▲ Effects of an Experiential Learning Program on the Clinical Reasoning and Critical Thinking Skills of Occupational Therapy Students

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This study examined the effects of participation in a 1-week, experiential, hands-on learning program on the critical thinking and clinical reasoning skills of occupational therapy (OT) students. A quasi-experimental, nonrandomized pre- and post-test design was used with a sample of 25 students. The students had completed three semesters of didactic lecture coursework in a master's level OT educational program prior to participation in a hands-on therapy program for children with hemiplegic cerebral palsy. Changes in critical thinking and clinical reasoning skills were evaluated using the following dependent measures: Self-Assessment of Clinical Reflection and Reasoning (SACRR) and the California Critical Thinking Skills Test (CCTST). Changes in pretest and posttest scores on the SACRR and the CCTST were statistically significant ($p<0.05$) following completion of the experiential learning program. This study supports the use of hands-on learning to develop clinical reasoning and critical thinking skills in healthcare students, who face ever more diverse patient populations upon entry-level practice. Further qualitative and quantitative investigations are needed to support the results of this study and determine which components of experiential learning programs are essential for developing clinical reasoning and critical thinking skills in future allied health professionals. J Allied Health 2010; 39(4):280–286.

OCCUPATIONAL THERAPY (OT) practice is changing to meet the demands of today's more complex healthcare system where infants are born earlier and the elderly are living longer.[1] A recent study of health trends revealed a significant worsening of several key health indicators in patients seeking healthcare services between 1992 and 2002.[2] Traditional OT educational programs must provide the depth and breadth of knowledge and skills to ensure entry-level therapists can meet the expectations of a more medically complicated and comprised patient population.[1] Current OT educational programs use a variety of instructional methods to teach critical thinking and clinical reasoning skills while developing the professional attitudes needed for entry-level OT practice.[3] The educational focus has changed to meet the needs of an evolving healthcare system that places greater demands on entry-level therapists. Teaching basic knowledge is a relatively routine task, but developing higher-level clinical skills needed to evaluate more medically complicated clients, develop appropriate treatment interventions, and make modifications to therapeutic activities is a much greater challenge for today's OT educational programs. The climate of today's clinical practice requires entry-level therapists to think critically and use sound clinical reasoning while working effectively within a healthcare team as outlined in the Standards of Practice for Occupational Therapy document.[4] Specifically cited in the Standards of Practice for Occupational Therapy document is the an occupational therapists' responsibility for "using sound clinical judgment when selecting, measuring, documenting, and interpreting expected or achieved outcomes that are related to the client's ability to engage in occupations."[4]

A variety of teaching styles are currently used in OT educational programs including the case method, problem-based learning, and experiential learning. Early research on case study and problem-based learning has shown that these teaching methods are not fully successful at improving higher-level thinking skills as they apply to real-life clinical situations and that interaction with real-life clients may be the important link to developing the essential critical thinking and clinical reasoning skills necessary for entry-level practice.[5–9] Research on the use of case studies has determined that it allows students to apply basic knowledge in real-life scenarios which can motivate student learning.[10,11] The same proponents of the case study method of instruction also concede the limitations of this instruction and that live cases with real clients provide unquestionable value.[8]

Problem-based learning (PBL), in which students are provided case-based problems in which to identify client issues and therapy solutions, has received increased attention as an instructional method in OT educational programs over the last two decades.[12–14] A recent systematic review on the effects of PBL in medical education found a lack of evidence to support the use of PBL to enhance basic medical knowledge, technical, and teaching dimensions in medical students, although positive effects were found for improving social and cognitive competency in the area of coping with uncertainties.[15] Studies cited in OT educational literature have determined that participation in PBL

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may not significantly improve critical thinking skills and that students may not perform as well on outcome tests of clinical reasoning skills.[5–9]

Experiential Learning

Although the number of published studies are limited, current research on OT educational programs that use experience-based learning have demonstrated that it can improve students' clinical reasoning and critical thinking skills.[16-18] Experiential learning has been proposed as a method to lay the foundation between theory, practical experience, and professional development in OT education.[16]

Experiential learning involves hands-on experience in a practical setting to test information learned in didactic coursework in an actual practice environment. The emphasis is on learner self-direction and reflection about the learning experience.[19] Studies suggest that the use of experiential activities within the health professions curriculum will increase the student's preparedness for the future demands of clinical practice.[20–22] Critical thinking and clinical reasoning skills are developed and improved when students focus on complex issues, delve into them, examine relationships closely, and process them in their own way.[22] This suggests that experiential learning, with an emphasis on active learning strategies involving clinical application, may be the best method to improve critical thinking and clinical reasoning skills.

Although experiential learning may help students build the clinical reasoning and critical thinking skills necessary for today's entry-level practice, the published literature on the effectiveness of hands-on learning programs is limited. A study by Liu et al.[18] investigated the influence of the OT curriculum on two student groups participating in different clinical experiences. This qualitative study found that students who interacted with actual patients developed interactive and conditional reasoning through a feedback mechanism that included input from and interaction with actual clients. The students who did not interact with patients during clinical coursework only developed procedural reasoning skills inherent in novice clinicians.[18]

A study by Benson and Hanson[16] examined the use of an experiential learning lab embedded into an OT intervention course. A qualitative program evaluation was used to evaluate a program which enrolled 30 OT students in a senior level course. A questionnaire and a reflective journal were used to determine the students' perceptions of participation in an experiential learning program that engaged students in direct patient treatment with children who had both physical and mental disabilities. Students identified several positive outcomes of this experience, including the ability to apply clinical reasoning skills. Students reported that participation in a learning experience with actual clients allowed for examination of their own clinical reasoning skills and evaluation of how reasoning skills change over time when presented with clinical challenges.

These few qualitative research studies on experiential learning programs provide a beginning understanding of how experience-based learning can be used to challenge students to critically think and solve treatment problems. However, there are no studies on the effectiveness of experiential learning programs using quantitative measures of clinical reasoning and critical thinking skills commonly seen in allied health education research on PBL or case method instruction. More studies must be completed to determine how experiential learning affects student performance, which could help OT educational programs determine which type of instruction holds the best promise for training future practitioners.

The purpose of this study was to evaluate the clinical reasoning and critical thinking skills of OT students before and after the students' participation in a 1-week hands-on experiential learning program using for children with hemiplegic cerebral palsy. This study built on the earlier qualitative studies on experience-based learning programs, while using reliable and valid assessments seen in healthcare education research to measure the effects of PBL and case method instruction.[5,9,22–25]

Methods

Participants

This study was approved by the university's Institutional Review Board, and informed consent was obtained from all students who participated in this study. A quasi-experimental, one-group, nonrandomized, pre- and posttest design was used with a sample of 25 graduate OT students enrolled in a 2-year master's level program. The course is part of the curriculum in the OT program at a midsized academic medical center; thus, all learners enrolled in this course were invited to participate in the research study. The OT curriculum offers educational experiences that integrate didactic, problem-based, experiential, and interprofessional learning. The program is full-time, year-round, and includes classroom, laboratory, community, and clinical work. The participants in this study ranged in age from 22 to 29 years, and the sample included 24 females and 1 male student. This is similar to the national ratio of female-to-male practitioners, greatly favoring women at 94% to men at 6% currently practicing in the field.[26]

Procedure

The experiential learning program investigated in this study involved student participation in a 1-week day camp developed for children with hemiplegic cerebral palsy. The experiential learning program was offered to OT students after they had completed at least 1 year (three semesters) of study involving didactic and laboratory instruction in therapeutic techniques used for pediatric clients. This experiential program has been offered for several years, but no

field or pilot data had been collected on how this experiential learning program affected the students' critical thinking and clinical reasoning skills. However, participation data had been collected on the students' perception of this course through a university-wide course-rating system called E*Value (https:/www.e-value.net). E*Value is a web-based evaluation system designed to help manage medical education programs' course evaluations. The experience-based learning program received an overall score of 4.66 on a rating scale of 1 (lowest) to 5 (highest). Areas rated by students included the organization of the course, how the course developed understanding of concepts and principles, and if the course was intellectually challenging.

The pediatric intervention used at camp involved constraint-induced movement therapy (CIMT), which is an intensive, evidenced-based treatment approach for children with hemiplegia who demonstrate unilateral weakness. CIMT requires restraint of the child's uninvolved (stronger) upper extremity, while a skilled person provides massed practice of the involved (weaker) upper extremity in developmental activities that shape more mature motor movements for reach, grasp, and dexterity.

The OT students were trained to provide one-on-one CIMT treatment to the children attending camp for 5 consecutive days, 6 hours each day. The students were supervised by a licensed occupational therapist at all times, including the faculty coordinating the experiential program. The pre-camp training involved lectures on pediatric CIMT and group work with fellow students to plan the theme-based activities for camp. The students were responsible for planning daily treatment interventions, implementing treatment each day of camp, and writing reflective notes on their child's progress at the end of each camp day. These notes were reviewed by the faculty teaching the course. A rigorous and specific daily camp schedule was developed by students to support task-specific, developmentally appropriate play in predesigned gross and fine motor activities. The students were encouraged each day of camp to work with fellow students and try different intervention strategies based on the child's overall therapy goals and response to treatment.

Instrumentation

The Self-Assessment of Clinical Reflection and Reasoning (SACRR) and California Critical Thinking Skills Test (CCTST) were administered by a faculty member in the university's Department of Health Professions to all student participants 3 days before the start of the experiential learning program. Parallel forms of each test, designed to reduce the effects of pre- and posttesting, were administered 3 days after completion of the experiential learning program by the same faculty member who administered the pretest. The SACRR has been used in published educational research to assess the impact of PBL on the clinical reasoning skills of OT students.[5,9] The CCTST has been widely used in health education research to measure the critical thinking skills in nursing, physical therapy, and dental students.[23,24,27]

The SACRR was developed and tested by Royeen et al.[3] and can be used to evaluate the effects of different educational methods on clinical reasoning. It consists of 26 items that are rated on a 5-point scale, ranging from 5 "strongly agree" to 1 "strongly disagree." The scores for each item on the pretest and posttest can be added to collect aggregate scores for all 26 items. Measures of internal consistency using Cronbach's alpha yielded a 0.87 for the pretest and 0.92 for the posttest. The Spearman rank order correlation coefficient for test-retest reliability is 0.60.[3] A limitation of the SACRR is that it relies on the student's self-perception of clinical reasoning skills and behaviors rather than an objective measure of clinical reasoning performance.[5]

The CCTST is designed for use with college students and adults to gather data on individual and group critical thinking skills.[28] It is a standardized, 34-item, timed, multiple-choice test that targets core critical thinking skills regarded as essential for adult learners in higher education programs. Six scores can be obtained from an individual CCTST, including an overall critical thinking score and scores for the subscales of analysis, evaluation, inference, deductive reasoning, and inductive reasoning. Reliability measures for the instrument are reported for Form 2000 as ranging from Kuber-Richardson (KR)-20 of 0.78 to 0.84, Form A and B as KR-20 ranging from 0.70 to 0.75 in various studies.[28]

Data Analysis

The SACRR was scored and imported into SPSS 16.0 for Windows (SPSS, Inc., Chicago, IL) for further analysis. The pre- and posttest scores for each item on the SACRR were compared using the Wilcoxon signed-ranks test for nonparametric data. The completed CCTST forms were sent back to the publisher of the test, Insight Assessment (Mellbrae, CA; www.insightassessment.com), for scoring. The pretest and posttest scores of the CCTST were compared using the two-tailed, paired samples *t* test after a test of normality was completed on the data using the statistical package SPSS 16.0 for Windows. The P-P and Q-Q plots for the differences between the pretest and posttest total and subscale scores on the CCTST and the subscales scores indicated no significant deviation from the fitted line and skewness <1.0 and approached zero (skewness = –0.086), so the test of normality was met. The Shapiro-Wilk test was also used to test the normality of the difference between the pretest and posttest total and subscale scores on the CCTST with W= 0.938 (being close to 1 indicates normality) and $p = 0.106$.

Results

Of the 26 items of the SACRR, statistically significant improvements were noted in 22 of the 26 items, or 84.6%

TABLE 1. Self-Assessment of Clinical Reflection and Reasoning (SACRR) Pretest and Posttest Comparisons

	SACRR Items	Z score	*P* value
1	I question how, what, and why I do things in practice.	–2.887	0.004*
2	I ask myself and others questions as a way of learning.	–0.905	0.366
3	I don't make judgments until I have sufficient data.	–2.673	0.008*
4	Prior to acting, I seek various solutions.	–2.673	0.008*
5	Regarding the outcome of proposed interventions, I try to keep an open mind.	–2.324	0.020*
6	I think in terms of comparing and contrasting information about a client's problems and propose solutions to them.	–2.714	0.007*
7	I look to theory for understanding a client's problems and proposed solutions to them.	–3.260	0.001*
8	I look to frames of reference for planning my intervention strategy.	–2.333	0.020*
9	I use theory to understand treatment techniques.	–2.714	0.007*
10	I try to understand clinical problems by using a variety of frames of reference.	–3.276	0.001*
11	When there is conflicting information about a clinical problem, I identify assumptions underlying the differing views.	–2.810	0.005*
12	When planning intervention strategies, I ask "What if" for a variety of options.	–2.138	0.033*
13	I ask for colleagues' ideas and viewpoints.	–1.897	0.058
14	I ask for the viewpoints of clients' family members.	–2.138	0.033*
15	I cope well with change.	–1.000	0.317
16	I can function with uncertainty.	–3.497	0.000*
17	I regularly hypothesize about the reasons for my client's problems.	–3.356	0.001*
18	I must validate clinical hypotheses through my own experience.	–2.828	0.005*
19	I clearly identify the clinical problems prior to planning intervention.	–1.897	0.058
20	I anticipate the sequence of events likely to result from planned interventions.	–3.317	0.001*
21	Regarding a proposed intervention strategy, I think, "What makes it work?"	–2.500	0.012*
22	Regarding a particular intervention, I ask, "In what context would it work?"	–3.398	0.001*
23	Regarding a particular intervention with a particular client, I determine whether it worked.	–3.300	0.001*
24	I use clinical protocols for most of my treatment.	–3.500	0.000*
25	I make decisions about practice based on my experience.	–2.178	0.029*
26	I use theory to understand intervention strategies.	–2.676	0.007*
	TOTAL	–4.375	0.000*

* An asterisk denotes statistically significant change.
SACRR scale ranges from 1 (strongly disagree) to 5 (strongly agree).

of the items (Table 1). The 22 items on SACRR that showed a statistically significant change from pretest to posttest were clustered in the following general themes: a) use of theory and frames of reference to plan and understand treatment interventions, b) asking questions of self in regard to intervention strategies, c) use of clinical protocols, and d) decision making and judgment based on examining data and one's own experience. In addition, the student's total score for pretest and posttest (composite for all 26 items) demonstrated a statistically significant improvement upon completion of the 1-week, experience-based learning program. Overall scores for all 25 students improved from 102.96 to 113.88 with a statistical significance of $p < 0.001$.

For the CCTST, the students' total scores improved from a mean of 19.60 (SD 3.731) to a mean of 21.52 (3.920) with a statistical significance of $p = 0.006$. A further analysis of the test revealed that students made statistically significant changes in three of the five subscales of the CCTST: evaluation, inductive reasoning, and deductive reasoning ($p < 0.05$). There was no significant change in the subscale scores for inference and analysis ($p = 0.101$ and 0.103, respectively) (Table 2, Fig. 1).

Discussion

The results of this study indicate that an experiential learning program can improve the clinical reasoning and critical thinking skills of occupational therapy students. Participation in hand-on learning with actual clients could reinforce information learning in lecture courses and prepare students for entry-level practice. In comparison to the educational literature on the current instructional models used to improve both clinical reasoning and critical thinking skills in the allied health professions, the results of this study provide favorable data on the use of experience-based learning and support the development of hands-on learning in current OT curricula.[3,5,11,22,25,29]

Based on the specific data collected from the SARCC, the students perceived improvements in their clinical reasoning skills as related to use of clinical protocols, clinical hypotheses, intervention strategies, decision making, and judgment. There was a statistically significant change in questions directly related to use of clinical protocols, including "I must validate clinical hypotheses through my own experience" (Table 1, question #18) and "Regarding a proposed intervention strategy, I think 'What makes it

TABLE 2. California Critical Thinking Skills Test (CCTST) Pretest and Posttest Scores

Total and Subscales	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	*p* Value
Total Critical Thinking Score	19.60	3.731	21.52	3.920	0.006*
Analysis	4.64	1.162	5.12	1.177	0.103
Evaluation	5.32	2.014	6.20	1.549	0.039*
Inference	9.64	2.464	10.20	2.315	0.101
Inductive	10.40	1.980	11.44	1.878	0.015*
Deductive	9.20	2.514	10.08	2.897	0.046*

*An asterisk indicates statistically significant change; SD, standard deviation.

work?'" (Table 1, question #21). In addition, the students' tolerance for uncertainty and ambiguity improved, as did their reliance on their own experience to validate their clinical hypotheses and practice decisions.

In response to questions related to experience, students demonstrated statistically significant changes in questions such as "I make decisions about practice based on my own experience" (Table 1, question # 25) and "I anticipate the sequence of events likely to result from planned interventions" (Table 1, question #20). These findings are similar to those seen in qualitative studies, which identify the ability to apply clinical reasoning skills in real patient situations as one of positive outcomes of experienced-based learning.[16] Published literature on experience-based learning reports that students who are provided experiences with actual clients examine their own clinical reasoning skills and determine how their reasoning skills change over time as they were presented with clinical challenges.[18,21]

Students who participated in this experiential learning program demonstrated statistically significant improvements in 84.6% of the items on the SACRR. A previous study on clinical reasoning skills used the same outcome measure as in this study, the SACRR, to determine changes in clinical reasoning before and after participation in a PBL program.[5] Scaffa and Wooster[5] investigated the use of a PBL course that was provided over 5 weeks for a total of 30 hours prior to starting clinical Level II fieldwork. The 48 OT students who participated demonstrated statistically significant changes in 11 items, or 40% on the test, after completion of the course. The Scaffa and Wooster study noted improvements in the overall composite pre- and posttest scores on the SACRR, but only less than half of individual test items improved. In comparison, in the experienced-based program tested in this study, twice as many individual test items improved (22 out of 26 items). It could be argued that the greater gains seen in the current study were due to the intensity of the hands-on experience and the specific learning elements of this program. Further study is needed to determine what components of the learning experience provided in this program lead to the significant change in pre- and posttest scores on 22 of 26 items on the SACRR. The results of this study are supported by current evidence on PBL, which suggests it is only as effective as traditional lecture-based curriculum in preparing students for entry-level clinical practice and may have limited effect on enhancing clinical reasoning.[6,9]

The students who participated in this experience-based learning program also demonstrated statistically significant improvements in their overall critical thinking skills as well as the subcomponent skills of evaluation and inductive and deductive reasoning as measured by the CCTST (Table 2). At the core of the CCTST is a measurement of the critical thinking skills required for a person to analyze his/her own inferences in order to come to a reasonable decision when faced with a clinical challenge. These skills are necessary for synthesizing information in order to thoughtfully assess a client's situation in the time allotted in an evaluation or treatment session. Occupational therapists are required to use inductive and deductive reasoning skills to synthesize information from a wide variety of sources during the evaluation and treatment process.[4] In could be considered that participation in this hands-on learning opportunity with an actual client is similar to conducting experiential research in which a hypothesis is formulated and tested in actual practice. The ability to develop treatment ideas for a client and test the actual treatment intervention in "real time" gives rise to reflective thought and inductive and deductive reasoning. This mirrors the development of decision-making skills witnessed as entry-level therapists transitions from novice to expert.[19,29]

Changes seen in the students' overall critical thinking skills and use of inductive and deductive reasoning could also be due to the nature of experiential learning, which uses reflection and analysis to help students to determine future actions.[30–32] Reflective practice is a conscious process of thinking, analyzing, and learning from work situations.[30,32] By examining anticipated and unanticipated outcomes while actually providing treatment to a client, students improve their clinical skills, begin to develop expertise, and contribute to their own professional knowledge.[33] Reflection is seen as enhancing the students' critical thinking skills, particularly in evaluating the effectiveness of a care plan in relation to patient outcomes and improving powers of deductive and inductive reasoning.

Several recently published healthcare education studies have also used the CCTST to determine changes in critical thinking following PBL and case method instruction and have not demonstrated the same positive results as found in

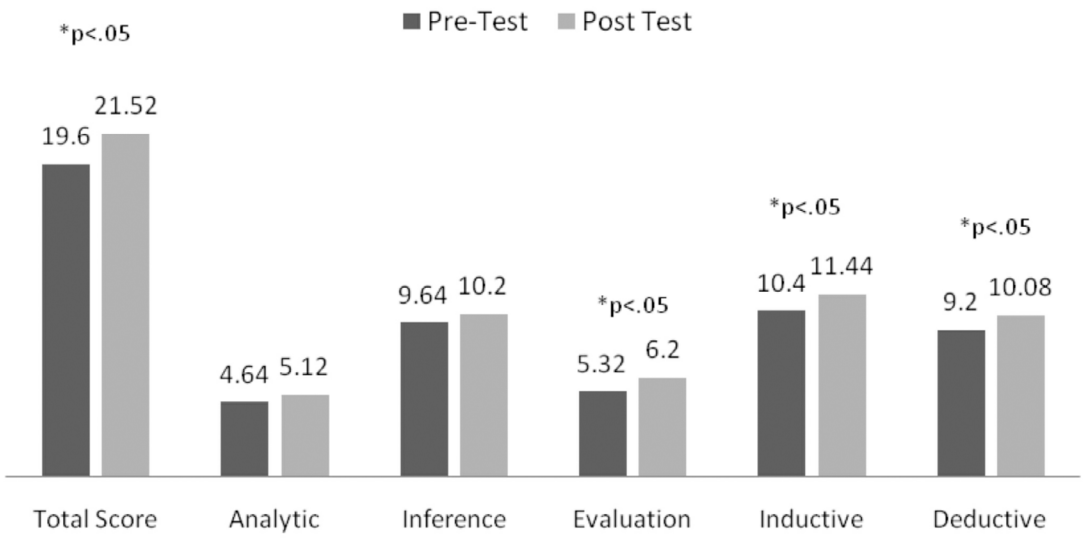

FIGURE 1. California Critical Thinking Skills Test (CCTST) pretest (*black bars*) and posttest scores (*gray bars*).

our study.[5,19,29,34] In comparison to the recently published literature on critical thinking skills, the results of the current study on experiential learning found gains not only in the overall critical thinking score but also significant changes in three of five subcomponents on the CCTST. Velde et al.[29] examined the effects of seminar-based case method instruction on the critical thinking skills of 64 OT students using the CCTST before and after participation in the program. Students randomly assigned to the experimental group, who participated in case method instruction, did not show a statistically significant change in CCTST overall or subtest scores in comparison to the control group who did not participate in this instructional approach. Vendrely[34] studied the changes in first-year physical therapy (PT) students after completion of 1 year in the academic curriculum, which included mostly lecture and PBL instruction. The 42 students who participated in this study were administered the CCTST 1 week after starting the PT educational program and again during the last week of a full year of academic coursework. The data in the study by Vendrely indicated that there was no significant changes in the critical thinking skills as a result of completing a year of instruction using lecture and PBL formats. The author indicated that the students may not have performed well on the posttest due to a lack of rewards for successful completion of the test, which was not built into the course grade.

LIMITATIONS

The students who participated in this experiential learning program were a convenience sample of 25 OT students who enrolled in this course. Due to several factors, caution should be used in generalizing the results of this study. The sample of students engaged in this learning experience were self-selected and not randomized into experimental and control groups. Therefore, there was no comparison of the results of participation in this experienced-based program to other traditional learning approaches, such as case method instruction or PBL. This study only examined clinical reasoning and critical thinking skills at one point in time after 1 hour learning experience. Conclusions about all experienced-based learning programs that go beyond this sample of students may not be reliable.

Although the course involved elements important to experiential learning, the changes seen in the students' clinical reasoning and critical thinking skills could be due to the specific type of experiences offered in this course. Therefore, the results of this study should not be generalized to all experienced-based learning opportunities for therapy students. Further study is needed to determine what elements of this hands-on experience were most beneficial to the students' learning in order to determine what qualities of experiential learning most enhance clinical reasoning and critical thinking skills.

Conclusions

The result of this study provides encouraging support for the use of experiential learning in OT educational programs to improve both clinical reasoning and critical thinking skills for students in a master's degree OT programs. This study supports the use of hands-on learning to develop clinical reasoning and critical thinking skills and encourage faculty to develop appropriate experiential learning programs that will foster the skills needed for students to successfully enter today's healthcare environment. Faculty in educational programs must consider the needs of students, the type of material to be learned, and the presentation of the material when determining the most effective instructional method to prepare students for entry-level practice.

Finally, future qualitative and quantitative investigations on the use of experiential learning in allied health

professions programs should consider several questions based on information from this study: 1) What components of an experiential learning program are critical for developing clinical reasoning and critical thinking skills in allied health professions? 2) When should hands-on learning could be embedded into curriculum to help students apply foundational information learned in lecture courses to practical client situations? 3) How much hands-on time do students require with clients to receive the benefits of experiential learning? 4) What are the long-term effects of experiential learning programs? Does participation in learning situations with actual clients better prepare students for entry-level practice?

References

1. Griffiths Y, Padilla R. National status on the entry-level doctorate in occupational therapy (OTD). *Am J Occup Ther* 2006; 60(5): 540–550.
2. Parker M, Thorslund M. Health trends in the elderly population: getting better and getting worse. *The Gerontologist* 2007; 47(2):150–158.
3. Royeen C, Mu K, Barrett K, Luebben AJ. Pilot investigation: evaluation of clinical reflection and reasoning before and after workshop intervention. In *Innovations in Occupational Therapy Education*. Bethesda, MD: American Occupational Therapy Association: 2001.
4. American Occupational Therapy Association. Standards of Practice. *Am J Occup Ther* 2004; 58:664–687.
5. Scaffa M, Wooster D. Effects of problem-based learning on clinical reasoning in occupational therapy. *Am J Occup Ther* 2004; 58(3): 333–336.
6. Coppard BM, Dickerson A, Commission E. A descriptive review of occupational therapy education. *Am J Occup Ther* 2007; 61(6): 672–677.
7. Lederer J. Disposition toward critical thinking among occupational therapy students. *Am J Occup Ther* 2007; 61(5):519–526.
8. Lysaght R, Bent M. A comparative analysis of case presentation modalities used in clinical reasoning coursework in occupational therapy. *Am J Occup Ther* 2005; 59(3):314–324.
9. McCarron K, D'Amico F. The impact of problem-based learning on clinical reasoning in occupational therapy education. *Occup Ther Health Care* 2002; 16(1):1–12.
10. Erskine J, Leenders M, Mauffette-Leenders L. Teaching with cases. London, ON: School of Business Administration, The University of Western Ontario; 1981.
11. Tomey A. Learning with cases. *J Contin Educ Nurs* 2003; 34(1): 34–38.
12. Jacob P. The academic-fieldwork interface. *Aust Occup Ther J* 1992; 39:33–37.
13. Royeen C, Salvatori P. Comparison of problem-based learning curricula in two occupational therapy programmes. *Can J Occup Ther* 1997; 64:190–202.
14. Royeen C. A problem-based learning curriculum for occupational therapy students. *Am J Occup Ther* 1995; 49:338–346.
15. Koh B, Khoo H, Wong M, Koh D. The effects of problem-based learning during medical school on physician competency: a systematic review. *CMAJ* 2008; 178(1):34–41.
16. Benson J, Witchger Hansen A. Moving the classroom to the clinic: the experiences of occupational therapy students during a "living lab". *Occup Ther Health Care* 2007; 21(3):79–91.
17. Ganley K, Mueller K. Clinically relevant outcomes of immersion in a service based experience for physical therapy students. *Pediatr Phys Ther* 2006; 18(1):90–101.
18. Liu K, Chan C, Hui-Chan C. Clinical reasoning and the occupational therapy curriculum. *Occup Ther Int* 2000; 7(3):173–183.
19. Seruya F. Preparing entry level occupational therapy students: an examination of current teaching practices. *Spec Interest Sect Q—Educ* 2007; 17(4):1–4.
20. Peloquin S, Osbourne K. Establishing a practice climate in academic settings. *J Allied Health* 2003; 32(2):78–85.
21. Sewchuk D. Experiential learning—a theoretical framework. *AORN J* 2005; 81(6):1311–1318.
22. Vogel K, Geelheod M, Grice K, Murphy D. Do occupational therapy and physical therapy curricula teach critical thinking skills? *J Allied Health* 2009; 38(3):152–157.
23. Bartlett D, Cox P. Measuring change in students' critical thinking ability: Implications for health care education. *J Allied Health* 2002; 31(2):64–69.
24. Choi H. The effects of problem-based learning on the meta-cognition, critical thinking problem solving of nursing students. *Taehan Kanho Hakhoe Chi* 2004; 34(5):712–721.
25. Yuan H, Williams BA, Fan L. A systematic review of selected evidence on developing nursing students' critical thinking through problem-based learning. *Nurs Educ Today* 2008; 28(6):657–663.
26. Hussey S, Sabonis-Chafee B, O'Brien J. *Introduction to Occupational Therapy,* 3rd ed. St. Louis: Mosby-Elsevier; 2007.
27. Tiwari A, Lai P, So M, Yeun K. A comparison of the effects of problem-based learning and lecturing on the development of students' critical thinking. *Med Educ* 2006; 40:547–554.
28. Facione P, Facione N, Blohm SW, Giancarlo C. *California Critical Thinking Skills Test: Test Manual—2002 Revised Edition*. Millbrae, CA: The California Press; 2002.
29. Velde B, Wittman P, Vos P. Development of critical thinking skills in occupational therapy students. *Occup Ther Int* 2006; 13(1):49–60.
30. Cirocco M. How reflective practice improves nurses' critical thinking ability. *Gastroenterol Nurs* 2007; 30(6):405–413.
31. DiBartola L, Miller M, Turley C. Do learning style and learning environment affect learning outcome? *J Allied Health* 2001; 30(2): 112–115.
32. Kolb D. *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice Hall; 1984.
33. Maudsley G, Strivens J. Promoting professional knowledge, experiential learning and critical thinking for medical students. *Med Educ* 2000; 34(7):535–544.
34. Vendrely A. Critical thinking skills during a physical therapist professional education program. *J Phys Ther Educ* 2005; 19(1):55–59.