Has arteriography gotten a bad name? Current accuracy and morbidity of diagnostic contrast arteriography for aortoiliac and lower extremity arterial disease.” Presented Delaware Valley Vascular Society, 1998.

Invited Presentations:

Schindler N. “Faculty Development: Description of a Teaching Effectiveness Program” University of Chicago RIME conference June 2011.

Schindler N. Garcia P. “Success on the Wards: Introduction to the Clinical Clerkships” Feinberg School of Medicine 2008.

Schindler N. “The One Minute Teacher” Residents as Teachers Course, Northwestern 2008.

Schindler N. “How do I give and receive constructive feedback?” Residents as Teachers Course, Northwestern 2007.

Schindler N. Garcia P. “Success on the Wards: Introduction to the Clinical Clerkships” Feinberg School of Medicine 2007.

Schindler N, Schneider J, Verta M, Hahn D. “The

contemporary treatment of varicose veins” Evanston Northwestern Healthcare Obstetrics and Gynecology Grand Rounds, February 22, 2007.

Schindler N. Garcia P. “Success on the Wards: Introduction to the Clinical Clerkships” Feinberg School of Medicine 2006.

Schindler N. “How do I give and receive constructive feedback?” Residents as Teachers Course, Northwestern 2006.

Schindler N. “Update on Endovascular Surgery”, Department of Medicine Continuing Education, ENH, 2004.

Schindler N “Carotid Artery Disease” Feinberg School of Medicine, 2003-present, quarterly.

Schindler N “Venous Disease” Feinberg School of Medicine Lecture, 2003-present, quarterly.

Schindler N “Lower extremity arterial disease” Feinberg School of Medicine, 2003-present, quarterly.

Schindler N. “Teaching in the Surgery Clerkship”, Residents as Teachers Course, Northwestern 2004.

Schindler N “Lower Extremity Vascular Disease”, Northwestern University Core Curriculum, March 2003.

Schindler N, DaRosa D "Improving student evaluations" ENH Grand Rounds, November 2002.

Schindler N “Does a faculty intervention improve quality of student evaluations and faculty attitudes toward evaluations?” Association for Surgical Education, Baltimore MD, April 2002.

Schindler N, “Abdominal Aortic Aneurysms: Traditional and endovascular repair” Mended Hearts, Evanston IL, October 2001.

Schindler N, Golan JF, Droste J, Irons A, Haddad S, Ensler M, Lazarus M, “A Multidisciplinary approach to foot wounds” Presented at Medical Grand Rounds, Evanston Hospital, January 2001.

Schindler N, “ Abdominal Aortic Aneurysms: Past, Present and Future” Medical Grand Rounds, March 2000, Evanston Hospital.

Schindler N, "Trends towards less invasive vascular surgery"
Surgical Grand Rounds, September 1999, Evanston Hospital.

Schindler N, "Superior vena cava syndrome: Experience with
endovascular stents and surgical bypass." Presented at
Northwestern Resident's Day, 1999.

Schindler N, Dougherty MJ, Calligaro KD, Raviola CA, Ntoso
KA, "Endovascular versus surgical treatment of thrombosed
hemodialysis access grafts: A prospective, randomized study."
Presented New York Vascular Fellows Competition, 1999, first
prize.

WORKSHOPS:

Downing S, Schindler N, Corcoran J, "The Politics
And Policies of Grading". Invited workshop for the Association
for Surgical Education, Toronto, April 2008.

Schindler N. STAT: A method to measure competence in the OR,
presented as part of "Operative Competence... How to assess and
what to do with the results." Accepted for presentation at the
Association for Surgical Education Meeting, San Antonio, TX
2010.