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Evaluating the Role of Key Learning Theories in ECHO: A Telehealth Educational Program for Primary Care Providers

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Abstract

Background: ECHO (Extension for Community Healthcare Outcomes) is a telehealth educational program that uses videoconference technology to train community-based primary care providers (PCP's) on the management of complex, chronic diseases. The main components of ECHO are didactics, case presentations, and case-based learning. ECHO was developed using the key principles of Social Cognitive Theory, Situated Learning Theory, and Community of Practice Theory.

Objectives: In a prior study, we implemented an ECHO curriculum to improve management of resistant hypertension. The goals of the current study were to determine the extent to which the learning theories served as the foundation of the ECHO curriculum and identify opportunities to more effectively incorporate key principles of these theories into the ECHO program.

Methods: We conducted semi-structured interviews with the nine clinicians who participated in the pilot curriculum. A community-based PCP assisted with question development, analysis, and manuscript preparation. We analyzed the interview transcripts using Directed Content Analysis.

Results: Transcript analysis supported the contention that ECHO is based upon Social Cognitive Theory, Situated Learning Theory, and Community of Practice Theory. Comments from study participants highlighted benefits of each theory's principles. Conversely, they also suggested we could improve our implementation of ECHO by adhering more closely to specific learning theory strategies.

Conclusions: Our results indicate that ECHO indeed reflects the key tenants of Social Cognitive Theory, Situated Learning Theory, and Community of Practice Theory. Several aspects of our ECHO curriculum can be improved by more complete application of these learning theories.

Keywords

Medicine, Community-based Participatory Research, Health Disparities, Cardiovascular Diseases, Urban Health

Patients who receive care at community health centers have limited access to subspecialist care.[1] ECHO (Extension of Community Healthcare Outcomes) is an innovative educational program designed to train community-based primary care providers (PCP's) on the management of complex, chronic diseases, thereby reducing the need for referral to subspecialists.[2] Developed by Arora and colleagues almost ten years ago with a focus on rural communities,[3] the ECHO model utilizes educational videoconferences between university-based subspecialists and community-based PCP's. The main components of each ECHO videoconference are lecture-based didactics, case presentations, and case-based learning.

ECHO relies on the educational principles of Social Cognitive Theory,[4] Situated Learning Theory,[5] and Community of

Practice Theory.[6] Social Cognitive Theory posits that individuals must believe there exists benefit in learning a new behavior, must develop confidence in their ability to perform this behavior and must receive reinforcement of positive behavior changes from influential individuals. Situated Learning Theory focuses on the importance of providing learners modeled experiences to develop new skills, engage their interest, and simplify tasks. Finally, Community of Practice Theory emphasizes the significance of learning through continuous participation in a collaborative community consisting of peer learners and expert individuals. In sum, this model was constructed to resemble the educational theory underlying postgraduate medical education.[7] Recent studies show that ECHO has enabled community-based PCP's to provide chronic disease care that is on par with university-based subspecialists.[8]

The underserved communities on the South Side of Chicago experience reduced access to subspecialists and demonstrate increased morbidity and mortality related to complex, chronic conditions.[9-11] To address this condition, the University of Chicago (UC) formed the South Side Healthcare Collaborative (SSHC) in partnership with local Federally Qualified Health Centers (FQHC's). The SSHC is a program of the Urban Health Initiative, a UC program instituted to improve health outcomes on Chicago's South Side.

In order to enhance management of common, complex medical conditions and reduce dependency on subspecialists, we recently completed a twelve-session ECHO curriculum among PCP's at six of the South Side FQHC's focusing on the management of resistant hypertension. Our curriculum, ECHO-Chicago, is the first application of the ECHO model to an urban setting. Pre- and post-intervention assessments identified a positive effect on hypertension knowledge and self-efficacy among participating PCP's compared to controls.[12] Other studies have also surveyed PCP's regarding the effect of ECHO on provider benefit, degree of learning, patient safety, and quality of care.[7, 13]

No study, however, has evaluated the relationship between the key principles of each learning theory and the ECHO model of education. The goals of the current study were to determine the extent to which Social Cognitive Theory, Situated Learning Theory, and Community of Practice Theory underlie the ECHO curriculum and identify opportunities to more effectively incorporate the key principles of these theories into the ECHO curriculum.

METHODS

Participating Clinics and Study Subjects

From November 2010 through April 2011, we conducted a pilot curriculum in collaboration with six FQHC's on Chicago's South Side. Consistent with the principles of Community Based Participatory Research,[14] the disease topic (resistant hypertension), setting of the curricular components, and goals of intervention were selected based upon discussions with the providers and directors of the FQHC's. One of the FQHC physicians (GA) served as our Community Liaison and was involved in all stages of the project, including development of the manuscript and dissemination of results.

In our six-month curriculum, FQHC's allotted one hour in the morning once every two weeks for providers to attend ECHO videoconferences in each FQHC's conference room. We provided each clinic with internet connectivity, videoconference equipment, and ongoing technical support. Each ECHO session began with a short didactic lecture by our disease expert (GB), followed by case presentations by participants regarding patients with resistant hypertension. Cases were discussed and management strategies were developed in collaboration with GB.

All providers at the clinics were encouraged to attend each ECHO session, but nine providers completed formal pre- and post-intervention knowledge and self-efficacy surveys. These

Table 1. Demographics of Study Participants ($N = 9$)

Mean age, y (*SD*)	33.10 (*4.28*)
Female,	7
Physician,	7
Internal Medicine,	4
Family Medicine,	3
Physician assistant,	2
Mean years in practice (SD)	6.78 (10.49)
Race/ethnicity	
White,	3
African-American,	1
Latino,	1
Asian/Pacific Islander,	2
East Indian,	2
Attended U.S. professional school,	8

Abbreviations: *SD*, standard deviation.

nine providers were the most consistent participants. The demographics of the nine participating PCP's were obtained as part of our pilot study[12] and are listed in Table 1. Upon completion of the curriculum, participating PCP's were asked whether they were willing to be interviewed regarding their ECHO experience and all nine agreed. These nine PCP's served as the subjects for the present qualitative study.

Question Development and Interview Procedures

Key principles of the three learning theories served as the basis for the interview questions. (See Table 2.) The questions were designed to determine the extent to which the key tenants of each theory were incorporated into the curriculum. Consistent with the semi-structured interview approach, each question was open-ended to minimize the likelihood that the interviewer would bias interviewee responses[15] (See Table 3). Based upon each PCP's preference, 1-hour interviews were conducted either in the clinic or at our institution. After obtaining informed consent, all interviews were conducted by one author (CS) and all were digitally recorded for subsequent transcription. Approval of this qualitative study was obtained from the University of Chicago's Institutional Review Board.

Table 2. Key Principles of Learning Theories Underlying Project ECHO

Social Cognitive Theory

- Individuals must believe that the benefits of performing the new behavior outweigh its costs
- Individuals must have confidence in their ability to perform specific behaviors in a variety of circumstances
- There must be reinforcement of positive behavior changes from persons who are seen as important

Situated Learning Theory

- Teaching requires providing learners with the opportunity to extend their current skills and knowledge
- Teaching requires providing learners with the opportunity to model the idealized version of the task
- Teaching requires providing learners with the opportunity to engage learners' interest
- Teaching requires providing learners the opportunity to simplify tasks so they are manageable
- Teaching requires providing learners the opportunity to motivate learners to pursue the task

Community of Practice Theory

- Learning evolves more profoundly with continuous participation in a community of learners with those more expert than themselves
- The community of practice is supported by collaborative learning, coaching, and mentoring with those more expert than oneself but also with one's peers

Analysis

After removing personal identifiers, each transcript was analyzed using a Directed Content Analysis approach. The key principles of each learning theory served as the conceptual

Table 3. Guiding Questions

Social Cognitive Theory

- What motivated you to participate in Project ECHO?
- What were your goals for participating? Have you met your goals?
- Since participating in ECHO, are you more motivated to achieve your goals or less?
- What has been your biggest obstacle to being able to attend seminars and what can we do to address that issue?
- Can you describe how your participation has affected your ability to care for patients?
- Do you feel that your patients have benefitted from the HTN knowledge you have acquired through project ECHO?
- What satisfies you professionally about participating in Project ECHO? Does this have any effect on your overall job? If so, how?

Situated Learning Theory

- Can you describe your overall learning experience in Project ECHO?
- How important are the following to your learning about HTN management: lectures, e-mailed handouts, advice from Dr. Bakris following the case presentations?
- What do you value most about the case presentations?
- Did you learn about presenting the cases from listening to others present?
- Is there any way that you would change your presentation if you were to make a presentation in the future?
- How helpful was the coaching provided by Dr. Bakris? Do you feel you were given guidance to improve in specific areas?

Community of Practice Theory

- Has your perception of interacting with academic medical centers changed? If so, how? If not, why not?
- Has your perception of your peers who also took part in Project ECHO changed? If so, how? If not, why not?
- Do you have any suggestions that you think could improve your learning experience through Project ECHO?
- Do you have any suggestions for how we could improve the case-based learning section of the course?
- What do you think we could do to motivate more clinicians to participate in the future?

Abbreviation: HTN, hypertension

framework of our analysis, which included data coding, category development, and theme identification.[16] Two authors (CS and CM) developed a set of initial coding themes, each of which was defined using the concepts and keywords of the key principles of the learning theories. The authors read each transcript independently to identify text in the participants' responses relevant to the coding themes. They then compared their analyses to facilitate comment sorting. Themes and the associated comments were classified as either evidence that a particular theory contributed significantly to the ECHO curriculum or as an opportunity to further incorporate the key principles of each learning theory. GA provided feedback regarding the face validity of the identified themes and associated comments. Additionally, GA provided final editorial direction prior to submitting the manuscript.

RESULTS

Transcript analysis suggested that our pilot curriculum indeed reflected the key principles of each learning theory. In addition, study participants noted several opportunities to enhance ECHO-Chicago. These opportunities typically represented new ways in which the principles of each learning theory can be implemented. Listed below are the key principles of each learning theory, followed by representative quotes from providers. The providers were coded using letters A through I.

Social Cognitive Theory

I. Individuals must believe that the benefits of performing the new behavior outweigh its costs.

The importance of this principle to the curriculum was evidenced by comments from PCP's who stated the benefits of participating in the curriculum outweighed the burden of the additional time required. Benefits included gaining new knowledge, improving clinical skills, and the ability to manage resistant hypertension without referring to subspecialists. As participant B said, "It's hard to refer out . . . I think anyone would always want to better themselves . . . learning different treatment options, better algorithms." This sentiment was echoed by participant D who said, "In here, it would take me about 6-7 months if they don't have insurance to get to a cardiologist. And now, this way, Monday [day of sessions] I'm going to have my answer. I'm going to know what to give the patient. So it's exciting."

Although twice monthly one-hour meetings are not overly burdensome, only nine PCP's from our six partner clinics consistently attended the videoconferences. Provider feedback regarding attendance suggests that barriers to participating in ECHO, such as scheduling variability and intermittent problems with the videoconference equipment, occasionally outweighed the benefits gained from the curriculum. Respondents believed that addressing these issues while also publicizing the benefits of the curriculum would likely increase the number of participating providers. For example, participant D said, "I think if you can show the impact, show the satisfaction of the physicians, be able to market how much more empowered we are after taking this versus before . . . they're definitely going to be more motivated." Several PCP's requested home videoconference access via their laptops in addition to the clinic-based teleconferencing. Provider I explained, "[Home access] would be very helpful because there is one of our providers who I know she would have loved to attend but she lives two hours away and she only works on Wednesdays and Saturdays."

II. Individuals must have confidence in their ability to perform the specific behavior in a variety of circumstances.

Responses highlighted the importance of this principle to the curriculum as several participants verbalized increased confidence in caring for patients with resistant hypertension. Said respondent C, "I feel more confident, more comfortable putting them on the right meds and why I'm putting them on this med versus that med, and in what population. I feel like I'm asking the right questions, as far as why their blood pressures are not controlled. So yeah, I definitely feel more confident." Participant D expressed a similar sentiment, "I think you become a lot more confident about medications that you can use and how you're managing more difficult patients than prior to Project ECHO."

III. There must be reinforcement of positive behavior changes from persons who are seen as important.

The participants indicated uniform respect for our hypertension expert (GB) and appreciated his positive approach to conveying information during the videoconferences. His encouragement reduced participant anxiety about asking questions, which enhanced the learning process. For example, respondent C said, "Dr. B definitely wouldn't say, 'Oh that's a dumb question.' There were no negative comments. He

would definitely tell you encouraging things, so it made you feel like you were able to be more open with the cases." The extent to which GB was viewed as important is highlighted by provider E who said, "When [GB] came to our clinic to talk about the project, everyone was excited. And I'm not just talking about the doctors . . . But our nurses, our staff members, everyone was talking about it. And we saw a huge spike in ECHO attendance afterwards, and I think that's a big selling point."

Situated Learning Theory

I. Teaching requires providing the learners with the opportunity to extend their current skills and knowledge.

Respondents indicated our curriculum provided several opportunities to enhance their skills and knowledge regarding hypertension management. For example, participant C used what she learned in the curriculum to create a food guide for her patients, empowering them to have more control over their blood pressure: "I created a low-salt diet handout with my patients based on what I learned from ECHO. We used to have these DASH handouts, which were good. It was kind of a guide for patients on foods to eat, but it was never foods not to eat . . . But when I created this handout, they were like, "Oh my goodness! This is everything I eat."

Provider E lamented the tension between clinical productivity and opportunities for continuing medical education but indicated the ECHO model was a convenient way to extend clinical skills and knowledge: "There's such a struggle between the administrative people constantly wanting people to see patients because it improves the bottom line, versus the kind of professional development that's required to maintain a high quality work force. The kind of educational opportunities that most people get are not really there. And having ECHO around is kind of like still having grand rounds, which is nice."

II. Teaching requires providing learners with the opportunity to model the idealized version of the task.

In the ECHO model, the opportunity to model the idealized version of the task occurs when PCP's present cases and engage in interactions with the expert and each other about disease management. Although participants indicated that they most enjoyed the didactic lectures, the majority of participants spent a significant amount of time describing the benefits of the case discussions, reinforcing the value of these discussions to the ECHO curriculum. Participant B said, "We go over a case. Somebody explains what they're doing. And then I'm always wondering, what would I do if I don't know? And then I get to hear what [GB] says and there's always something to learn." Referring to her own experience in presenting a case, participant F said, "Doing the case studies was great because you can get more out of it. Kind of think of how you would do it, then hear how [GB] managed it, it would help us more."

III. Teaching requires providing learners with the opportunity to engage learners' interest.

The ECHO model combines didactics (e.g., lectures, slides, and handouts) with case presentations and discussions. Based upon the feedback we received regarding these educational strategies, this principle was an important component of the ECHO model. Regarding GB's lectures, participant F stated, "Oh, the lectures were great. He always had a topic and then the evidence-base behind the topic," and participant B added, "[Dr. B] was good. He keeps my attention. He's very to-the-point. There's always a new topic. There's always something to revisit." The case presentations also engaged the learners, as suggested by respondent H: "The thing was, we not only have a lecture, we have a case presentation from the physician, so we have a real case. So in the future, if you get a similar type of patient, [we know] how we can approach."

PCP's also offered suggestions for improving the case discussions. Several participants requested a printed copy of the case presentation so they could follow along more easily; provider E explained for example: "It's hard for me to follow unless I actually have something written in front of me . . . Otherwise, I tend to just sort of let my mind wander as people are mentioning things." While most appreciated the e-mailed handouts and slides, others felt these could be improved. For example, provider C said all of the handouts should be printed and given to the participants prior to the beginning of the curriculum: "Something that would be helpful is to have a big binder of all the packets so we don't have to sit there and download each one. . . . My colleague, she was telling me the secret that she was having trouble so she never downloaded anything." Participant F requested a summary of the material so she could keep all the information in perspective: "I just like to have a summary of what we learned . . . [Dr. B] does it sometimes at the end of each of his presentations, but I'd like it if he did it at the end of the half [of the curriculum] . . .

and at the end [of the curriculum] . . . so we just make sure we get it right."

IV. Teaching requires providing learners the opportunity to simplify tasks so they are manageable.

PCP responses suggested that this principle was indeed an important part of the ECHO curriculum. Specifically, several respondents indicated that the didactics and case discussions helped them simplify their approach to managing resistant hypertension. PCP F stated, "[The teaching] was based on ethnicity, compliance, their kidney levels. So it was very specific as far as how to choose which medication to give." The case presentations also helped participant G better understand what can be an overwhelming amount of information regarding hypertension management: "I think [the case presentations] were practical. Things you may not read in a textbook, or if you have a textbook that's 1,000 pages, you may never know where to get it."

V. Teaching requires providing learners the opportunity to motivate learners to pursue the task.

This principle is similar to the cost/benefit principle of Social Cognitive Theory in that both address the motivation of learners to seek new information. The comments we heard suggest that knowing more about hypertension management provides both satisfaction and confidence. For some participants, these feelings provide sufficient motivation to participate in the videoconference sessions. Provider A said, "You get the satisfaction of knowing more and feeling more competent in dealing with hypertension. It's been great." For participant E, ECHO's unique approach motivated him to participate: "I've always been interested in bridging the gap between research and practice . . . I think ECHO's probably the most innovative by far and the one that shows the most promise."

However, participant D felt motivation would be enhanced if participants received recognition for their participation in ECHO: "If you spend all this time learning about it, then you should be able to get a certificate. Everyone wants to have some sort of certification to show that you've done this and you took the time to do it and that you're more educated than doctors who maybe didn't take the time to do it."

Community of Practice Theory

I. Learning evolves more profoundly with continuous participation in a community of learners with those more expert than themselves.

This principle mirrors the Social Cognitive Theory principle of positive reinforcement from important persons. It also emphasizes the community of learners, as well as the continuous participation of learners in that community. The feedback we received suggested that ECHO indeed facilitated a Community of Practice. For example, participant E said, "[I like] the real-world examples of people struggling with the ideas that we talk about. I think you need real, clinical discussion in order to make ECHO useful." As for collaborating with the disease expert, participant D gave a typical response: "[Dr. B's] advice was out of this world. It was amazing. I could tell you that since residency, I've never learned this much."

II. The community of practice is supported by collaborative learning, coaching, and mentoring with those more expert than oneself but also with one's peers.

This principle emphasizes the importance of learning through collaboration with peers and experts in a community of practice. PCP comments suggested that peer-to-peer interaction was a valuable component of our ECHO model. For example, participant G said, "I've enjoyed being able to see the participants from the different sites, to hear their questions. When they present their patients, I say, 'Oh, okay I've had a patient like that' or 'that's a good question. I've never thought about that aspect before.'"

On the other hand, some participants indicated that more should be done to enhance peer-to-peer interaction and they offered suggestions regarding how to accomplish this. According to respondent E, "When it comes to this collaborative component, I think we are still feeling around how to effectively do it. I'd like to find a way to increase spontaneous case discussions, as opposed to formalized discussions. When it comes to case presentations, I wish I could see something. Like have a tangible thing to look at to help me follow the case so that I could at least prepare some ideas." Provider G also believed the videoconference experience would be enhanced if participants had a chance to meet each other in person at least once: "We've not had an opportunity to actually talk or meet, aside from maybe communicating on the cases. I think it would be nice to periodically have a session where we all meet in one place, rather than, you know because you're just seeing people on the screen."

DISCUSSION

We sought to determine the extent to which Social Cognitive Theory, Situated Learning Theory, and Community of Practice Theory serve as the foundation of the ECHO curriculum and also identify opportunities to more effectively incorporate the key principles of these theories into the ECHO curriculum.

Responses from study participants suggest that the key principles of the learning theories were integral to the ECHO curriculum and enhanced the ability of PCP's to care for patients with resistant hypertension. Consistent with Social Cognitive Theory, participants in our curriculum noted increased confidence in managing hypertension and emphasized the benefits of successful management without having to refer patients to a subspecialist.[17] These responses suggest that the principles of this theory contributed to the success of our curriculum. However, measures to facilitate providers' attendance at ECHO sessions, such as providing home access to videoconferences, will likely increase the number of participating providers, thus expanding the impact of the ECHO program upon the community.

Interview responses also suggested that our ECHO curriculum incorporated the principles of Situated Learning Theory, which posits that optimal learning requires interaction and collaboration.[6] For example, many of the participants focused on positive interactions with our disease expert, as well as the high quality of his lectures. Additionally, respondents indicated they derived clinically relevant information from presenting cases and listening to their peers' case presentations. They noted that these techniques improved their disease management skills. At the same time, most participants emphasized the disease expert (GB) played an important role in ensuring high quality instruction within the ECHO modules. Although many factors are important to the success of ECHO, this feedback highlights the importance of carefully selecting moderators who are both knowledgeable disease experts and talented instructors.

Finally, we found evidence that the principles of the Community of Practice Theory were integral to our curriculum. Respondents indicated that the ECHO model fostered a learning community that reinforced the lessons of the disease expert. Because our disease expert accounted for most of the teaching, a few respondents suggested ways to improve peer-to-peer teaching.

Using this feedback, we have taken several steps to enhance the ECHO-Chicago curriculum. For example, in order to "get the word out," we distributed the journal article regarding our pilot study to all providers at each of the six FQHC's. Results from this study demonstrated increased hypertension knowledge and treatment self-efficacy among curriculum participants compared to controls.[12] We expect by sharing these findings, we will increase motivation among other providers to participate in the ECHO-Chicago curriculum. To further enhance participant knowledge and skills, we also obtained a copy of the handout participant C created regarding high-salt foods and distributed it to all providers in the pilot.

In our new curriculum, we will distribute written copies of case summaries prior to discussing each case. Similarly, we have prepared a summary of our disease expert's approach to the diagnosis and management of resistant hypertension. This summary includes key teaching points regarding disease management and anti-hypertensive medications. We anticipate these documents will assist participants in developing management plans and encourage additional peer-to-peer discussion. To further enhance the community of practice, an annual dinner will offer an opportunity to provide each participant a certificate indicating completion of the program. Such recognition should enhance motivation to participate in the ECHO-Chicago curriculum. Finally, we developed a system whereby providers with sufficient internet bandwidth can participate in the sessions using their home computers. This should improve the convenience of participation, a prerequisite for success according the Social Cognitive Theory.

Certain limitations of this study should be considered. For example, all interviews were conducted face-to-face so responses may reflect an element of social desirability. Second, all interviewees were providers who had originally volunteered to participate in the ECHO-Chicago curriculum. This selection bias may have yielded more positive responses than would be obtained if the original curriculum had included PCP's who were required to participate in the program. Third, our sample size of nine interviewees is small and primarily consisted of female providers. Different responses might have been obtained if our sample size was larger or included a more even mix of genders. Finally, all participants provide care at urban FQHC's. As a result, our findings may not be generalizable to providers from other types of clinics, including private practice and rural clinics.

CONCLUSIONS

We found evidence that the key principles of Social Cognitive Theory, Situated Learning Theory, and Community of Practice Theory indeed form the basis of the ECHO model. This finding supports the contention that ECHO's success depends upon implementation of established learning theories.[7] Although our curriculum was faithful to the key principles of each learning theory, we identified new ways to enhance their implementation, especially with respect to learner motivation and optimizing the experience of case-based discussions and peer-to-peer interactions. We expect that results from this study will encourage others to utilize the key principles of established learning theories as they develop ECHO curricula to train community-based PCP's on the management of complex, chronic diseases.

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