

Study on the Impact of Team Teaching Using the Rasch Measurement Model: Perception of Students and Lecturers

Arsad, N.^{1,2*}, Bais, B.^{1,2}, Kamal, N.^{1,2}, Hashim, F. H.², Wan, W. M. Z.² and Husain, H.^{1,2}

¹Centre for Engineering Education Research, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

²Department of Electrical, Electronic and Systems Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

ABSTRACT

This article reports the results of team teaching practice at the Department of Electrical, Electronic and Systems Engineering (JKEES), Universiti Kebangsaan Malaysia (UKM). Two sets of questionnaires were used for lecturers and students to explore their perception of team teaching. A total of 21 lecturers and 253 students were chosen as survey respondents. The Rasch Measurement Model was employed to measure the reliability and validity of the survey instrument developed to evaluate the team teaching practice. Data were then analysed to identify the effectiveness of the team teaching method employed, and to measure its impact on students and lecturers. Results showed that the survey questions were developed with good individual and item reliability. Most of the respondents gave good feedback to the team teaching practice. Thus, students and lecturers perceive that team teaching as a method is effective and has positive impact on teaching and learning.

Keywords: Team teaching, Rasch Measurement Model, learning and teaching process

ARTICLE INFO

Article history:

Received: 09 October 2015

Accepted: 31 March 2016

E-mail addresses:

noa@ukm.edu.my, norhana.arsad@gmail.com (Arsad, N.),

badariah@ukm.edu.my (Bais, B.),

fazila@ukm.edu.my (Kamal, N.),

fazida@ukm.edu.my (Hashim, F. H.),

wmdiyana@ukm.edu.my (Wan, W. M. Z.),

hafizahh@ukm.edu.my (Husain, H.)

* Corresponding author

INTRODUCTION

Team teaching is a complex activity that is conducted to actively support the teaching process towards the escalation of quality teaching and learning processes. This is evidenced by many reports by researches regarding team teaching (Fuller et al., 2001; Rowland, 2003; Mullin et al., 2006). Team teaching is an integrated process

that involves many aspects to support the system. This is especially true for lecturers and students who are involved in the teaching and learning process. Members in team teaching must purposefully, regularly and cooperatively work as a group in setting the goals (Williams, 1997).

The team teaching approach is known as a part of nurturing the teaching and learning process among students and lecturers. However, it is the responsibility of the lecturers to conduct the appropriate approach in terms of promoting an inclusive education environment to students. Students also need to develop the skill to work in a group where interaction is needed to support the implementation of team teaching (Bergen, 1994).

In the Department of Electrical Electronics and Systems Engineering (JKEES), team teaching is defined as a group of two or more lecturers teaching a course to the same group of students. Team teaching in JKEES was implemented in 2009 but the effectiveness of its implementation has yet to be evaluated. Therefore, a survey instrument was developed to measure the effectiveness of team teaching as a teaching-and-learning method. The survey was targeted at two groups, namely, lecturers and students.

For subject evaluation, the Rasch Measurement Model was widely used to perceive the impact on undergraduate students who were pursuing subjects such as Microelectronic subject (Abdullah et al., 2012) and Space Science Education (Abdullah et al., 2013). Team teaching,

as a supporting system that was arranged cooperatively, revealed the effectiveness of the teaching and study process towards student achievement.

In this study, the Rasch Measurement Model was used to measure the reliability and validity of the survey instruments that were developed. The Rasch Measurement Model offers many advantages in measuring reliability and the validity because the end results can be understood and they provide estimates of personal parameters. The Rasch Measurement Model can be used as a good tool assessment of a person's ability because this measurement software provides quantitative analysis as well as predictive and qualitative analysis (Ayob et al., 2011). The purpose of using the Rasch Measurement Model is to obtain data size category reaction. Basically, these data categories do not just use mathematical operations. Consequently, these data justify the conclusion using the mode and median in the process of scheduling data. Therefore, the results obtained can be used to measure the validity and the reliability of the instruments in measuring the impact of team teaching methods as perceived by lecturers and students.

METHODOLOGY

Two sets of questionnaires were designed, one for lecturers and another for students. The questionnaire for lecturers was divided into two parts: (i) information on the background and experience of the lecturers in a team-teaching environment and (ii) a total of 17 questions about the perception

of the teaching team. The questionnaire to the students was also divided into two parts: (i) information about the students' background and experience of students in a team-teaching environment and (ii) a total of 23 questions about their perception of the teaching team. The questionnaires used the Likert scale from "strongly disagree" (1) to "strongly agree" (5). Responses to the survey questions were received from 21 lecturers and 253 students. This study used a descriptive statistical analysis and the Rasch Measurement Model to see how team teaching impacted the perception of the students and lecturers. According to (Kubinger, 2009), the Rasch Measurement

Model can be used to measure the perception of the effectiveness of the teaching team.

RESULTS AND DISCUSSION

The summary of statistical and individual item categories for each lecturer is shown in Tables 1 and 2, respectively. Table 1 shows that the perception of lecturers who participated in team teaching showed a significant response, with an individual test score of 0.71 for the Cronbach alpha. This shows the satisfaction of the lecturers with team teaching. According to the instrument scale criteria rating, this value indicates a good score (Fisher, 2007).

Table 1
Summary Statistics of Measured Person (Lecturer)

SUMMARY OF 21 MEASURED Person								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	73.7	22.0	.73	.29	1.00	.0	.99	-.1
S.D.	6.6	.0	.54	.01	.35	1.1	.38	1.1
MAX.	84.0	22.0	1.62	.31	2.10	2.9	2.23	3.1
MIN.	59.0	22.0	-.42	.27	.55	-1.7	.59	-1.5
REAL RMSE	.31	TRUE SD	.45	SEPARATION	1.46	Person RELIABILITY	.68	
MODEL RMSE	.29	TRUE SD	.46	SEPARATION	1.59	Person RELIABILITY	.72	
S.E. OF Person MEAN = .12								
Person RAW SCORE-TO-MEASURE CORRELATION = 1.00								
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .71								

Table 2
Summary Statistics of Measured Item (Lecturer)

SUMMARY OF 21 MEASURED Item								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	72.7	21.0	.00	.29	1.00	-.2	.99	-.3
S.D.	17.9	.0	1.41	.04	.53	1.9	.50	1.8
MAX.	94.0	21.0	4.07	.44	2.03	2.8	2.09	3.0
MIN.	28.0	21.0	-1.80	.25	.23	-4.0	.24	-3.7
REAL RMSE	.33	TRUE SD	1.37	SEPARATION	4.20	Item RELIABILITY	.95	
MODEL RMSE	.30	TRUE SD	1.38	SEPARATION	4.64	Item RELIABILITY	.96	
S.E. OF Item MEAN = .32								

The summary statistics shown in Table 1 and 2 show that the measured items represent 21 questions from the questionnaire that revealed a very good answer of 0.95 among the lecturers. This is an excellent spread for the items in the questionnaire.

Table 3 shows the summary statistics for individual categories while Table 4 presents a summary of the item statistics for students. In Table 3, the tabulated measured

person data of students indicated good consistency with the raw score given by Cronbach's alpha of 0.80. In the summary of statistics, the measured item maximum reliability value is 1.00. This provides an interpretation of the results for satisfaction with team teaching that can be shown on a measurement ruler. The maximum item on the logit ruler used is 3.20 and the minimum is -1.43.

Table 3
Summary Statistics of Measured Person (Student)

SUMMARY OF 253 MEASURED Person								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	108.0	35.0	.13	.24	1.00	-.3	.99	-.3
S.D.	9.5	.0	.54	.01	.55	2.0	.54	2.0
MAX.	140.0	35.0	2.10	.27	3.85	7.2	3.93	7.4
MIN.	69.0	35.0	-2.01	.23	.20	-5.0	.19	-5.3
REAL RMSE	.26	TRUE SD	.47	SEPARATION	1.81	Person RELIABILITY	.77	
MODEL RMSE	.24	TRUE SD	.48	SEPARATION	2.03	Person RELIABILITY	.80	
S.E. OF Person MEAN = .03								
Person RAW SCORE-TO-MEASURE CORRELATION = 1.00								
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .80								

Table 4
Summary Statistics of Measured Item (Student)

SUMMARY OF 34 MEASURED Item								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	796.1	253.0	.00	.09	.97	-1.0	.99	-.8
S.D.	211.1	.0	1.46	.01	.44	4.4	.45	4.4
MAX.	997.0	253.0	3.20	.11	2.56	9.9	2.58	9.9
MIN.	356.0	253.0	-1.43	.08	.43	-9.0	.44	-8.7
REAL RMSE	.09	TRUE SD	1.45	SEPARATION	15.47	Item RELIABILITY	1.00	
MODEL RMSE	.09	TRUE SD	1.45	SEPARATION	16.48	Item RELIABILITY	1.00	
S.E. OF Item MEAN = .25								
MAXIMUM EXTREME SCORE: 1 Item								
MEAN=.0000 USCALE=1.0000								

The mean person measure in the summary statistics for lecturers as shown in Table 1 is 0.73 compared to 0.8 for students' (Table 3). This indicates that in

general, both lecturers and students are satisfied with the expected output of the team teaching programme.

Table 5 shows the maximum measure of items (questions for students) where the value of the item reliability is 1.00. This is a high value of reliability and showed great consistency. In question number 4, the students were asked to give their opinion on whether team teaching leads to

better student performance. Almost all the students agreed with the question because according to them, team teaching led to better performance and created a good environment for learning. As a result, the students were able to achieve the course objectives in every semester.

Table 5
Item Measured Table (Student)

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	EXP.	EXACT OBS%	MATCH EXP%	Item
4	253	253	9.35	1.82			MAXIMUM MEASURE		.00	.00	100.0	100.0	Q4
5	356	253	9.20	.11	.82	-1.9	.95	-1.3	.06	.30	60.5	63.8	Q5Q
9	375	253	2.98	.11	.76	-2.7	.82	-1.9	.10	.31	51.4	58.5	Q9
8	379	253	2.93	.10	.64	-4.3	.68	-3.6	.29	.32	58.1	57.3	Q8
7	397	253	2.75	.10	.73	-3.3	.75	-2.9	.04	.33	51.4	53.6	Q7
3	421	253	2.52	.09	1.34	3.5	1.46	4.6	-.12	.34	39.5	49.9	Q3
6	426	253	2.48	.09	.64	-4.8	.67	-4.2	-.04	.34	56.1	49.4	Q6
1	570	253	1.41	.08	1.93	9.0	1.94	9.1	-.09	.38	28.1	46.9	Q1
11	594	253	1.26	.08	.51	-7.4	.52	-7.2	.36	.39	60.1	46.3	Q11
10	727	253	.44	.08	.43	-9.0	.44	-8.7	-.06	.39	72.3	45.4	Q10
2	763	253	.21	.08	2.56	9.9	2.58	9.9	.13	.39	12.6	45.8	Q2
26	764	253	.21	.08	1.43	4.6	1.43	4.6	.43	.39	34.8	45.8	Q26
34	830	253	-.21	.08	1.20	2.3	1.24	2.6	.23	.38	50.6	46.2	Q34
25	845	253	-.31	.08	1.05	.6	1.06	.7	.25	.38	51.4	46.8	Q25
32	846	253	-.32	.08	1.24	2.6	1.27	2.9	-.18	.38	46.2	46.8	Q32
35	861	253	-.42	.08	1.84	7.9	1.89	8.2	-.16	.38	39.9	47.1	I0035
27	892	253	-.63	.08	1.05	.6	1.05	.6	.46	.37	54.2	48.5	Q27
30	902	253	-.70	.08	.67	-4.1	.68	-4.1	.55	.37	58.5	49.0	Q30
28	906	253	-.73	.08	1.35	3.6	1.37	3.8	.22	.37	45.1	49.1	Q28
31	907	253	-.74	.08	1.03	.4	1.02	.3	.54	.37	50.2	49.6	Q31
24	913	253	-.78	.09	.87	-1.6	.87	-1.5	.57	.36	54.2	49.8	Q24
23	934	253	-.94	.09	.60	-5.2	.61	-5.1	.60	.36	62.8	51.6	Q23
33	934	253	-.94	.09	.80	-2.4	.80	-2.3	.54	.36	56.9	51.6	Q33
15	935	253	-.94	.09	.78	-2.6	.78	-2.6	.64	.36	57.7	51.7	Q15
22	936	253	-.95	.09	.67	-4.2	.68	-4.1	.62	.36	59.3	51.7	Q22
21	946	253	-1.03	.09	.76	-2.8	.76	-2.9	.63	.36	60.5	52.5	Q21
12	957	253	-1.11	.09	.84	-1.8	.84	-1.9	.53	.35	63.2	53.1	Q12
17	958	253	-1.12	.09	.61	-5.0	.62	-4.9	.58	.35	64.0	53.2	Q17
14	960	253	-1.13	.09	1.21	2.3	1.20	2.1	.45	.35	49.8	53.3	Q14
19	966	253	-1.18	.09	.72	-3.5	.71	-3.5	.64	.35	62.5	53.7	Q19
20	966	253	-1.18	.09	.67	-4.2	.67	-4.1	.65	.35	61.3	53.7	Q20
29	966	253	-1.18	.09	1.04	.5	1.05	.6	.32	.35	53.8	53.7	Q29
13	968	253	-1.20	.09	.72	-3.4	.71	-3.5	.42	.35	63.6	53.8	Q13
18	970	253	-1.21	.09	.73	-3.3	.74	-3.2	.61	.35	57.7	53.9	Q18
16	997	253	-1.43	.09	.71	-3.5	.71	-3.6	.61	.34	63.2	55.2	Q16
MEAN	780.6	253.0	.27	.14	.97	-1.0	.99	-.8			53.3	51.1	
S.D.	226.8	.0	2.12	.29	.44	4.4	.45	4.4			11.5	4.0	

Table 6 shows the maximum measure of items (questions for lecturers). Table 6 shows that question item number one had the high value of 1.00. It had a significant correlation with the question given to the students. Question number one stated that

team teaching meant organising lecturers into groups to enhance teaching and learning. All the lecturers agreed with the statement in the questionnaire and gave a high score for the item measurement.

Table 6
Item Measured Table (Lecturers)

Item STATISTICS: MEASURE ORDER													
ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S. E.	INFIT		OUTFIT		PT-MEASURE		EXACT MATCH OBS% EXP%	Item	
					MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.			
1	21	21	7.56	1.83	MAXIMUM MEASURE		.00	.00	100.0	100.0	Q1		
3	28	21	4.07	.44	.89	-.2	.93	-.1	.17	.25	81.9	87.8	Q3
5	42	21	2.23	.31	.31	-2.8	.32	-2.8	.49	.34	81.0	55.5	Q5
15	47	21	1.78	.29	1.60	1.7	1.54	1.6	.46	.37	47.6	51.1	Q15
20	55	21	1.17	.26	2.01	2.8	2.09	3.0	.14	.40	19.0	43.0	Q20
2	59	21	.90	.26	.24	-4.0	.27	-3.7	-.43	.42	81.0	41.7	Q2
21	61	21	.77	.26	1.50	1.7	1.55	1.8	-.14	.42	19.0	42.0	Q21
4	62	21	.71	.25	.86	-.5	.87	-.4	.24	.42	57.1	40.3	Q4
7	66	21	.45	.25	1.23	-.9	1.27	1.0	.47	.43	33.3	39.8	Q7
12	77	21	-.28	.26	.55	-1.8	.58	-1.6	.54	.42	47.6	45.9	Q12
8	79	21	-.42	.27	.82	-.5	.77	-.7	.64	.41	61.9	46.0	Q8
11	80	21	-.49	.27	.23	-3.9	.24	-3.7	.78	.41	81.0	45.8	Q11
18	80	21	-.49	.27	.68	-1.1	.69	-1.1	.56	.41	52.4	45.8	Q18
10	83	21	-.72	.28	.83	-.5	.83	-.5	.27	.39	57.1	47.4	Q10
19	83	21	-.72	.28	1.68	2.0	1.70	2.0	.39	.39	19.0	47.4	Q19
13	86	21	-.97	.30	1.17	-.6	1.11	.5	.54	.38	47.6	47.9	Q13
16	86	21	-.97	.30	.73	-.8	.75	-.8	.37	.38	52.4	47.9	Q16
9	87	21	-1.06	.30	.46	-2.0	.48	-2.0	.44	.37	71.4	48.5	Q9
14	90	21	-1.35	.32	1.48	1.4	1.32	1.0	.48	.35	47.6	50.8	Q14
22	90	21	-1.35	.32	2.03	2.6	1.73	2.0	.36	.35	52.4	50.8	Q22
6	91	21	-1.45	.33	.95	-.1	.86	-.3	.60	.35	52.4	51.7	Q6
17	94	21	-1.80	.36	.81	-.5	.83	-.4	.30	.32	57.1	56.8	Q17
MEAN	70.3	21.0	.34	.36	1.00	-.2	.99	-.3			52.4	48.3	
S.D.	20.5	.0	2.09	.32	.53	1.9	.50	1.8			18.1	6.2	

The result of the Rasch analysis is highlighted in Figure 1. Of notice is question Q17, which asked lecturers whether a team-teaching group should have different areas of expertise. The majority of the answers were neutral to this question. According to

the lecturers, different expertise was not the key to success in encouraging a proper teaching and learning process among students; rather, team teaching required shared understanding and cooperation as a team.

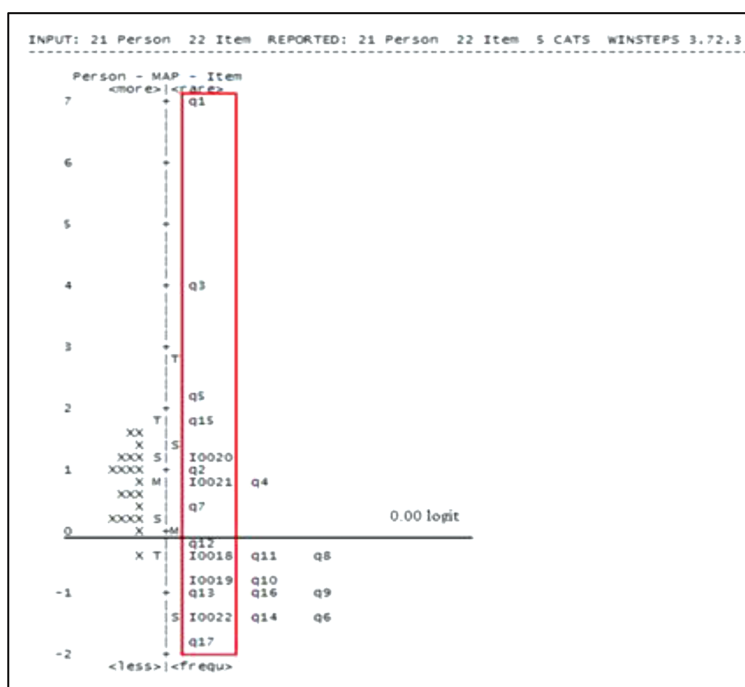


Figure 1. PIDM for team teaching analysis (lecturer).

The Rasch Measurement Model is a unique software that was able to give a quick summary of students' interest and involvement in team teaching. This is shown in the Person-Item Distribution Map (PIDM) of Figure 2. The students were involved in team teaching in the current and previous semesters. The aim

of the questions was to confirm how many students were actively involved in team teaching method for different subjects. As can be seen from Figure 2, almost all the students agreed that team teaching was effective, as they were actively involved lessons that used team teaching as a method.

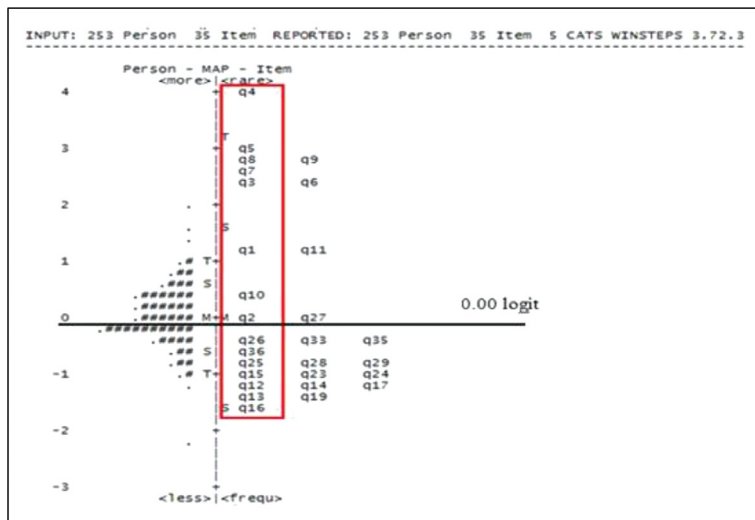


Figure 2. PIDM for team teaching analysis (student).

CONCLUSION

The Rasch Measurement Model was an appropriate model to analyse persons and items in this study. It is observed that the majority of the respondents gave positive feedback in the questionnaire to the method of team teaching to deliver teaching and learning. In the Rasch Measurement Model, the use of the logit ruler was useful in measuring specific outcomes such as the perception of lecturers and students of the team teaching method. It was observed that team teaching

was well-tolerated and can be used to improve the teaching and learning process in JKEES, UKM.

ACKNOWLEDGEMENT

The authors appreciate the financial support received from the Centre for Engineering Education Research, (P3K), and Universiti Kebangsaan Malaysia (PTS-2013-012 and PTS-2014-033) in the form of research grants in an effort to improve the quality of teaching and learning in engineering education.

REFERENCES

- Ayob, A., Bais, B., Norazreen, A. A., Arsad, N., & Hafizah, H. (2011). Use of Rasch analysis in engineering students' psychometric evaluation. In *Proceedings of the Engineering Education (ICEED)* (pp. 214–217).
- Abdullah, H., Arsad, N., Hashim, F. H., Aziz, N. A., Amin, N., & Ali, S. H. (2012). Evaluation of students' achievement in the final exam questions for microelectronics (KKK13054) using the Rasch model. *Procedia-Social and Behavioral Sciences*, *60*, 119–123.
- Abdullah, M., Bais, B., Hasbi, A. M., Majid, R. A., Yatim, B., Ali, M. A. M., ... Zain, A. F. M. (2013). Development of UKM-Sid teaching module for space science education. *Procedia-Social and Behavioral Sciences*, *102*, 80–85.
- Bergen, D. (1994). Teaching strategies: Developing the art and science of team teaching. *Childhood Education*, *70*, 242–243.
- Fisher, W. (2007). Rating scale instrument quality criteria. *Rasch Measurement Transactions*, *21*(1), 1095.
- Fuller, A., Awyzio, G., & Mcfarlane, P. (2001). Using WebCT to support team teaching. In *Proceedings IEEE International Conference Advanced Learning Technologies (2001)* (pp. 315–318). IEEE.
- Kubinger, K. D. (2009). On designing data-sampling for Rasch model calibrating an achievement test. *Psychology Science Quarterly*, *51*, 370–384.
- Mullin, J., Lohani, V. K., & Lo, J. (2006). Work in progress: Teaching a first semester freshman engineering course: A team effort between faculty and graduate teaching assistants at Virginia Tech. *Frontiers in Education Conference, 36th Annual*, pp. 24–25.
- Rowland, J. R. (2003). Interdisciplinary team teaching improvements. *33rd Annual Frontiers in Education (FIE 2003)*, S4C-7-10.
- Williams, J. M. (1997). Technical communication and team teaching: Making collaboration work. In *IEEE International Professional Communication Conference 1997 (IPCC '97)* (pp. 53–60). IEEE.