

RESEARCH ARTICLE

Student learning styles: Implications for interprofessional education program design

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Abstract: This cross-sectional, exploratory, quantitative research project investigated differences in students' learning styles across multiple academic disciplines. The Grasha-Reichmann Student Learning Style Scales (GRSLSS) was selected which presents six learning styles: independent, avoidant, collaborative, dependent, competitive, and participant. Surveys were administered to students (N = 448) registered in professional preparatory programs (n = 6) at a Midwest regional commuter-based campus. Results support the need for interprofessional education initiatives to be developed from a student-centered perspective where the attributes of learners are interwoven – explicitly and implicitly, into the learning experience.

Keywords: learning styles, interprofessional education

1 Introduction

Interprofessional collaborative practice (IPCP) has been viewed as an important avenue to increase health care quality and safety^[1]. In creating these types of collaborative health care teams, a plethora of academic attention is being paid to how health profession educators incorporate interprofessional education (IPE) into the curriculum^[2-4]. The Cochrane Collaboration concluded that interprofessional education should begin early in the curriculum for students in health profession programs as a way to promote role understanding, improve communication, and advance patient safety^[5,6]. Emergent models of IPCP have been clarified through the passage of the Recovery and Reinvestment Act of 2009^[7] and the Patient Protection and Affordable Care Act of 2010^[8] with the intent to improve the delivery of health care services. These new concepts in care will require health care providers to be trained in interprofessional collaborative care to promote high quality health care services^[9-11].

IPE is concerned with training, teaching, and fostering competent health care professionals while they are students, so new knowledge, skills, and attitudes align

with collaborative interprofessional practice^[11,12]. This affords IPE program designers a significant opportunity to take learner characteristics into account, while embracing competency-based educational approaches that contain specific content domains and related practice behaviors. It would be best if IPE program designs were flexible, wide-ranging, and adaptable to the individual profession and to the clinical or institutional settings^[4]. The core premise of all IPE initiatives is the support of “integrated applications of knowledge where the student can adapt to change, develop new behaviors, and continue to improve performance”^[14]. Interprofessional education is “when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes”^[15]. The delivery of IPE encompasses different pedagogies—didactic (class or online method of interactive instruction), case competitions (written plans of care), problem-based learning (experientially learning concepts through solution-focused review), simulations (real or online tasks), and clinical rotations (field education)^[16-18]. However, most IPE models take the form of didactic, simulation, or clinical approaches^[18].

To maximize learning, IPE program developers need to be aware of students' internal learning dispositions^[19]. Students bring interpersonal dynamics into their participation in special programs, which can impact learning outcomes both negatively and positively^[16,20]. In many ways, these interpersonal dynamics can impact the very premise of IPE – that greater collaboration among students will create more effective and collaborative practices as professionals. For example, anxiety can certainly impact the learning process and impede the collaborative

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experience of student groups/teams^[21].

Each individual learner that participates in an IPE initiative brings with him or her worries, fears, and/or attributes that can impact the enterprise. This can be shown through computer anxiety^[22], general anxiety – both social and in the workplace^[23–25], their need for social support^[26] or their interpersonal decision-making skills^[27]. Placing a group of students with high levels of computer anxiety might not generate the types of desired outcomes of program developers or students-as-participants in IPE initiatives. Whereas intentional design of an IPE collaborative clinical rotation with students that indicate a preference for high levels of support and demonstrate high interpersonal decision-making could produce highly prized outcomes. There is a myriad of internal student characteristics that could be a focal point in designing a reflexive and “best fit” program for learners.

IPE has received increasing regard in the literature. A wide range of academic disciplines have focused on infusing IPE initiatives into existing course work^[28], developing mandatory training curriculums, and bolstering interprofessional efforts in relation to accreditation requirements^[29]. By extension, the literature often focuses program design considerations on aspects of feasibility^[30]. These studies center on when or at what point students are introduced to IPE^[31], and what type of IPE approach will be used; whether it be simulation, conference or workshop style, course assignment, or within a clinical rotation^[32,33].

Yet within all this increased attention to IPE program design, there remains a lack of intention given to the variety of professional disciplines invited to participate in IPE programs – those typically referred to as ancillary or allied health professions (for example, social work and public health) versus the typical association of primary health professions (for example, medicine and nursing)^[34]. This lack of inclusivity poses two major problems. First, it challenges the design and implementation of IPE educational initiatives. The lack of intention to student learning styles and their learning needs calls into question the aim of determining a best practice model for IPE design^[35,36]. As the question stands, best for whom and when? Second, with balanced inclusivity and attention to pre-design, a more thorough understanding of the learning needs and styles of students-as-participants from multiple academic disciplines could support improved educational outcomes. The need to focus on inclusivity in IPE program design supports the embedded competencies of IPCP. Specifically, gains are seen in the emerging literature of IPE program design in relation to targeting dialogics on roles and responsibilities^[37].

A wide variety of health care disciplines play a vital

role in the delivery of safe, effective, and high-quality health care services. Equally missing in the literature is attention to program design that matches the types of IPE being developed (clinical, didactic, simulation, or service-learning) with the needs of the student learners-as-participants in mind. There are numerous considerations that emerge as potential focal points for designing a reflexive and “best fit” program for learners. A “best fit” for learners would be a natural extension of the growing literature centered on best practice in program design. Within IPE program design, it is important to consider the interactions of learning styles of students participating in collaborative IPE initiatives. Designers of IPE could use these understandings to inform which academic health care disciplines (primary, ancillary or secondary, and allied as tertiary) might participate in future research efforts^[38–40].

1.1 IPE as a learning process

Way and colleagues^[41] (2001) illustrate that collaboration in health care teams are synergistic efforts that foster effective communication and ethical decision-making where separate and shared knowledge is combined with various professional skill sets to influence patient care. This synergy creates what has become known as interprofessional collaborative practice, which is when “multiple health workers from different professional backgrounds work together with patients, families, care givers, and communities to deliver the highest quality of care”^[15]. The aim of IPE is the transformation of students to professionals – cognitive and behavioral changes that share the language of collaboration, patient-centered philosophy, and scope of practice^[11,42,43].

1.2 Links to theory

Payler and colleagues^[44] (2008) concluded that no educational pedagogy was superior to another until a theoretical framework could be established for IPE that evaluated various interventions. Sargeant^[45] (2009) asserted that an “array of related theories can contribute to understanding and implementing IPE” (p. 179) – such as but not limited to social learning theories, while noting the value of reflective, experiential, and situational learning models in instruction^[46,47]. The literature supports the significance of students’ learning styles in areas of vocational training^[48], field education^[16], online learning environments^[49], distance education^[50], continuing professional development^[51], and in relation to different instructional methods^[52]. These areas traverse and directly connect to the variety of IPE program designs – for example, field education to clinicals and online learning to simulations. Assessing the needs of students-as-participants

for improved IPE program implementation is a logical extension of numerous pedagogical practices^[53].

1.3 Outcomes of IPE participation

The substantive literature on IPE programs and initiatives is vast, and systemic reviews and meta-analyses provide a wealth of information regarding the outcomes of IPE programs. One such systematic review found that participants' attitudinal changes towards collaboration created a positive culture of change in both the organizational cultures (responsiveness) and patient care (integration)^[54]. Barr *et al.*^[55], (2008) extended the tenet of culture change and found IPE programs increased the focus of the participants' learning through recognizing personal change in knowledge, skills, and patient care. Hammick and colleagues^[56] (2007) reported a greater linkage between learning tasks and instructional processes and positive learning outcomes for participants. Reeves and colleagues^[5] (2008) discovered that IPE program evaluations employ rigorous research designs and small sample sizes and tend to report positive changes to professional practices and patient satisfaction. There tends to be considerable heterogeneity in IPE programming. The increased attention on IPE has created an increased focus on the various types of education initiatives^[57].

Minimal attention on assessments of the learning needs of students-as-participants prior to participating in IPE programming is found in the literature^[58]. As malleable as the constructs of IPE and IPCP are, there remains a lack of attention to the learning styles and learning needs of students-as-participants and to the intention of IPE program developers to plan initiatives with those needs in mind^[59,60]. The purpose of this study was to examine the differences in students' learning styles across multiple academic disciplines. The disciplines chosen to participate in the study were as follows: social work, criminal justice, medicine, nursing, dental, and radiology; All disciplines were within one college at an urban commuter-based university in the Midwest. The differences in learning styles serve as special considerations for IPE program design.

2 Methods

This project is best viewed as a cross-sectional, exploratory, quantitative research design that sought to determine differences and similarities in student's learning styles across multiple academic disciplines that may participate in collaborative-based IPE initiatives. The design is cross-sectional in that it is relational^[61], not interested in cause and effect^[62], and targets characteristics shared within a community^[63]. By extension, the work is exploratory as it seeks to better understand an existing prob-

lem^[64]. Specifically, a two-fold exploration: What are the learning styles of student respondents, and how might those styles shape IPE program design?

Respondents were recruited from six academic disciplines, which were selected given the high likelihood each would be invited to participate in the academic institution's interprofessional education initiatives. Any actively enrolled student attending graduate and/or undergraduate courses in the spring semester from the disciplines above were invited to participate. Thus, the sampling is best defined as purposive^[65] as well as convenient^[66], which given the intent of the project and its quantitative design is acceptable^[63]. This research project was approved by the university's Institutional Review Board

2.1 Pre-testing

Two instructors (nursing and social work) recruited students for pre-testing of the survey and distributed it to one class each. The pre-test sample size was 56 students with 20 from social work and 36 from nursing. None of these students were surveyed as part of the project's implementation in the spring semester. The researcher was given the first 20 minutes of both class sessions to introduce the study, review the recruitment letter, and invite students to review the survey. Out of the 56 students, 52 completed the survey and 31 provided either written or verbal feedback.

The students shared that the layout of the instrument was visually appealing, readable, that the content made sense to their role as learners, and that the survey was easy to move through. Both groups completed the survey in 16 minutes. Students reported that the questions clearly linked to styles of learning. These responses endorsed the face and content validity of the instrument. Students made the following suggestions: shorten the survey where possible, correct the minor typos to promote greater clarity, and increase space for narrative remarks. The survey was modified in two succinct ways: 1) the instructions were clarified; and 2) the learning style scale wording was revised to support general course reflection versus specific course reflection^[67].

2.2 Data collection

Eleven faculty members across 15 courses agreed to the distribution of the paper-pencil survey in their courses. Of those students invited to participate, 84% completed the survey (N = 448). Respondents received a recruitment letter, a study information sheet that explained the purpose of the study, their rights as participants, and the voluntary nature of participation as well as contact information for researchers in case they had any questions. No personal identifying information was collected through the survey,

Table 1. Reliability of learning styles scale

Category	N	Excluded	%	Alpha	Mean	Variance	SD
Collaborative	438	10	2.2	0.784	36.15	39.69	6.3
Competitive	442	6	1.3	0.769	25.28	41.56	6.45
Avoidant	432	16	3.6	0.748	26.38	41.56	6.42
Participant	434	14	3.1	0.717	38.53	30.6	5.53
Dependent	435	13	2.9	0.543	38.13	18.72	4.32
Independent	432	16	3.6	0.580	35.04	21.37	4.62

Table 2. Sample characteristics

Characteristic	TOTAL (N = 448)	Criminal Justice (n = 91)	Dental (n = 47)	Medicine (n = 34)	Nursing (n = 98)	Social Work (n = 93)	Radiology (n = 85)
Age							
Traditional	324 (72%)	80 (88%)	39 (83%)	28 (82%)	73 (74%)	48 (52%)	56 (66%)
Non-Traditional	112 (25%)	11 (12%)	7 (14%)	5 (14%)	24 (24%)	40 (43%)	25 (29%)
Race/Ethnicity							
White Non-His	304 (67%)	52 (57%)	36 (77%)	20 (58%)	69 (70%)	54 (58%)	73 (86%)
African-American	48 (11%)	14 (15%)	3 (6%)	3 (9%)	8 (8%)	20 (22%)	
Hispanic	48 (11%)	14 (15%)	6 (12%)	1 (3%)	13 (13%)	9 (10%)	5 (6%)
Asian	9 (2%)	0	0	8 (24%)	0	0	1 (1%)
Bi-racial	15 (4%)	9 (10%)	0	0	2 (3%)	3 (3%)	1 (1%)
Multiracial	4 (1%)	0	1 (2%)	0	0	2 (2%)	1 (1%)
Gender							
Female	340 (76%)	39 (43%)	46 (98%)	19 (56%)	85 (87%)	85 (91%)	66 (78%)
Male	108 (24%)	52 (57%)	1 (1%)	15 (44%)	13 (13%)	8 (8%)	19 (22%)
GPA							
2.0-2.99	64 (14%)	32 (35%)	1 (2%)	0	12 (12%)	14 (15%)	5 (6%)
3.0-3.50	219 (49%)	37 (40%)	35 (74%)	0	64 (65%)	31 (33%)	52 (61%)
3.51-4.0	136 (30%)	17 (18%)	9 (19%)	32 (94%)	18 (18%)	36 (39%)	24 (28%)
Level							
Undergraduate	369 (82%)	88 (97%)	47 (100%)	0	98 (100%)	50 (54%)	85 (100%)
Graduate	79 (18%)	3 (3%)	0	34 (100%)	0	43 (46%)	0
IPE							
Yes	18 (4%)	3 (3%)	0	2 (6%)	6 (6%)	5 (5%)	2 (2%)

and no follow-up contacts were sought.

2.3 Measures

A paper-based self-administered survey was employed as it has a higher rate of return/completion than other survey methods^[68]. The survey contained two sections: learning styles (60 items) and demographics (8 items). The questionnaire took approximately 20 minutes to complete.

2.4 Learning styles

The 60-item Grasha-Reichmann Student Learning Style Scales (GRSLSS) represents six learning styles: independent, avoidant, collaborative, dependent, competitive, and participant (10 items per learning style). Avoidant students tend to be at the lower end of the grade distribution and tend to exhibit absenteeism, poor organization of work, and little responsibility for their learning. Participative students are characterized as willing to accept responsibility for self-learning and relate well to their peers. Competitive students are described as suspicious of their peers leading to competition for rewards and recognition. Collaborative students enjoy working harmoniously with their peers. Dependent students typically become frustrated when facing new challenges not directly addressed in the classroom. Independent students prefer to

work alone and require little direction from the teacher^[67]. The higher the aggregated score in a learning style, the more the respondent identified with that approach. The GRSLSS uses a 5-point Likert type scale (1 = strongly disagree to 5 = strongly agree). Cronbach's alpha for four sub-scales were satisfactory in this study (collaborative, competitive, avoidant, and participant), while two sub-scales were poor (dependent and independent) as represented in [Table 1](#).

2.5 Demographic information

Demographic information was collected in categories. These categories included: gender, ethnicity, grade point average, program of study, age, involvement in IPE programs, and program type (graduate or undergraduate). Again, no personal identifying information was collected from participants.

2.6 Study participants

Convenience sampling was used to recruit respondents from across the various disciplines of social work, nursing, medicine, radiography, dental, and criminal justice. Each academic discipline represented views itself as a professional preparatory program. Sampling inclusion criteria consisted of any registered college student attending graduate and/or undergraduate courses in the spring

semester from the previously mentioned disciplines. The data recruitment strategy was equitable with an equal number of professors and courses solicited by discipline, differences in sample size by discipline exist (range = 34-93). The students from both the Dental and Medical Schools had the smallest sample size. The cohort model is used these two disciplines, and class sizes tend to be smaller as admission protocols limit admissions by cohort and level of academic programming.

3 Results

Descriptive statistics were used to summarize results for each scale and participants' demographics. Demographic information was compared across disciplines. The six learning styles were compared to determine existing relationships. Aggregated scores for each scale and both score sets were compared by program of study. An analysis of variance (ANOVA) was used to ascertain the differences between group means. Post-hoc analyses were used if ANOVAs were significant. Bonferroni analysis was used to adjust the significance rating to control for the risk of a type I error for multiple comparisons^[63].

3.1 Descriptive statistics

The sample consisted primarily of White non-Hispanic (67%) females (76%), in the age range of 18-28 (72%), which was defined as traditional students given the nature of the academic programs being surveyed (see Table 2). Within this sample, 79% of respondents self-reported a 3.0 or above grade point average for the most recent semester. More undergraduate students (82%) were represented. Less than 5% of the sample reported prior participation in IPE programs or initiatives. Medical students earned performance ratings as grades. The GPA of medical students ranked as "high performance" was recoded into a 3.75 GPA.

3.2 Demographic comparisons

A series of chi-square analyses were used to examine differences among students by demographic variables and academic program. Given the multiple analyses, a Bonferroni-adjusted significance level was calculated to account for the increased possibility of type-I error. Accordingly, the Bonferroni correction to adjust the p value from $p < 0.05$ for each analysis (9) to $p < 0.008$ to neutralize this risk.

A statistically significant difference by race was found across programs, $\chi^2 (1, N = 441) = 146.85, p < 0.001$. White Caucasian Non-Hispanic ethnicity accounted for nearly 70% of the sample size, while all minorities accounted for the remaining 30%. Three programs (criminal justice, medicine, and social work) had the most ethnically

diverse students. There was a significant difference by gender across academic programs, $\chi^2 (1, N = 448) = 92.794, p < 0.001$. Males accounted for 24% of the overall sample, but 57% of the criminal justice sample were male. The five remaining disciplines had more female than male respondents. Academic programs were significantly different by level of student (undergraduate or graduate), $\chi^2 (1, N = 448) = 249.159, p < 0.001$. A vast majority of the sample, 80%, were undergraduate students. The highest percentages of graduate students per program were found in medicine and social work. Lastly, no statistically significant difference was noted by academic program and IPE involvement.

3.3 Learning styles by Academic Program

Collaborative learning style was high for the social work, nursing, and dental students; the criminal justice students had the lowest mean score for collaborative learning style. Regarding the competitive learning style, medical students had the highest mean and social work had the lowest mean score. The avoidant learning style scores were highest for dental students and the lowest for nursing students. The highest mean score on the participant learning style was for nursing students and the lowest score was for medical students. The program with the highest mean scores for a dependent learning style was dental students, and the lowest mean scores were from medical students. The highest mean score for an independent learning style was from medicine and the lowest was from radiology.

Academic programs had distinct differences and similarities across the six categories of learning styles (see Table 3). The criminal justice, radiology, and dental students had the highest mean scores within the dependent learning style. Nursing students had the highest collaborative learning style mean scores. Medical students had the highest mean score in the independent learning style. The participant learning style had the highest mean scores for social work students. The competitive learning style held the lowest mean scores for the following programs: criminal justice, dental, social work, and radiology. Nursing and medical students has the lowest mean scores for the avoidant learning styles.

3.4 Correlation among learning styles

The six learning style distributions (independent, avoidant, collaborative, dependent, competitive, participant) were reviewed and each approximated normal distribution. The assumptions of normal distribution, sampling, and item independence were met. A range of negative and positive low level statistically significant correlations (10 out of 28 correlations) were found and moderate cor-

Table 3. Differences in learning style by discipline

		Independent	Avoidant	Collaborative	Dependent	Competitive	Participant
Nursing	Mean	34.92	24.12	37.13	38.30	24.34	41.05
	(SD)	(4.61)	(5.26)	(5.90)	(3.93)	(5.71)	(4.61)
Medical	Mean	37.47	27.59	34.94	36.48	27.59	34.44
	(SD)	(4.75)	(7.34)	(5.56)	(4.40)	(5.35)	(5.27)
Criminal Justice	Mean	35.32	27.99	34.30	38.07	26.57	37.90
	(SD)	(4.47)	(7.06)	(6.93)	(4.79)	(6.61)	(6.70)
Dental	Mean	35.19	29.00	36.30	40.15	25.46	37.93
	(SD)	(4.06)	(6.45)	(5.82)	(3.39)	(5.97)	(4.32)
Social Work	Mean	35.52	24.84	38.37	37.32	23.84	38.94
	(SD)	(4.51)	(5.45)	(5.40)	(4.53)	(6.71)	(5.15)
Radiologic	Mean	33.35	27.12	34.89	38.38	25.52	37.67
	(SD)	(4.69)	(6.44)	(6.69)	(4.12)	(7.04)	(4.99)

Table 4. ANOVA results

		Sum of Squares	df	Mean Square	F	Sig.
Independent	Between Groups	451.168	5	90.234	4.388	0.001*
	Within Groups	8759.609	426	20.562		
	Total	9210.777	431			
Avoidant	Between Groups	1333.414	5	266.683	6.925	0.000*
	Within Groups	16404.327	426	38.508		
	Total	17737.741	431			
Collaborative	Between Groups	1019.023	5	203.805	5.394	0.000*
	Within Groups	16321.126	432	37.780		
	Total	17340.148	437			
Dependent	Between Groups	347.829	5	69.566	3.838	0.002*
	Within Groups	7776.082	429	18.126		
	Total	8123.911	434			
Competitive	Between Groups	612.597	5	122.519	3.016	0.011
	Within Groups	17713.702	436	40.628		
	Total	18326.299	441			
Participant	Between Groups	1283.959	5	256.792	9.182	0.000*
	Within Groups	11969.806	428	27.967		
	Total	13253.766	433			

Note: * $p < 0.05$

relations near or above were statistically significant in two out of 28 correlations^[65].

Avoidant learning style demonstrated a negative moderate-level correlation to participant learning style, $r^2(420) = -0.59$, $p < 0.01$, while there was a positive moderate-level correlation between participant and collaborative learning style, $r^2(425) = 0.49$, $p < 0.01$. Thus, a learner with an avoidant style would not readily participate or seek avenues to participate in learning as a group activity. Furthermore, a learner who actively participates in their own learning process is more likely to collaborate with others in learning activities.

3.5 Learning style differences by discipline

An analysis of variance was conducted to evaluate the relationship between learning styles and academic discipline. The dependent variables were the aggregated scores of the six sub-scales on the learning styles instrument. The independent variable was academic discipline. These findings can be found in [Table 4](#).

Statistically significant findings were found for five of the learning styles by discipline: independent $F(5, 426) = 4.39$, $p < 0.001$; avoidant $F(5, 426) = 6.93$, $p = 0.000$, collaborative $F(5, 432) = 5.39$, $p = 0.000$, dependent

$F(5, 429) = 3.83$, and participant $F(5, 428) = 9.18$, $p = 0.000$. In using the conservative approach to control for a Type 1 error, the Bonferroni-correction, the adjusted alpha value from $p < 0.05$ to that of $p < 0.08$, one learning style did not show a significant difference by discipline relationship: i.e., competitive $F(5, 428) = 3.02$, $p = 0.011$.

The Tukey HSD was used to best determine which groups differed from each other. [Table 5](#) reviews the post-hoc findings. The mean score for the independent learning style for medicine was significantly different than radiology ($M = 4.12$, $SD = 0.95$). This suggests that the students within the medicine program identify with the independent learning style at a higher rate when compared with radiology students.

There were statistically significant differences in the avoidant learning style for criminal justice students compared to nursing ($M = 3.86$, $SD = 0.924$) and to social work ($M = 3.14$, $SD = 0.94$); dental by social work ($M = 4.16$, $SD = 1.11$) and nursing ($M = 4.88$, $SD = 1.12$); and nursing to radiology ($M = 2.9$, $SD = 0.93$). Learners who rated themselves more avoidant in their approach were found in the criminal justice and dental programs rather than nursing and social work. Statistically significant differences were also found in collaborative learning

Table 5. Post-Hoc analysis: Learning styles mean differences by program

Learning Style	(I) Program	(J) Program	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
INDEPENDENT	MEDICINE	RADIO	4.12*	0.95	0.000*	1.41	6.83
	SOCWRK	RADIO	2.17*	0.69	0.023*	0.18	4.16
	CRIMJUS	NURSING	3.86*	0.92	0.001*	1.22	6.51
AVOIDANT	CRIMJUS	SOCWRK	3.14*	0.94	0.012*	0.45	5.84
	DENTAL	NURSING	4.88*	1.11	0.000*	1.70	8.06
	DENTAL	SOCIAL	4.16*	1.12	0.003*	0.94	7.38
	NURSING	RADIO	2.99*	0.93	0.018*	0.33	5.67
COLLABORATIVE	NURSING	CRIMJUS	2.83*	0.91	0.025*	0.22	5.43
	SOCWRK	CRIMJUS	4.06*	0.91	0.000*	1.43	6.70
	SOCWRK	RADIO	3.47*	0.93	0.003*	0.80	6.13
DEPENDENT	DENTAL	MEDICINE	3.66*	0.97	0.002*	0.90	6.43
	DENTAL	SOCWRK	2.83*	0.77	0.003*	0.63	5.02
COMPETITIVE	MEDICINE	SOCWRK	3.75*	1.28	0.041*	0.09	7.42
	CRIMJUS	SOCWRK	2.74*	0.95	0.047*	0.02	5.46
	NURSING	MEDICINE	6.61*	1.08	0.000*	3.53	9.96
	NURSING	CRIMJUS	3.14*	0.78	0.001*	0.91	5.38
PARTICIPANT	NURSING	DENTAL	3.12*	0.96	0.014*	0.39	5.84
	NURSING	RADIO	3.38*	0.79	0.000*	1.19	5.63
	CRIMJUS	MEDICINE	3.47*	1.10	0.020*	0.33	6.60
	SOCWRK	MEDICINE	4.50*	1.09	0.001*	1.39	7.61
	RADIOLOGIC	MEDICINE	3.24*	1.10	0.040*	0.08	6.39

Note: * $p < 0.05$

style between social work with criminal justice ($M = 4.06$, $SD = 0.93$) and with radiology ($M = 3.47$, $SD = 0.93$). Thus, learners from social work programs scored higher in collaboration (more collaborative) than learners from the criminal justice and radiology programs.

Within the dependent learning style, there were statistically significant mean differences between the dental students and two other programs: medicine ($M = 3.66$, $SD = 0.97$) and social work ($M = 2.86$, $SD = 0.77$). Dental students scored higher as a group on having a dependent learning style than their peers from the medical school and social work program. There were several statistically significant mean differences across the participant learning style; between nursing and medical students ($M = 6.61$, $SD = 1.1$); nursing and criminal justice students ($M = 3.14$, $SD = 0.78$); nursing and radiology students ($M = 3.38$, $SD = 0.79$); and social work and medical students ($M = 4.5$, $SD = 1.1$).

4 Discussion

Distinct differences in learning styles by academic discipline were found in this study. In summary, the sample scored highest in three learning styles: participant, dependent, and independent. The collaborative learning style also earned high scores from five of the disciplines (nursing, medical, dental, social work, and radiologic sciences). The collaborative learning style was not the first learning style identified for these groups but was in the top three for each discipline. Students from medicine identified with the independent learning style, while the students from the criminal justice, dental, and radiologic sciences programs identified with the dependent learning

style. Students from social work and nursing shared high scores in the participant learning styles. This is a particularly interesting finding given students from the nursing program had means scores that approximated those of the social work program, while both disciplines rated themselves higher in participant learning style than students from all the remaining programs. This suggests that the students from the social work and nursing programs self-identify with the learning style of participant more so than medical, criminal justice, and radiology programs.

Determining the “best fit” for an IPE program can be balanced against the attributes associated with each learning style. For example, students with an independent learning style may perform well autonomously and feel confident in their own abilities/knowledge but may fail to collaborate when needed. Results from this study indicate that medical students would fit well in an IPE program that was competitive in nature and allowed for independent efforts. A team-based clinical rotation may prove to be a challenge for an independent learner, but a case-based learning activity might be more beneficial.

Students with a collaborative learning style enjoy the exchange of ideas and efforts. Consequently, they may not be well-versed in handling competition. Collaborative learners develop effective group skills and might enjoy engaging in a collaborative IPE program such as a service-learning project, a clinical experience, or a didactic initiative. Students with a participant learning style enjoy taking part in the action, discussion, and activities of learning; demonstrating stewardship of the learning process, yet, may struggle to maintain boundaries in group tasks – they tend to take on more than their fair share.

Participating and collaborating in learning activities are action-oriented behaviors. IPE initiatives would do well to include features from both collaborative and participant learning styles into any of the following design types: clinical rotations, multi-focal service-learning projects, didactic events, and team-based simulations. Students with an avoidant learning style are not actively involved in the process or tasks of learning, can be poor collaborators, and struggle to perform. IPE may generate a challenge for these students. Both the dependent and the avoidant learning style exhibit a passive approach to the learning process. The dependent learning style does not actively engage in learning processes or tasks, views instruction as the source of learning, and struggles with autonomous performance. These two groups would struggle to perform in a problem-based or case-based learning environment or in a simulation that relied on collaborative skills.

It becomes clear that placing a group of students that are avoidant or dependent into a competitive IPE program, which relies on a team approach may not bode well for the learning process for participants or the feedback from participants on the program's tenets. A competitive learning style would lend itself well to problem-based learning, case-based learning, and case competitions as this group tends to prefer autonomous work and places value on recognition and praise. Instructors should be aware that the competitive learner might struggle to work collaboratively.

A more proactive understanding of the learning styles of students and their disciplines would allow IPE programmers an opportunity to target desired outcomes with organizational tenets^[51-53] or what might better be known as a parallel process^[69]. Assessing for learning styles becomes an avenue for more effective and responsive IPE program design, while also promoting students' self-awareness^[70].

4.1 Lessons learned

There were several lessons learned from the research effort. These lessons consist of recognition of both the limitations of the work as well as the implications for future research. In addition, several lessons were learned in relation to future research efforts.

4.2 Limitations and considerations

There are several limitations to this study. First, the ability to generalize findings is limited in a few very distinct ways: 1) the study was a one-point in time survey of available and amenable professions; 2) the recruitment site was a non-typical university setting in that it is a commuter-based campus in an urban area versus a residential campus with a broader array of health care pro-

fessions; and 3) there was a significant amount of student respondents who had yet to participate in an IPE initiative. Students from a larger campus with a larger array of health care professions and IPE initiatives to choose from in addition to the frequency of those opportunities might generate very different results. Second, the survey itself consisted of multiple sections and took several minutes to complete. This could have been viewed as lengthy by respondents. Lastly, the data collection plan relied on pen and paper administration of the survey, which produced a high level of respondents.

4.3 Implications and future research

The findings from the project suggest that matching learning styles with program design considerations is an important element towards maximizing educational gains^[71,72]. Yet, the approach to learning is often dependent on the constructs and designs of the IPE programs^[18]. The development and assessment of IPE programs is an inter-dependent process encompassing both reflective and reflexive properties^[73]. Looking at the type of IPE program being considered, the type of students that are being invited to participate, and the unique characteristics of the learners-as-participants becomes critical to the evaluation of the process^[51,53].

The learning styles of students-as-participants are an active learning process. This active learning process is the central tenant of IPE and serves as an important consideration for instructional methods^[74-77]. IPE initiatives can be designed in a wide variety of ways and can be tailored to meet the learning needs of students. This project compared students from different disciplines in terms of their dominant learning style and offered several points for program consideration. The findings have a number of direct applications to IPE program design. First, program developers have direct knowledge about the number of students that have participated in IPE programs previously and the types of disciplines that have yet to be asked. Second, the scales were selected because it focused on the students' interaction with the learning group, with the facilitator, and across the learning process^[67] – these being essential ingredients in IPE program initiatives at the collegiate level. Third, the GRLSS is a scale that measures learning styles in relation to social interaction and allows for social and affective dimensions in relation to learning/teaching environments.

IPE program designs are naturally social in that they are trying to build a culture of interprofessionality and collaborative practice. Thus, knowing the learning styles of respondents prior to implementing an IPE program design informs the nature of instruction and the selection

of learning activities. Fourth, the anchored definitions of each learning style relate to the purpose of IPE and the operationalization of the IPCP domains. There are a wide variety of uses for knowing the learning styles of students-as-participants in IPE programs. For example, certain learning styles could be used as criteria for placement in an IPE program. Targeting the instructional approach might better accommodate diverse learning styles as well. There are several implications for academe, which functions as the central developer in IPE programming^[48,50]. IPE programs should be developed with both diversity and inclusivity in mind. This approach would extend to types of academic programs invited to participate in an initiative and into the programming aspect that diverse and well-structured learning activities may support the needs of a larger array of students-as-learners. Designers should consider the learning style of the students being invited. Does the nature of the academic program lend itself to a competency-based educational approach? If not, then the IPE initiative should be constructed with that in mind. Orientation to IPE programming is the essential ingredient to an IPE initiative given the differences and similarities across disciplines. Orientation could be a great bridge to the exploration and assessment of student learning styles as well as to how the program is developed^[4].

The implications for future research in the scholarship of teaching and learning applied to IPE programming are vast. Studies in concurrent design of IPE initiatives with a lens towards teaching and learning styles could make substantial contributions. What learning styles work best in what type of IPE initiatives? What types of academic programs work best with what types of IPE program? Best practices of IPE programs and potential fidelity studies within IPE types are additional avenues for research.

The goal of IPE and IPCP is to create a personal to professional change in participants that lead to better practices through collaboration^[78,79]. Thus, targeting university-community partnerships where employers are hiring and evaluating students that participated in IPE initiatives versus those that did not will be essential. Furthermore, ensuring that IPE programs are informed by the domains of IPCP will be crucial to creating systemic change in the interprofessional delivery of health care services.

5 Conclusion

As IPE efforts and initiatives begin to emerge as pedagogy, it will become increasingly important to balance the needs of students-as-learners with instructional methods and program aims^[42]. Increasing the attention and inten-

tion of program developers in a systematic fashion can better produce the true goals of IPE—for all health care profession students to understand disciplinary roles, improve communication, and advance patient safety through collaborative practice.

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