Journal of Interprofessional Education & Practice 9 (2017) 41–50

Contents lists available at ScienceDirect

Journal of Interprofessional Education & Practice

journal homepage: http://www.jieponline.com

Comparing change in perceived achievement of students in an interprofessional class: The effectiveness of participatory versus direct instruction

John F.K. Ekpe [a, d, *], David R. Moore [a, b], John W. McCarthy [a, c], Jeffrey J. DiGiovanni [a, c]

[a] Ohio University, Athens, OH, USA
[b] Educational Studies, Patton College of Education and Human Services, Ohio University, Athens, OH, USA
[c] Communication Sciences and Disorders, School of Rehabilitation and Communication Sciences, Ohio University, Athens, OH, USA
[d] Department of Mathematics and Statistics, Accra Technical University, P. O. Box 561, Accra, Ghana

ARTICLE INFO

Article history:
Received 25 October 2016
Received in revised form
10 July 2017
Accepted 1 August 2017

1. Introduction

Effectiveness and sequencing of instruction plays a major role in achieving learning outcomes in interprofessional health education.[1–3] Although there are lecture based discussions where the content is designed to teach team-based strategies, a learning approach where teamwork is a part of the actual instruction would seem to be a more valid approach. Unfortunately, empirical evidence to support such a statement is currently lacking in the literature. The aim of this study was to compare and explore the overall students' perceived achievement change scores of participatory instruction versus direct instruction approaches to learning interprofessional content in the form of the core competencies for interprofessional education identified by the Institute of Medicine (IOM). Greiner and Knebel[4] described the five IOM core competencies to include providing patient-centered care; working in interdisciplinary teams, applying quality improvement, employing evidence-based practice, and utilizing informatics (p. 4). These areas came from knowledge identified as critical to improving patient safety and quality of care through cooperation in health professions dating back to efforts in the 1970s. Planning for the current study began in 2011 and used the IOM competencies as a base for instruction. The idea was to find critical areas of overlap between health professions as suitable topics for an interprofessional class. In 2011, the Interprofessional Education Collaborative (IPEC) published a set of intperprofessional competencies designed to expand greatly on the interdisciplinary teams portion of the IOM competencies. These competencies were then expanded to included population health and an increased level of specificity in 2016. Although the IPEC competencies provided guidance for interprofessional education, knowledge at the time of this study as well as an emphasis on finding content areas lending themselves to direct and participatory instruction were foci for the current multi-year study.

1.1. Participatory and direct approaches

1.1.1. Direct instructional approach

On the most basic level, interprofessional education could involve a traditional teaching format with students from different health professions in the same classroom. Within the same space, students can participate in teacher directed activities where prompts guide the learners in the classroom to consider different perspectives and even engage in guided discussions from each other. The key element would be the teacher directed nature of all interactions, with an emphasis on content learning. The direct instruction approach is the most traditional lecture method. Kirschner, Sweller, and Clark[5] defined direct instruction as providing information that fully explains the concepts and procedures that students are required to learn as well as learning strategy support that is compatible with human cognitive architecture (p. 75). Kirschner et al.[5] noted direct instruction works better with a more homogeneous population. However, Felder and Brent[6] noted that students who receive direct instruction master the expected knowledge and skills better. The burden is then on an instructor to be able to develop content cycled to diverse students with widely different levels of clinical

* Corresponding author. Permanent address: Department of Mathematics and Statistics, Accra Technical University, P. O. Box 561, Accra, Ghana.
E-mail addresses: je208007@ohio.edu (J.F.K. Ekpe), moored3@ohio.edu (D.R. Moore), mccarthj@ohio.edu (J.W. McCarthy), digiovan@ohio.edu (J.J. DiGiovanni).

http://dx.doi.org/10.1016/j.xjep.2017.08.001
2405-4526/

experiences. For example, a single instructor could be addressing first year medical students who have no clinical experience and Nursing students ready to graduate with significant clinical experiences already. Kirschner et al.[5] emphasized that guided (direct) instruction is superior in the context of human cognitive architecture, expert-novice differences, and cognitive load (p. 75); however, it is very challenging when the learner's prior knowledge is high and when students have misconceptions or incomplete or disorganized knowledge,[5] p. 84). A challenge in interprofessional education is getting past students wide variety of knowledge and experiences with other health professions. One of the core competencies involves an accurate understanding of the scope of other professions.

Direct instruction approaches are efficient in the sense of being able to accommodate large number of students in a class, so that in principle all health profession and medical students could be exposed to the same content through the same instructional approach regardless of size or makeup of classes. With challenging schedules and different enrollment numbers across major programs, direct instruction approaches may be expedient and are not predicated on uninteresting and uninspired teaching methods. The question remains whether a direct instruction approach would be optimal in achieving desired learning outcomes, particularly when the end-goal is interprofessional practice (IPP).

1.1.2. Participatory instructional approach

The participatory learning approach focuses on a participation 'plus' pedagogy model; knowledge and insight are from diverse fields.[7] According to Kenny and Wirth,[8] participatory learning practices are more descriptive than prescriptive in nature; politics, negotiation, collaboration, advocacy, and change are the perspectives.[9] Skills training in health procedures may work well in single profession classrooms, but an interprofessional classroom requires an approach allowing for integration across diverse backgrounds.

Bodner, Metz, and Casey[10] noted, student-driven participatory approach should expose the students to a topic for understanding and then provide opportunities for editing their work: posing contradictions, presenting new information, asking questions, encouraging research, and/or engaging students in inquiries designed to challenge current concepts,[11] p. ix). This is not unlike real-world interprofessional encounters where different health professionals need to discuss their intersections in best serving individual patients where each case is different.

Brooks and Brooks[11] provided five overarching principles evident in participatory approach. These principles are a) instructors seek and value their students' points of view; b) classroom activities challenge students' suppositions, c) instructors pose problems of emerging relevance, d) instructors build lessons around primary concepts and big ideas, and e) instructors assess student learning in the context of daily teaching,[11] pp. ix-x). An advantage of these principles is that they promote an equal value of students' views regardless of their backgrounds or major or area of study. In interprofessional education the culture created by this kind of atmosphere is consistent with respect for patients and professionals in a way that supports teamwork. The question remains about the effectiveness for this approach in learning identified core competencies.

This study answered two questions: 1) does an interprofessional class taught using participatory instruction show a greater gain on overall perceived achievement change scores than the class taught using direct instruction; and 2) how do interprofessional students' journal reflections help explain the quantitative results relative to core IOM competencies?

2. Methods

2.1. Quantitative research design

The research design was quasi-experimental nonequivalent control group design. The participant assignments into participatory instruction group (the experimental group) and direct instruction group (the control group) has been illustrated (see Fig. 1). Both groups were given instructor-developed Institute of Medicine Self-rated Knowledge Achievement (IOMSKA) pre-survey and a post-survey. The two groups were not randomly assigned but were from intact classes.

According to Cook and Campbell,[12] nonequivalent means that the expected values of at least one characteristic of the groups are not equal even in the absence of a treatment effect (p. 148). In this case, the nonequivalent referred to the comparison of students in the participatory instruction (experimental) group who were taught and those in the direct (control) group who were not taught. We could not assume pre-treatment equivalence between the control group and the experimental group. Cook and Campbell note that understanding of the nature of the group nonequivalence implies understanding of the selection process and how it differs from being random.

2.2. Qualitative research design

2.2.1. A multiple case-study design

A multiple case-study design[9] was used for collecting and analyzing the qualitative data. According to Cohen, Manion, and Morrison,[13] multiple case-study designs involve comparative case-studies within an overall piece of research or replication case studies,[13] p. 291). In this study, there were six (6) selected student-cases, consisting of three (3) cases of two nursing students and an audiology student from direct instruction group (i.e., literal replications-cases selected from control group were identical) and three (3) cases of two music therapy and one speech language therapy students from participatory instruction group (i.e., theoretical replications-cases selected from experimental group were identical) (see Table 1). We did replication so that we would have two different groups of cases for comparison. The selection criteria used was that a student who had z-score of initial perceived achievement score fell above +2 or below −2 standard deviation (extreme or unique case) was a case-study.

2.3. Population

Target population for this study was all of the graduate and undergraduate students who completed an Interprofessional Health Care in Rural/Underserved Population course in a mid-western university campus from fall 2013 semester to summer 2015. A total of 93 students participated. After removing missing cases, the final sample for the quantitative data analysis was 90 medical and related health science professionals, consisting of 40 students (mean age, 24.28 years) who received participatory instruction from the third to fifth cohort groups and 50 students (mean age, 23.02 years) who received direct instruction from the sixth to eighth cohort groups. The cohort groups stretched over the fall, spring, and summer terms. The sample for qualitative journal reflection data consisted of three students from each instructional group.

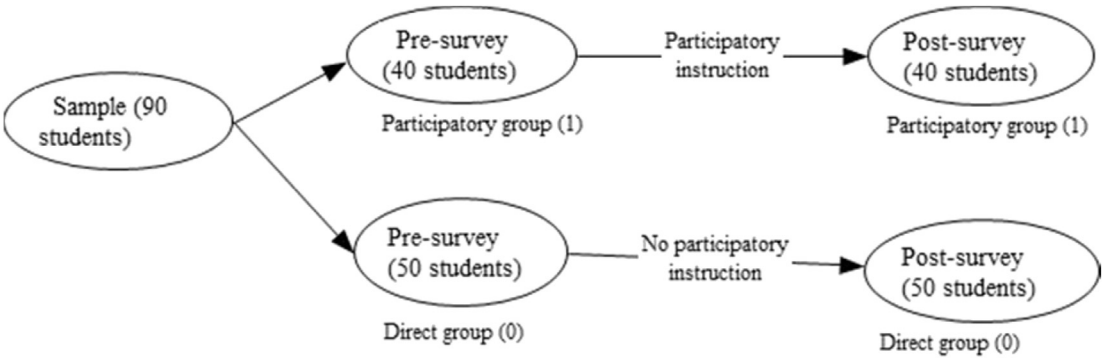

Fig. 1. Showing quasi-experimental design- a nonequivalent control group.

2.3.1. Sampling technique

A convenience sampling technique (intact class) was used for the quantitative data (phase one) of the study and then purposeful sampling technique for the qualitative data (phase two). The intact class consisted of students who were admitted from different fields, namely, medicine, nursing, social works, nutrition, speech language pathology, physical therapy, audiology, and music therapy.

Health profession and medical students who had all of their pre- and post-survey data and their journal reflections data retrieved from the database participated in this study. Health profession and medical students who had at least one of their pre- and post-survey data and their journal reflections data missing from the database were excluded from this study.

2.4. Data collection procedure

2.4.1. Participatory group instructional method

The participatory instruction focused mainly on having participants to design and create interactive online learning activities in a face-to-face classroom setting. Lesson plan was prepared on sample past modules based on the five IOM Core Competencies and the content materials were provided to the participants. Instructor created opportunities for students to work individually, in their professional teams, and in their interprofessional teams.

2.4.2. Participatory classroom environment

The participatory classroom environment encouraged teamwork and sharing of experiences. This environment provided opportunity for the students to discuss, collaborate, negotiate roles, advocate, solve problems, and make team decisions.

2.4.3. Direct group instructional method

Lesson plans was prepared on sample past modules based on the five IOM core competencies and the content materials were provided to the participants. Instructor taught students using a lecture format for two hours a day only in the first two weeks of the beginning of a semester (see Fig. 2).

Table 1
Summary of multiple- cases: Selected journals for students by instructional group and major.

Case	Group	
	Participatory (#case)	Direct (#case)
Case 1	Music Therapy (2)	Audiology (1)
Case 2	Speech language therapy (1)	Nursing (2)

2.5. Instrument

Perceived achievement was measured by using an instructor-developed 5-item instrument called an Institute of Medicine Self-rated Knowledge Achievement (IOMSKA) survey. An example of the questions on rating and comments on what you know about patient-centered care standard was presented (see Fig. 3, Appendix A).

2.5.1. Testing instrument

The instrument was used in pre- and post-surveys. The IOMSKA survey was designed to collect both quantitative and qualitative data. Each question represented a construct. The questions were quantitatively rated on 7-point knowledge scale ranged from “No knowledge” (1) to “Expert” (7) with no additional labels marked. The survey also had five items that were open-ended questions of the five constructs. The students were requested to provide comments on their perceived knowledge rated. Content validity analysis was examined using three content experts. The reliability coefficient for the five questions of the overall initial perceived achievement in Cronbach's alpha was 0.70 and that of the overall final perceived achievement was 0.84.

For the qualitative analysis of student journals, Microsoft Excel's “data-sort” command was used to sort keywords and themes.

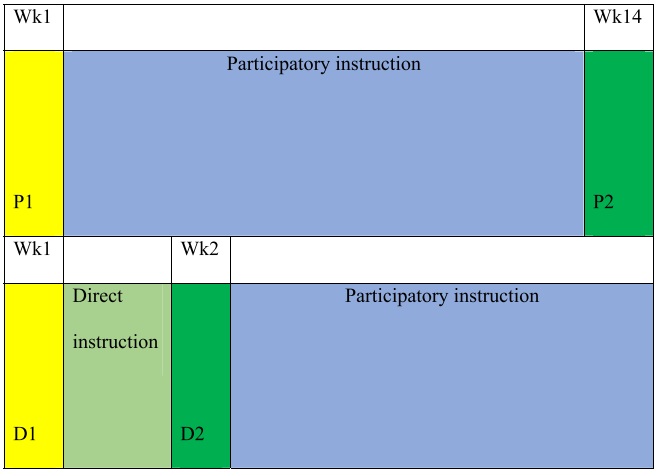

Fig. 2. Showing instructional types and the weeks of the pre- and post-survey administrations. *Note.* P1 = participatory group pre-survey; P2 = participatory group post-survey; D1 = direct group pre-survey; D2 = direct group post-survey; Wk1 = First week meeting; Wk2 = Second week meeting; and Wk14 = Last week meeting.

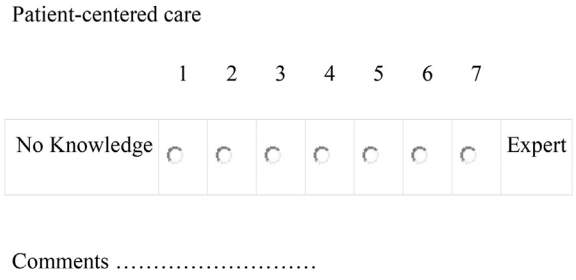

Fig. 3. Showing a patient-centered care item of IOMSKA survey with closed-ended ratings and open-ended comments sections.

Keywords of the assignments were color coded in the students' weekly written journals. A “keyword” column was created for the keywords. Using the Excel “data-sort” command, the keywords were arranged alphabetically. Another column, the “skills column” was created. In this column, each keyword of the cells under the “keyword” column had its category of IOM core competency typed. Using the Excel “data-sort” command on the “skill” column, the IOM core competencies were arranged in alphabetical order. The content of the cell for each core competency was read. Statements or sentences of underlying themes were teased out to explain the change due to participatory instruction or direct instruction on the students' self-concepts in the core competencies of a group module project. Initial thematization and coding was completed by the first author. Following a set of operational definitions for each theme, the second author verified each theme according to definitions and examples. Disagreements relative to themes was resolved through discussion. The third author then verified a subset of selected themes for accuracy of the coding scheme by repeating the first author's coding and sorting.

3. Results

3.1. Quantitative results: demographic data by instructional types

The frequency/percentage distributions of the demographic data for the two instructional groups of the health science and medical students were distributed in terms of cohort groups, status, sex, and age (see Table 2). Out of the 40 health science and medical students in the participatory group, 42.5% of the students were in fall cohort group, 27.5% were in spring cohort group, and 30% were in summer cohort group; 20% undergraduate students and 80% graduate students; 77.5% female and 22.5% male; and the mean ages ranged 20 to 38 ($M = 24.28$, $SD = 3.88$); whereas out of the 50 health science and medical students in the direct group, 38% of the students were in fall cohort group, 34% were in spring cohort group, and 28% were in summer cohort group; 30% undergraduates and 70% graduate students; 84% female and 16% male; the mean ages ranged 20 to 31 ($M = 23.02$, $SD = 1.99$).

For the participatory instructional group, the compositions of students in their majors were 10% Nursing, Medicine, and Nutrition, 17.5% Physical Therapy, 25% Speech Language Pathology students, 20% Social Work students, and 7.5%Music Therapy students; whereas for the direct instructional group, the compositions of their majors were 22% Nursing students, 18% Physical Therapy, Nutrition, Speech Language Pathology, 12% Social Works, and 4% Medicine, Music Therapy, and Audiology students (see Table 3).

Table 2
Frequency distributions of demographic data by instructional types.

Category	Participatory group ($n = 40$)	Direct group ($n = 50$)
Cohort		
Fall	17 (42.5%)	19(38%)
Spring	11(27.5%)	17(34%)
Summer	12(30%)	14(28%)
Status		
Undergraduate	8 (20%)	15 (30%)
Graduate	32 (80%)	35(70%)
Sex		
Female	31 (77.5%)	42 (84%)
Male	9 (22.5%)	8 (16%)
Age		
Mean	24.28	23.02
SD	3.88	1.99
Age range	[20, 38]	[20, 31]

Table 3
Frequency Distribution of Students by their Major and Group.

Major	Group	
	Participatory ($n = 40$)	Direct ($n = 50$)
Nursing	4 (10%)	11 (22%)
Physical Therapy	7 (17.5%)	9 (18%)
Nutrition	4 (10%)	9 (18%)
Speech Language Pathology	10 (25%)	9 (18%)
Social Works	8 (20%)	6 (12%)
Medicine	4 (10%)	2 (4%)
Music Therapy	3 (7.5%)	2 (4%)
Audiology	0 (0%)	2 (4%)

3.2. Effect of participatory and direct instructional types on students' overall perceived achievement change scores

3.2.1. Scoring level of perceived achievement

Each student's self-rated scores on the five items (instructor-developed IOMSKA survey) were added to give an overall weighted perceived achievement score. The expected maximum overall perceived achievement score was 35, and the minimum overall perceived achievement score was 5. Similarly, the expected minimum self-concept score on an item was a 1 and the maximum self-concept score was a 7 on an item. Using these weighted sums helped in calculating the overall students' perceived achievement change scores from pre- to post-survey rating.

3.2.2. Overall perceived achievement change score

From Tables 4 and 5, for students in the participatory group, their overall initial perceived achievement mean score was 19.42 (SD = 4.51) and their overall final perceived achievement mean score was 27.45 (SD = 3.37). Their overall perceived achievement change score was 8.33 (i.e., 27.45−19.42). Similarly, for students in the direct group, the overall initial perceived achievement mean score was 19.98 (SD = 3.03) and their overall final perceived achievement mean score was 24.98 (SD = 3.39). Their overall perceived achievement change score was 5.00 (i.e., 24.98−19.98).

3.3. Research question 1

The first research question was, does an interprofessional class taught using participatory instruction show a greater gain on overall perceived achievement change scores than the class taught using the direct instruction? The results of Levene test for equality of variances ($p = 0.06$) indicate that the t-test assuming equal

Table 4
Means and standard deviations of students' overall perceived achievement and self-concept scores before and after instructions by instructional type group.

Self-Concept	Part (40)		Direct (50)	
	Initial-Mean(SD)	Final-Mean(SD)	Initial-Mean(SD)	Final-Mean(SD)
Patient centered care	4.55(1.34)	5.80(0.72)	5.00(0.93)	5.48(0.74)
Interdisciplinary teams	4.20(1.04)	5.90(0.74)	4.58(0.84)	5.06(0.71)
Evidence-based practice	5.00(1.09)	5.78(0.86)	5.14(0.95)	5.46(0.86)
Quality improvement	3.42(1.47)	5.08(0.86)	3.46(1.39)	4.76(0.82)
Informatics	1.95(1.09)	4.90(1.06)	1.80(0.97)	4.22(1.27)
Overall-pAch	19.12(4.51)	27.45(3.37)	19.98(3.03)	24.98(3.39)

Table 5
Change scores, independent samples *t*-test results, and effect sizes for students' self-concept and perceived achievement due to instructional methods.

Self-Concept	Part($n = 40$)		Direct($n = 50$)				Cohen's
	M	*SD*	*M*	*SD*	*t*(88)	*p*	*d*
Patient-centered care	1.25	1.13	0.48	0.93	3.55	0.001	0.74
Interdisciplinary teamwork	1.70	1.31	0.48	1.04	4.95	0.001	1.03
Evidence-based practice	0.78	1.10	0.32	0.87	2.20	0.031	0.46
Quality improvement	1.65	1.61	1.30	1.50	1.06	0.290	0.23
Informatics	2.95	1.38	2.42	1.43	1.78	0.079	0.38
cpAch	8.33	4.73	5.00	3.63	3.78	0.001	0.79

Note. cpAch = Overall perceived achievement change scores.

variances should be interpreted (see Table 5).

The results of the *t*-test assuming equal variances indicated that there is a statistically significant gain between the overall perceived achievement change scores for the health science and medical students taught using a participatory instruction and the overall perceived achievement change scores for the health science and medical students taught without using the participatory instructions, $t(88) = 3.78$, $p = 0.001$, $d = 0.79$. On average, medical and health related professions students in the participatory group have greater gain on the overall perceived achievement change score ($M = 8.33$, $SD = 4.73$) than on the overall perceived achievement change scores of the health science and medical students who were not taught using participatory instruction ($M = 5.00$, $SD = 3.63$). In fact, some of the gains on the perceived self-concept change scores were statistically positive and significant, patient-centered care, $t(88) = 3.55$, $p = 0.001$, $d = 0.74$; interdisciplinary teamwork, $t(88) = 4.95$, $p = 0.001$, $d = 1.03$; and evidence-based practice, $t(88) = 2.20$, $p = 0.031$, $d = 0.46$. Others gains on the perceived self-concept change scores were statistically positive and nonsignificant, quality improvement, $t(88) = 1.06$, $p = 0.29$, $d = 0.23$; and informatics, $t(88) = 1.78$, $p = 0.08$, $d = 0.38$.

3.4. Quantitative findings

3.4.1. The effectiveness of participatory and direct instructional types on students' overall perceived achievement change scores

The results showed the interprofessional class taught using participatory instruction had greater positive and significant gains on the overall perceived achievement change scores than class taught using the direct instruction. (Regarding H1, we found a significant positive effect of participatory instruction on the overall perceived achievement change scores of the students).

3.4.2. Research question 2

The second research question was, "how do interprofessional students' journal reflections help explain the quantitative results relative to core IOM competencies?"

3.4.3. Qualitative findings

Keywords for subcategories included relationships based on thought, feeling, liking, interest, awareness, helpfulness, usefulness, importance, surprise, and excitement. The keywords were used to identify sentences from the categorized textual data. The explanations of health science and medical students' self-concept on core competency areas of the group module project were drawn from the students' journal reflections. We compared the journals of three cases selected students in the participatory instruction group with the three cases selected students in the direct instruction group.

3.5. Students' journal analyses by the five core competencies

3.5.1. Patient-centered care knowledge developing over time and through interactions with patients and other professionals

Selected students in both groups talked about patient centered care emerging from interactions with patients and with other professionals. A music therapy student selected from participatory instruction group, PB, noted that "Patient-centered care is something I knew about before this class but now I know effective ways to implement patient centered care as an interdisciplinary team." A speech language therapy student from this group, PC stressed that patient-centered care was "Focusing on the patients, they are more than an ICD-9 code."

However, an audiology student selected from direct instruction group, DA expressed her understanding of patient-centered care as "Putting patients' beliefs and values first; doing what is best for the patient at all times; basing the treatment on the best interests of the patient; and communicating with other healthcare professionals." A nursing student in this group, DB noted that patient-care is a "Care that is in the best interest of the patient." Finally, another nursing student in the group, DC outlined her experience: "As I progress through nursing school, my knowledge of patient-centered care has grown. It is not something that can be taught but instead it is learned as I grow as a nurse. As I gain more experience in the nursing field my knowledge of patient centered care will continue to grow." These results suggest that health science and medical students felt knowledgeable and gain deep

understanding on patient-centered care competency. Although indications of self-reported knowledge indicated an advantage for students in the participatory group with regard to knowledge of patient centered care, findings through student journals do not help to differentiate the reason why.

3.5.2. Interdisciplinary teamwork

Student comments relative to interdisciplinary teamwork indicated more confident comments in the participatory group. On interdisciplinary teamwork, a music therapy student selected from participatory instruction group, PB claimed that "After completing this course, I feel like a total expert on this topic." A speech language therapy student from this group, PC believed to "Work with other professions to provide the best care possible."

Students in the direct instruction group appeared more objective. An audiology student selected from direct instruction group, DA expressed her understanding as "Working in teams with other healthcare professionals to determine the best treatment for the patient; pulling together all professionals knowledge." A nursing student in this group, DB reported that "Obviously it is the teamwork of different professions to provide care. However, I do not yet know how to apply it completely." Finally, another nursing student in the group, DC noted that:

> Interdisciplinary teamwork is crucial in patient care. No single resource or person will be able to treat an individual and get them back to a healthy state. I have not had many experiences with interdisciplinary teamwork yet but I do know that it is very important in patient centered care. I look forward to gaining more skills and insight into this area throughout this course, during my clinicals, and she I become a registered nurse.

3.5.3. Evidence-based practice

Comments relative to evidence-based practice were objective from both groups and represented fairly standard answers to this competency area. On evidence-based practice, a music therapy student selected from participatory instruction group, PA noted that evidence-based practice referred to "Using what has been found best practices in research for clinic purposes." A nursing student in the direct instruction group, DC noted that "Evidence-based practice is necessary to provide the most recent and up to date care for patients. Without new research many healthcare providers would be stuck in old ways that are not the most efficient and/or effective way of treating patients."

3.5.4. Quality improvement

On quality improvement, answers from students in the participatory group appeared to support an understanding that now led them to more questions. Instead of feeling, "like experts," students in the participatory group noted more specific challenges. A music therapy student selected from participatory instruction group, PB claimed "I know more about quality improvement, but am still unsure of real implementations for it." A speech language therapy student from this group, PC stressed that "Just because something is already set in place, doesn't mean it is the best option. Always try to improve."

Answers from the direct instruction group were more general. An audiology student selected from direct instruction group, DA reported that quality improvement is a "Communication between professionals and improve quality of patients care for an improved patient experience." Similarly, a nursing student in this group, DB noted that quality improvement is "Using evidence to make improvements to care." Finally, another nursing student in the group, DC noted that quality improvements were the "Improvements in healthcare that will ultimately lead to better patient outcomes. This can happen through the use of EBP, quality patient centered care, and advocacy for patients."

3.5.5. Informatics

Qualitative comments about informatics did not appear to differentiate the groups. In each group, some members expressed confidence in stating a definition, while others continued to have questions about application. A music therapy student selected from participatory instruction group, PB reported that "Before this class I had never really heard of informatics. Now, I feel like I am fairly confident on what they are and how to read them." Similarly, a speech language therapy student from this group, PC noted that "I'm still not quite sure the role/purpose of this."

An audiology student selected from direct instruction group, DA reported that informatics was "Using technology to communicate, mitigate error, and for knowledge basis." A nursing student in this group, DB noted that informatics was "Technology used to provide a universal format for providing information." Finally, a nursing student in the group, DC expressed her feeling that "I am starting to understand what informatics is but I do not have a very good grasp on the concept yet to be able to comment." Thus, participatory instruction had increased health science and medical students' self-concept in informatics more than the direct instruction.

4. Discussion

The first research question was, does an interprofessional class taught using participatory instruction have greater gain on the overall perceived achievement change scores than the class taught using the direct instruction? In order to answer this question, a hypothesis was formulated and an independent samples *t*-test was conducted. Based on the quantitative analysis, the gain on the overall perceived achievement change scores for health science and medical students taught using a participatory instruction was statistically significant greater than the overall perceived achievement change scores for health science and medical students taught using direct instruction. In fact, within the core competency areas health science and medical students in the participatory instruction group had statistically positive and significant gains on the change perceived self-concept of patient-centered care, interdisciplinary teamwork, and evidence-based practice, and statistically positive and no significant gain on change perceived self-concept of quality improvement and informatics; suggesting students in the participatory group had positive self-concepts on the competency areas. Considering the effect size of the competency areas, the results show that the instructional sequencing of the five core competencies from simple to complex is as follows: interdisciplinary teamwork ($d = 1.03$), patient-centered care ($d = 0.74$), evidence-based practice ($d = 0.46$), informatics ($d = 0.38$), and quality improvement ($d = 0.23$).

Sequencing instructional design is an efficient ordering of content, task, and project.[14–17] There are several approaches to sequencing instruction based on learning-related (identifiable prerequisite, familiarity, difficulty, interest, and development), physical characteristics, and concept-related sequence,[18]

elaboration theory of instruction (content expertise and task expertise sequencing)[15] essential and supporting prerequisites[14] sequencing decisions[16] and designing the instruction sequence.[17] These instructional sequencing categories guide the thoughts of the curriculum developer, evaluator, and researcher and provide a structure for the designer.[18] Instructional sequencing helps students to gain deep understanding because it reduces learner anxiety, creates learner expectations, and helps produce positive outcomes.[15,16,18]

The sequence in the current data set is interesting and gives some potential insight into the benefits and challenges in teaching interprofessional competencies in the classroom in general. Participatory groups can be easily created in the classroom. Students can work in groups to complete tasks and can learn to work together in tasks that are or are not tied to clinical patient services. Similarly, patient centered care indexed through skills like effective listening and communication strategies can also be replicated through active group learning. However, issues related to informatics or quality improvement are more difficult to recreate in the classroom. Regardless of the ability of teams to work together to discuss issues of quality improvement, it is still different than practices in clinical setting related to reducing falls, or taking universal precautions. Likewise students can practice using data together in teams; however, such practices are different from compiling reports using an actual electronic health record at a facility. Issues related to quality improvement and informatics may have to do more with how teams exchange information or hand-off information from one professional to another rather than skills that are fostered through collaborative learning and involve ongoing discussion on group projects.

The second research question was, “how do interprofessional students' journal reflections help explain the quantitative results relative to core IOM competencies?” In order to answer this question, a multiple case-study design method and a thematic analysis were conducted. The qualitative analysis revealed that health science and medical students taught using the direct instruction acknowledged that they had no knowledge about informatics and quality improvement competency areas. An illustrative excerpt from journal reflection expressing this feeling: One student reported: “… Before this PowerPoint, I had no prior knowledge regarding quality improvement and informatics … It was interesting hearing about how evidence based practice was incorporated in each curriculum. All programs have somewhat of a different approach, but EBP is integrated in each profession whether it is classes or research.” One reason is that quality improvement and informatics core competencies are applied skills whereas the others were concepts that leant themselves more to discussion and case based learning. Quality improvement is something that a health facility may want to impact (e.g., fewer infections, fewer falls, fewer readmissions) as it can lend itself less to feelings of competence changing within a course. Similarly, informatics is an applied skill in the field where health information from patients is used to enact change and is done on more of a facility or macro level and not so much at the patient level.

These findings were consistent with previous researches. Bandura and Locke,[19] Bloom,[20] and Gropper[21] found that students' level of achievement increases if instruction is approached sensitively and systematically. Moore[3] noted that designing instructional sequences helps student gain deep understanding. Moore concluded that implementing appropriate learning strategies may guide students' behavior to master the content material. Although design as it relates to direct instruction versus participatory instruction is important the sequencing of the actual content is also important. In any competency set whether it is IOM or IPEC it is important to consider whether it is optimal to discuss roles and responsibilities first followed by ethical decision making, or if all five areas should be constantly integrated within each lesson.

DiGiovanni and McCarthy[1] and Ekpe[2] found that students rated interdisciplinary teamwork, patient-centered care, and evidence-based practice knowledge high but rated informatics and quality improvement low. Another approach would be to address areas of low initial competency to bring them up to the levels of other areas. Bray and Rogers[22] noted, training programs should educate professionals about patient evaluation and treatment, and what professional can and cannot offer. Bray and Rogers recommended that the development of standards for training should emphasize collaborative relationships that include a) negotiating communication issues; b) explaining theories; c) ensuring confidentiality; d) identifying time scheduling differences; and e) acknowledging lack of competition in practices. These findings have implication for curriculum design.[2,3,22–24] More research is needed to investigate the sequencing of competency areas within interprofessional instruction.

5. Conclusion

This study shows that interprofessional class taught using participatory instruction had statistically positive and significant gains on the overall perceived achievement change scores than class taught using the direct instruction, implying that participatory instruction had effectively increased health science and medical students' final perceived achievement scores. In addition, health science and medical students taught using participatory instruction claimed that they were able to work in team very well on interdisciplinary teamwork, and that they knew effective ways to implement patient-centered care competency areas, indicating differences among the subsets of the IOM Core Competencies. However, health science and medical students taught using direct instruction acknowledged that they had no knowledge about informatics and quality improvement standard but knowledgeable in evidence-based practice, suggesting a participatory learning experience should be considered when teaching Health Science Core Competencies; yet, in some cases, direct instruction should not be discounted.

Funding

This work was supported by the Ohio Department of Medicaid, Medicaid Technical Assistance and Policy Program (MedTAPP) Healthcare Access Initiative ODM Federal Funding: G-1415-07-0060; ODM201409.

Acknowledgment

This research was done in partial fulfillment of the requirements for the Ph. D. program in Educational Studies at Ohio University for John F. K. Ekpe.

Appendix A. IOM Self-Reported Knowledge Achievement (IOMSKA) Survey

This survey is to find out what you have learned about inter-professional education

---

Required

Identification #

Demographic Information

Age on your last birthday

Sex:

Male

Female

Status:

Undergraduate

Graduate

Major:

Self-reported perceptions about the following:

Ratings and comments related to what you know and how you feel about each.

Patient-centered care

	1	2	3	4	5	6	7	
No knowledge	○	○	○	○	○	○	○	Expert

Comments ……

Interdisciplinary teamwork

	1	2	3	4	5	6	7	
No knowledge	○	○	○	○	○	○	○	Expert

Comments ……

EBP (evidence based practice)

	1	2	3	4	5	6	7	
No knowledge	○	○	○	○	○	○	○	Expert

Comments ……

Quality improvement

	1	2	3	4	5	6	7	
No knowledge	○	○	○	○	○	○	○	Expert

Comments ……

Informatics

	1	2	3	4	5	6	7	
No knowledge	○	○	○	○	○	○	○	Expert

Comments ……

Submit

(*continued*).

References

1. DiGiovanni JJ, McCarthy JW. IPE 102: innovative interprofessional education that includes audiology and speech-language pathology. In: Johnson A, ed. *Interprofessional Education and Interprofessional Practice in Communication Sciences and Disorders: An Introduction and Case-based Examples of Implementation in Education and Health Care Settings*. Rockville, MD: American Speech-Language-Hearing Association; 2016:29–53.
2. Ekpe JK. Comparing participatory and direct instructional types of interdisciplinary health sciences and professions students' perceived achievement in a group module project (Doctoral dissertation). Retrieved from https://etd.ohiolink.edu/pg_10?0::NO:10:P10_ETD_SUBID:114936 ; 2016.
3. Moore DR. A framework for preparing students to design their own learning strategies. *Coll Q*. 2004;7(4). Retrieved from http://www.senecac.on.ca/quarterly/2004-vol07-num04-fall/moore.html.
4. Greiner AC, Knebel E. *Health Professions Education: A Bridge to Quality*. Committee on the Health Professions Education Summit; 2003. Retrieved from http://www.nap.edu/catalog/10681.html.
5. Kirschner PA, Sweller J, Clark RE. Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educ Psychol*. 2006;41(2):75–86.
6. Felder RM, Brent R. The ABC's of engineering education: ABET, Bloom's taxonomy, cooperative learning, and so on. In: *Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition*. 2004:1. Retrieved from http://aucache.autodesk.com/au2011/sessions/5091/additional_materials/v2_ED5091_Miller_AdditionalMaterials.pdf.
7. Hedges H, Cullen J. Participatory learning theories: a framework for early childhood pedagogy. *Early Child Dev Care*. 2012;182(7):921–940.
8. Kenny RF, Wirth J. Implementing participatory, constructivist learning experiences through best practices in live interactive performance. *J Eff Teach*. 2009;9(1):34–47.
9. Creswell JW, Plano Clark VL. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: SAGE Publications, Inc; 2011.

10. Bodner GM, Metz PA, Casey KL. Twenty-five year experience with interactive instruction in chemistry. In: *Learning with Understanding in the Chemistry Classroom*. Springer; 2014:63–74. Retrieved from http://link.springer.com/chapter/10.1007/978-94-007-4366-3_8.
11. Brooks JG, Brooks MG. *In Search of Understanding: The Case for Constructivist Classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development; 1999.
12. Cook TD, Campbell DT. *Quasi-experimental: Design and Analysis Issues for Field Settings*. Boston, MA: Houghton Mifflin Company; 1979.
13. Cohen L, Manion L, Morrison K. *Research Methods in Education*. New York, NY: Routledge Taylor & Francis Group; 2011.
14. Aronson DT, Briggs LJ. Contributions of Gagne and Briggs to a prescriptive model of instruction. In: Reigeluth CM, ed. *Instructional-design Theories and Models: An Overview of Their Current Status*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1983:75–100.
15. English RE, Reigeluth CM. Formative evaluation research on sequencing instruction with elaboration theory. *Educ Technol Res J*. 1996;44:23–41.
16. Gropper GL. A behavioral approach to instructional prescription. In: Reigeluth CM, ed. *Instructional-design Theories and Models: An Overview of Their Current Status*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1983:101–161.
17. Morrison GR, Ross SM, Kemp JE, Kalman HK. *Designing Effective Instruction*. fifth ed. Hoboken, NJ: John Wiley & Sons, Inc; 2007.
18. Posner GJ, Strike KA. A categorization scheme for principles of sequencing content. *Rev Educ Res*. 1976;46:665–690.
19. Bandura A, Locke EA. Negative self-efficacy and goal effects revisited. *J Appl Psychol*. 2003;88(1):87–99.
20. Bloom BS. *Human Characteristics and School Learning*. New York, N.Y: McGraw-Hill Book Company; 1976.
21. Gropper GL. A metatheory of instruction: a framework for analyzing and evaluating instructional theories and models. In: Reigeluth CM, ed. *Instructional-design Theories and Models: An Overview of Their Current Status*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1983:37–53.
22. Bray JH, Rogers JC. Linking psychologists and family physicians for collaborative practice. *Prof Psychol Res Pract*. 1995;26(2):132–138.
23. Bergan J. Behavioral training and the new mental health: are we learning what we need to know? *Behav Ther*. 1995;18:161–164.
24. Ludwigsen KR, Albright DG. Training psychologists for hospital practice: a proposal. *Prof Psychol Res Pract*. 1994;25(3):241–246.