

First, we conducted the explanatory factor analysis(EFA), to verify whether our variables can be described by 2 summary variables, or not. This analysis supported 2 factor solutions, to validate our model. We used 23 instructional practice questions with instructors' - and students' data.

Table1. PIPS model fit statistics for 2 factors(2F) with Instructor- and Student data

	Instructor	Student
Chi-square(χ^2)	478.31	806.76
<i>df</i>	208	151
Chi-square/ <i>df</i>	2.29	5.34
CFI	0.737	0.803
RMSEA	0.086	0.076
N(Number of Observations)	177	515

Table2. PIPS factor reliability scores, model fit statistics, and items by factor with Instructor- and Student data

	Factor 1:Instructor-centered practice	Factor 2: Student-centered practice
Instructor Data		
Reliability(Instructor/Student data)	0.86	0.72
Number of items	9	14
Eigenvalue	16.117%	43.498%
Percent variance explained	4.002	6.238
Items	Q1, Q3, Q5, Q11, Q18, Q21, Q22, Q23, Q24	Q2, Q4, Q7, Q8, Q9, Q10, Q12, Q13, Q14, Q15, Q16, Q17, Q19, Q20
Maximum possible sum	45	70
Student Data		
Reliability(Instructor/Student data)	0.76	0.9
Number of items	8	13
Eigenvalue	2.480	5.711
Percent variance explained	11.085%	30.510%
Items	Q1,Q3,Q5,Q11,Q21,Q22, Q23,Q24	Q2,Q4,Q8,Q9,Q10,Q12,Q13,Q14,Q15,Q16, Q17,Q19,Q20

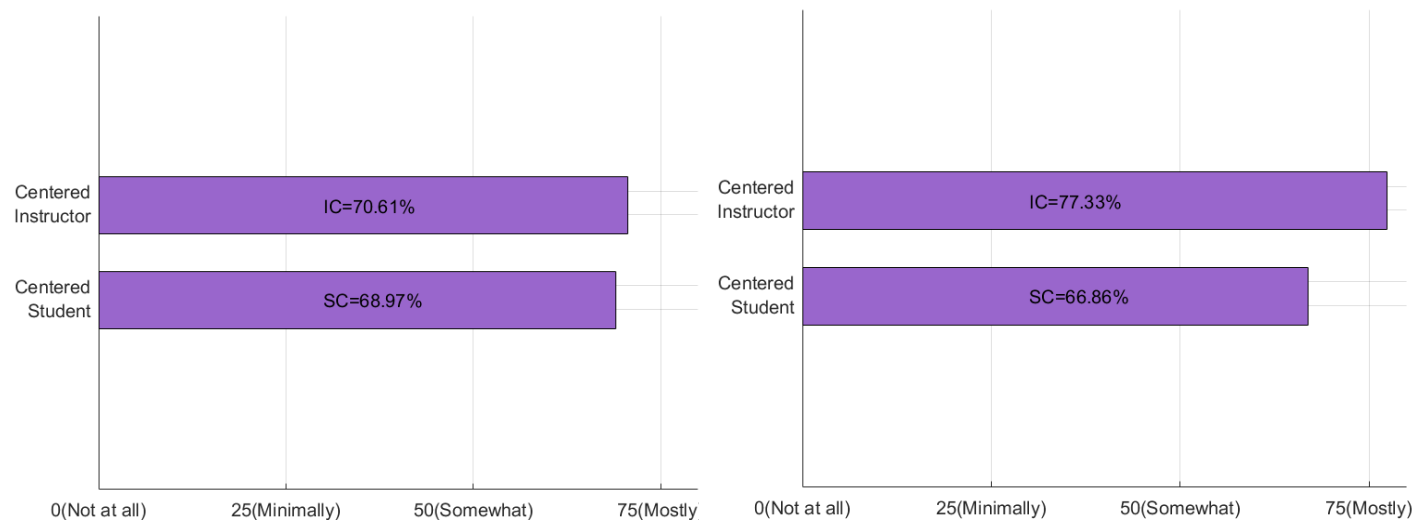
Instructor Data: Kaiser-Meyer-Olkin Measure :0.831/ Bartlett's Test of Sphericity(χ^2 : 1795.918; p:.000)

Student Data : Kaiser-Meyer-Olkin Measure :0.903/ Bartlett's Test of Sphericity(χ^2 : 3918.437; p:.000)

<PIPS Histogram>

Averaged PIPS 2 factors(2F) scores are represented on a frequency-based bar graph in Figure1 with each score along the axis. Each factor score can vary between 0 (not at all descriptive of instructor's teaching) and 100 (very descriptive of instructor's teaching). The calculated scores can be utilized to make comparisons among departments, institutions, or demographic groups. Unlike the correlation between the Student-centered(SC) and Instructor-centered(IC) practice in the 2F model for instructors' data ($r = -0.0714$, $p = 0.3253$), a significant correlation was found between the SC and IC factors from the 2F model for students' data ($r = -0.2723$, $p = 3.2912e-10$).

FIGURE 1. Averaged PIPS 2F Scores for Instructors (left) and Students (right)



<PIPS Scatter Plot>

PIPS 2F scores are placed on an x, y scatter plot because of the independent nature of the factors. Figure 2 highlights the scatter plot of individual 2F PIPS scores for instructors and students in various sampled departments. For instructor data, there were total of 192 instructors ($N=192$) dividing into multiple departments (N : AE=20, BME=45, CHBE=10, CEE=26, ECE=45, ISYE=13, MSE=4, ME=24, OTHERS=5). 16 data sets were duplicated for the instructors who were in two departments. For student data, there were total of 486 students ($N=486$) dividing into multiple departments (N : BME=69, CHBE=84, CEE=32, ECE=112, ISYE=74, MSE=39, ME=76). Figure 3 shows the mean value of the departments in instructor- and student-centered scores from Figure 2. Significant differences were found in the mean score of each department for the student's SC practice ($p = 7.3198e-04$), the student's IC practice ($p = 1.0353e-05$), and the instructor's SC practice ($p = 0.0106$). However, the significant difference did not appear in the instructor's IC practice ($p = 0.5641$). Comparing the results of two graphs in Figure 3, BME is depicted as the highest SC practice for both instructors' and students' data. In contrast, CHBE appears to be the highest IC practice for instructors' data and MSE for the student's data.

Figure2. PIPS scores for instructors (left) and students (right) in the sampled departments

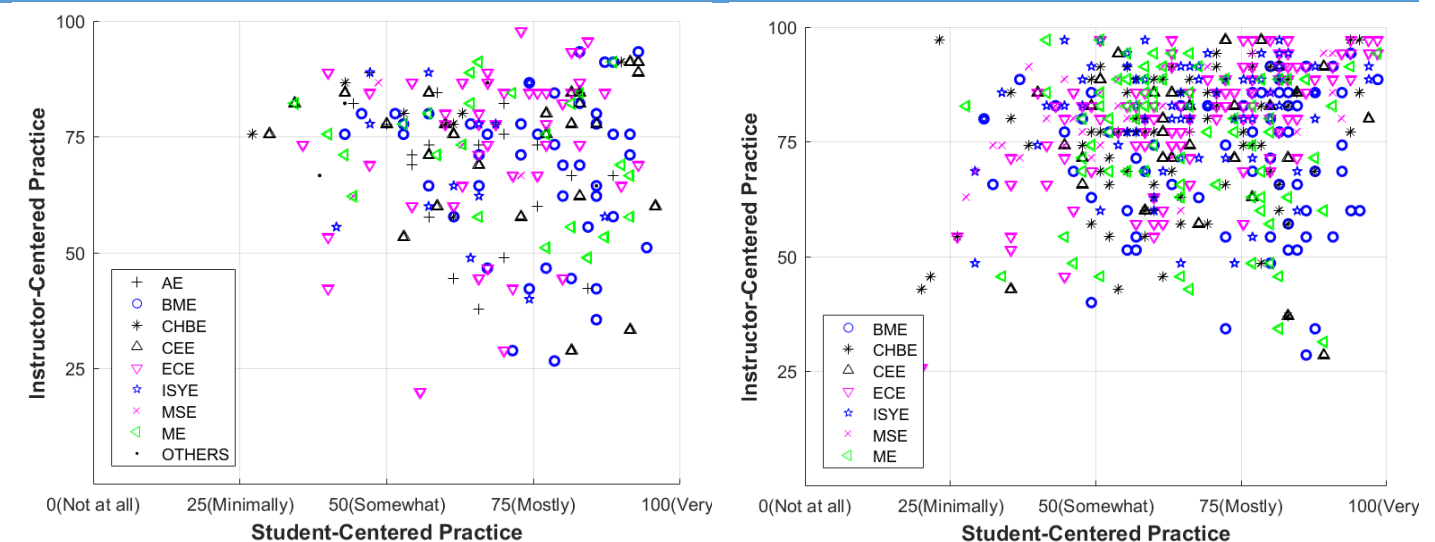
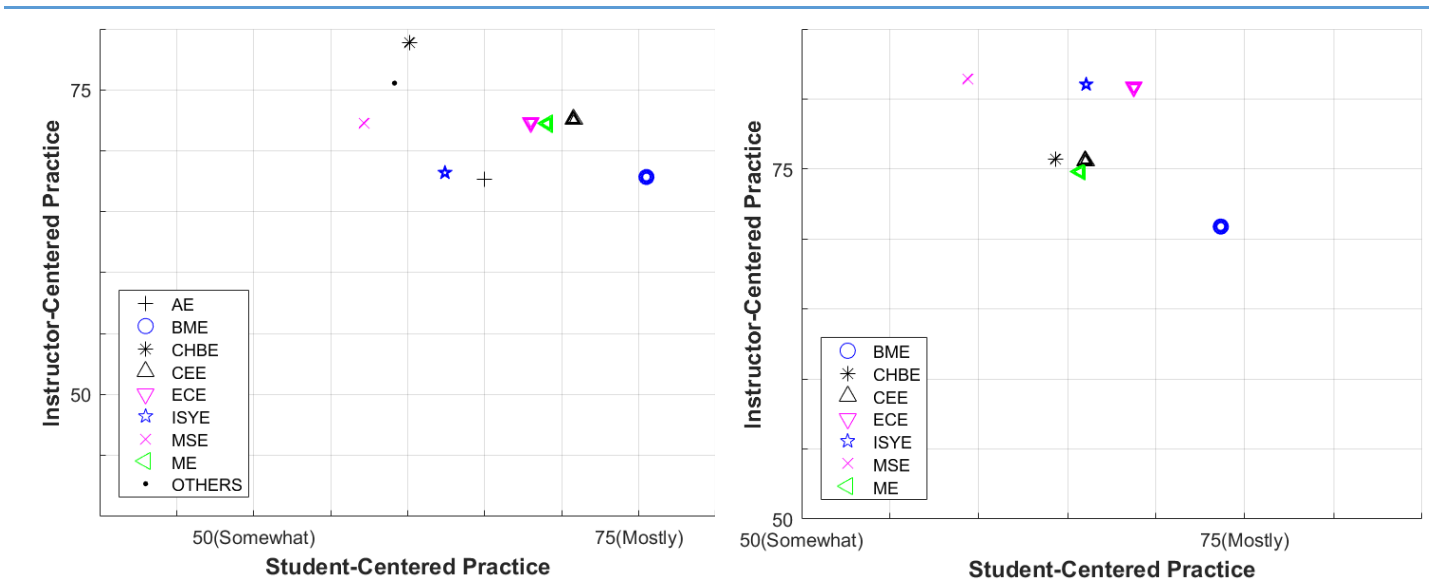


Figure3. The averaged PIPS scores for instructors (left) and students (right) in the sampled departments



In figure 4, the points on the scatter plot represent PIPS 2F scores based on courses in the each department. For instructor-centered data, there were total of 182 instructors($N=182$), according to courses in the same department.(N : AE=17, BME=40, CE=3, CEE=16, CHB=10, COE=13, ECE=43, ISYE=12, MSE=3, ME=22, MP=1, NRE=2). If the number of the course is below 5, it was eliminated. There were duplicate data for the instructor who was in two departments; the data for the duplicated instructors were 4. For student-centered data, there were total of 457 students ($N=457$) dividing into courses for the each department.(N : BME=54, CEE=23, CHBE=65, CHE=7, COE=39, CS=18, ECE=102, ISYE=53, MAT=9, ME=55, MSE=26, PHY=6). The figure 5 shows the mean value of instructor- and student-centered scores in the respective departments from the figure 4. Significant differences were found in the mean score for all instructor- and student- data.(Instructor's SC practice (p : 0.0023), Instructor's IC practice (p : 0.0347), Student's SC practice (p : 6.4858e-07), and Student's IC practice(1.1118e-04) Comparing results of two graphs in Figure 5, the BME is depicted as the highest SC practice for both instructors' and students' data. Contrary, the CHBE appears to be the highest IC practice for instructors' data and the PHY for the student's data.

Figure4. PIPS scores for courses in the each department(instructors(left) and students(right))

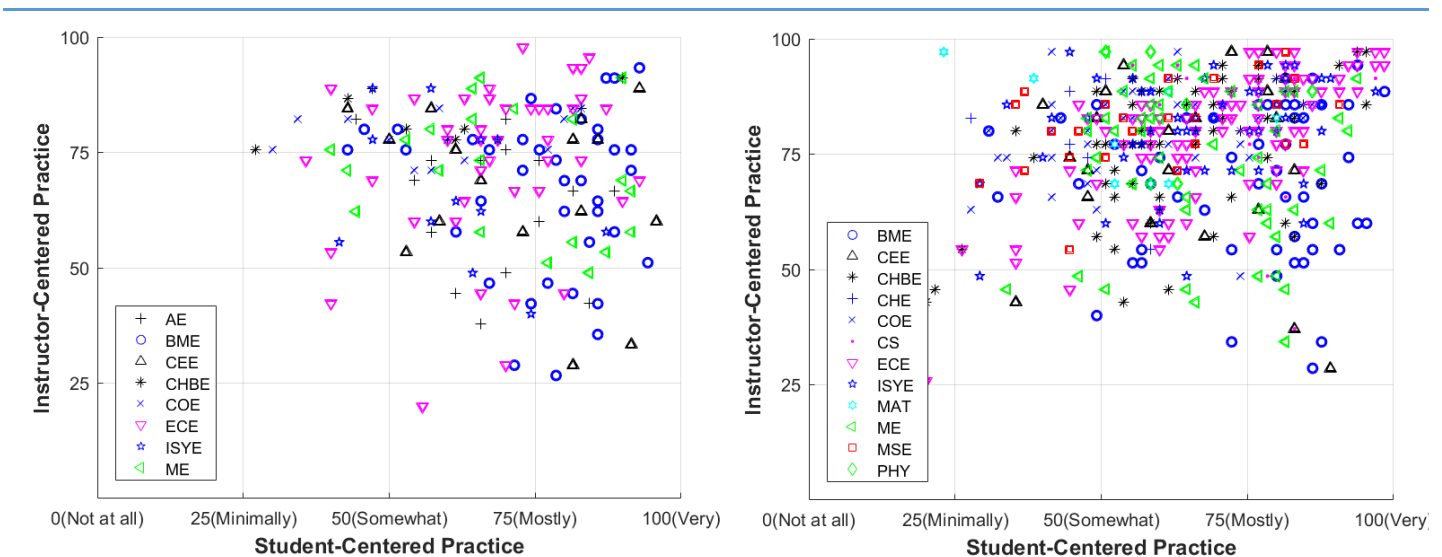
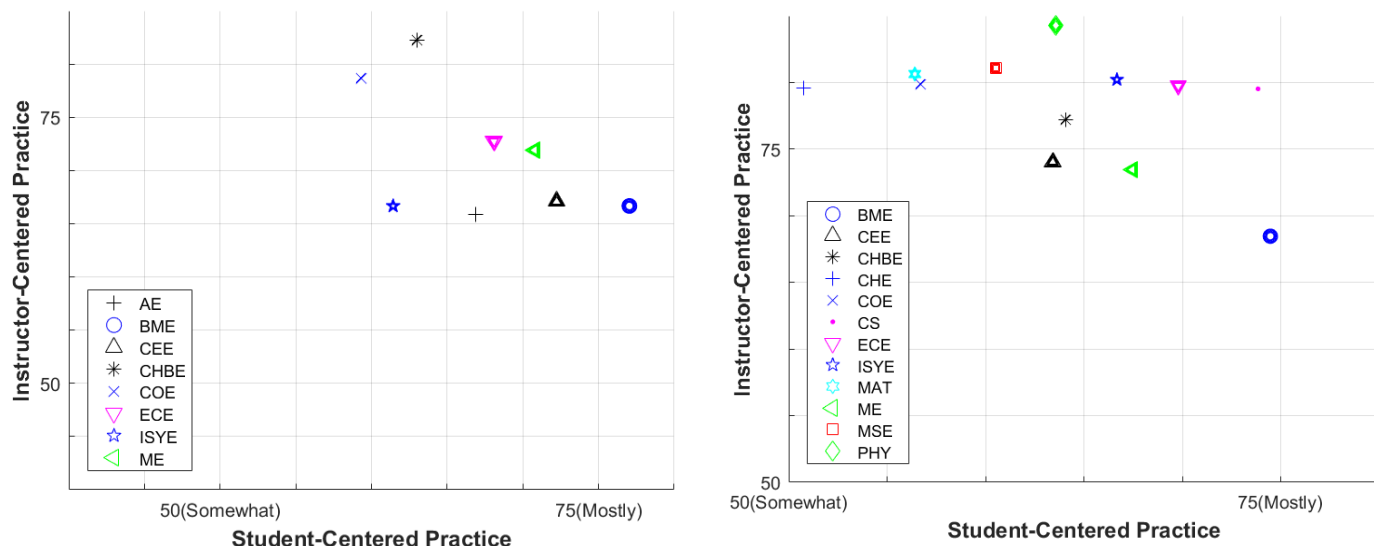


Figure5. The averaged PIPS scores for courses in the each department(instructors(left) and students(right))



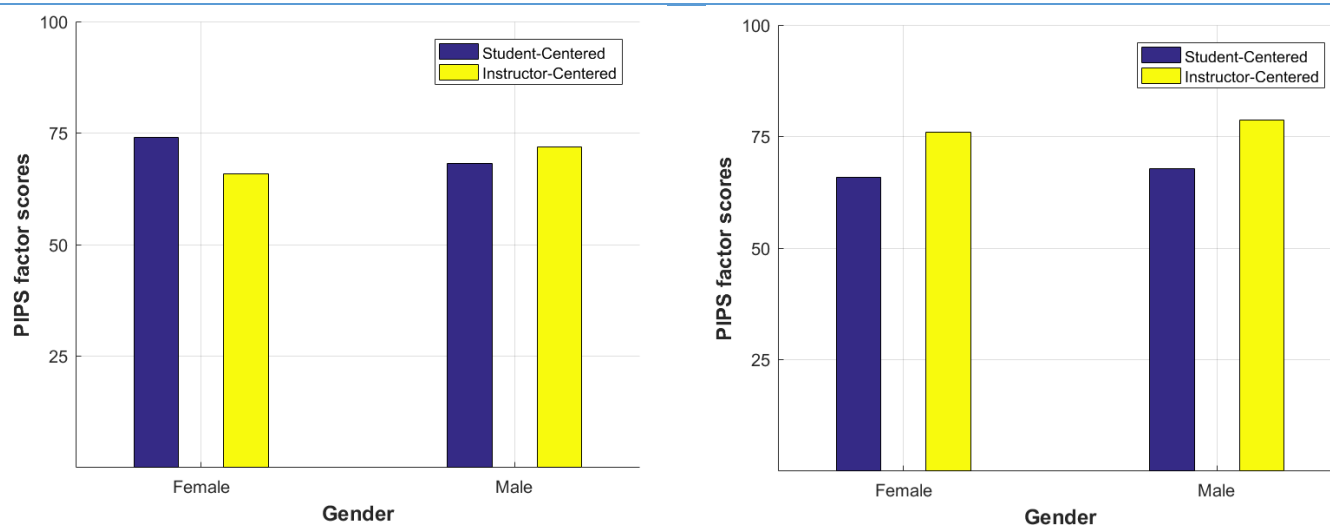
<Demographic Differences>

We examine whether there exists demographic differences in SC and IC scores, as generated by the 2F PIPS model. We run two sample t-tests and ANOVA comparisons to explore demographic differences between and among PIPS scores for different instructor groups (Gender, Tenure, Rank, Years teaching, Years in the higher education).

1) By Gender

We explore the instructor data (N=26 female; N=139 male; N=10 no answer) and the student data (N=242 female; N=242 male; N=2 no answer) to verify whether there exists a significant difference. There was a significant difference between gender for the mean of the IC scores with students data. ($p: 0.0276$) In contrast, there was no significance between gender for the mean of the IC ($p: 0.4711$), SC ($p: 0.7124$) with instructor data, and SC with student data ($p: 0.2464$). Thus, it can be concluded that male students described their courses as instructor-centered practice more than female students.

Figure6. The Averaged PIPS scores by Gender (Instructors (left) and Students (right))



2) How time is spent in class: doing lecture, small group, individualized instruction, and other instruction

We found that the lecture-based pedagogies were negatively correlated with SC practice, and positively with IC practice for both data. For the small group, instructors felt that there was a negative correlation with IC, but a positive correlation with SC. Similarly, students felt that small group was positively correlated with SC, but that there was no correlation between small group and IC. Students also thought that individual instruction had significant correlation with SC and IC practice, but the significant correlation was not founded for the instructor-data.

Table2. Pearson correlations among PIPS, and participant estimations of how time is spent in class: doing lecture, small group work, individualized instruction, and other instruction(Instructor)

	IC	SC	Lecture	Small group	Individual	Others
SC	-0.0847 (0.2621)	1	-0.5357** (1.5584e-14)	0.5855** (1.1440e-17)	0.0238 (0.7530)	0.0338 (0.6556)
IC	1		0.4689** (4.6014e-11)	-0.4102** (1.4323e-08)	0.0602 (0.4262)	-0.3040** (3.8921e-05)

Table3. Pearson correlations among PIPS, and participant estimations of how time is spent in class: doing lecture, small group work, individualized instruction, and other instruction(Student)

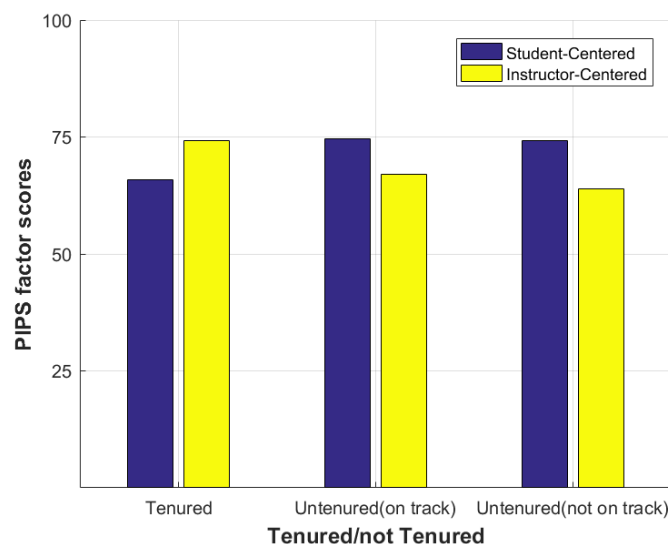
	IC	SC	Lecture	Small group	Individual	Others
SC	-0.2723** (3.2912e-10)	1	-0.4078** (6.6799e-21)	0.1520** (7.7725e-04)	0.3801** (3.7204e-18)	0.0974* (0.0317)
IC	1		0.2924** (4.8999e-11)	-0.0576 (0.2047)	-0.3275** (1.3065e-13)	-0.0206 (0.6498)

Next, the characteristics of the instructor are explored(Tenure, Ranking, By Years Teaching/ years in the higher education)

3) By Tenure or not.

Data was divided into three groups(Tenured: 109, Untenured(on the Tenured track): 27, Untenured(not on the Tenured track): 39) There were significant differences of mean scores between three divisions for SC and IC practice. For the student-centered practice, Tenured instructors had significantly lower scores than untenured (on the track) (p: 0.0189), and untenured instructors(p: 0.0079). But, untenured instructors(on the track) were not be able to be compared with the untenured(not on the track).(p: 0.9952) For the instructor-centered practice, Tenured instructors had significantly higher scores than untenured instructors(not on the track) in IC practice.(p: 0.0012), but the others were not able to compared to each other(untenured instructors(on the tenure track) with the untenured(not on the tenure track) (p: 0.7019), tenured with untenured(on the tenure track) (p:0.0836))

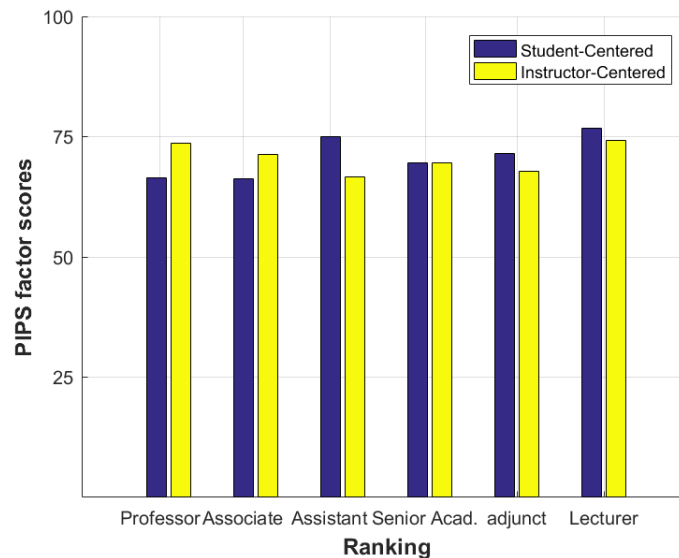
Figure7. The Averaged PIPS scores by Tenure or not



4) By Ranking

The data is following: (N=76 Professor; N=28 Associate Professor; N=26 Assistant Professor; N=9 Senior Academic Professor; N=11 Adjunct or Par-time; N=7 Lecturer) There was no significance of mean scores by ranking for SC(p:0.1024) and IC practice.(p: 0.2025)

Figure8. The Averaged PIPS scores by Ranking



5) By Years Teaching/ years in the higher education

Table4. PIPS factor correlations with class size, years teaching, and years in the higher education

	Years teaching(r(p))	Years in higher education (r(p))
Student-centered	-0.3398** (4.7739e-06)	-0.3231** (1.4479e-05)
Instructor-centered	0.0905(0.2363)	0.1157(0.1296)
Years teaching	1	0.8741** (1.6533e-55)
Years in higher education		1

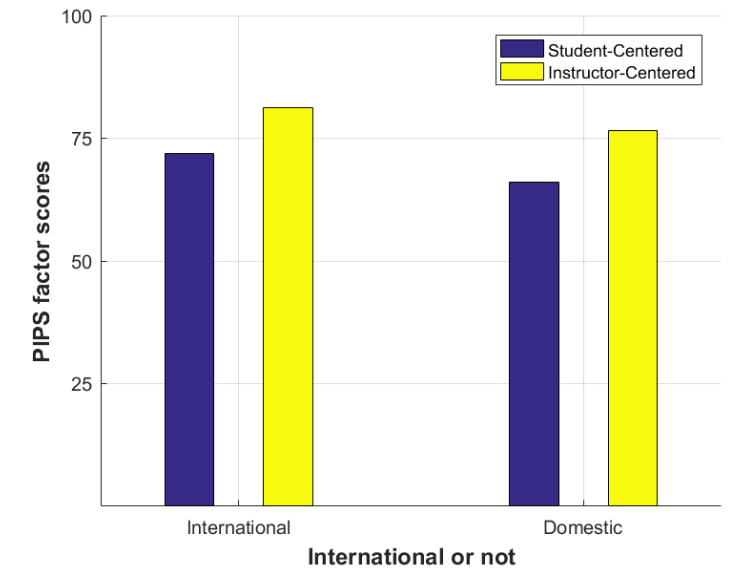
We note years teaching and years in higher education were negatively correlated with SC. However, they had no significant correlation with IC.

6) Academic standing

The data is following according to the academic standing:(N=42 Freshman; N=73 Sophomore; N=149 Junior; N=222 Senior) There were no significant correlation between mean scores based on academic standing for SC(p: 0.1448) and IC practice(p: 0.5854).

7) By International or not

The data is following by International or not: N=73 International; N=486 Not international)
International students significantly felt more than domestic students that their courses had SC and IC practice, because Mean scores for SC and IC practice were significantly different(p: 0.0047/ p: 0.0103)



8) The weekly contact hours you participate in Lecture/lab/discussion/others

Table6. PIPS factor correlations with class size, years teaching, and years in the higher education

	Lecture	Lab	Combined	Discuss	Others
SC	-0.0215 (0.6381)	0.2258** (5.4575e-07)	0.1284** (0.0048)	0.2049** (5.7467e-06)	0.0541 (0.2355)
IC	0.3486** (3.2473e-15)	-0.1818** (5.9612e-05)	0.0038 (0.9344)	0.0309 (0.4989)	-0.1298** (0.0043)