

Analysis on Items of Lecturer Self-Efficacy Instrument Using Rasch Modeling

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Abstract—Strong self-efficacy from a lecturer will encourage the lecturer to have motivation and performance in carrying out the duties and functions as a lecturer: teaching, conducting a research and implementing community service. The purpose of this research is to analyze the sub-construct and items of lecturer self-efficacy. The research was conducted at private universities. Data were collected using a questionnaire containing 7 sub-constructs of lecturers' self-efficacy. Rasch modeling was used for data analysis. The research findings revealed that the 7 sub-construct of lecturer self-efficacy can be used in the lecturers' self-efficacy research. Furthermore, the findings of Person DIF Plots analysis can be used by the management of educational institution for policy making or actions-taking to develop lecturer self-efficacy. The findings of this study are expected to be the subject of discussion in the development of self-efficacy lecturers in Indonesia.

Keywords—self-efficacy; lecturer self-efficacy; Rasch modeling

I. INTRODUCTION

A lecturer's self-efficacy refers to the belief that he/she can succeed in lecturing [1]. Self-efficacy is a capital for a lecturer to be able to complete tasks in teaching, researching and serving the communities. Self-efficacy has been found to be an important characteristic determining the effectiveness of any innovation in education [2].

The university where the lecturer works must improve the lecturer's self-efficacy. But the method that is effective to strengthen the self-efficacy of lecturers depends on which context of self-efficacy of lecturers needs to be improved. So, the information about the objective conditions of the lecturers' self-efficacy is necessary.

This study discusses the scarce research on the lecturer self-efficacy items. This research is expected to contribute to the development of lecturer self-efficacy research and serve as a reference for further self-efficacy research.

A. Self-efficacy

Self-efficacy is the feelings of competence [3]. Self-efficacy is one's self-confidence in the ability to succeed in doing works [4], someone's belief about his ability to do a job successfully [5], self-efficacy as a belief that someone can perform adequately in special situations [6]. Nelson and Quick extend the definition of self-efficacy by dividing self-efficacy into two parts: general self-efficacy and task-specific self-efficacy [7], self-efficacy can apply to specific tasks or various cross-jobs [8].

Self-efficacy has an impact on the seriousness of achieving a goal because self-efficacy encourages someone to be more persistence, expressive, and able to face difficulties [4]. The higher self-efficacy, the higher the confidence to complete tasks, the more trustworthy to succeed and the more encouraging to improve performance [9]. Self-efficacy has a relationship with hope, the higher self-efficacy, the higher the expectation for success [10].

The source of self-efficacy: (1) past performance, he/she was successful in past work, (2) observation, he/she saw the success of friends, (3) verbal persuasion, he/she was persuaded by successful friends, and (4) reading and learning [11], the source of efficacy is past accomplishment, vicarious experience, and verbal persuasion [10].

B. Rasch Model

Rasch analysis is a statistical approach to measuring performance, attitudes, and human perception. It was named after the name of its inventor, Georg Rasch, a Danish nationality. He published his theory in 1960 and died in 1980 [12]. The Rasch Model has been applied to human Sciences [13], we recommend using the Rasch model more broadly to improve the quality of measurements both qualitative and quantitative measurements [14].

Rasch analysis, based on item response theory, provides a better alternative for examining the quality of assessment of psychometric scales and informing scaling up [15]. Rasch can be used in various studies. The use of Rasch analysis in education, for example is to create instruments to measure conduciveness for teaching and learning and measuring professional development [16]. The advantage of Rasch Model is that it can explain items and person, [17]. The unit of measurement of scale for ability and item difficulty is generally known as "logit", the contraction of "unit odds log". The Rasch model helps to overcome item measurements in the right way [18].

II. METHODOLOGY

The research was conducted in three private universities in Bogor, Indonesia. The respondents of this research were lecturers who had National Lecturer Identification Number (NIDN), which amounted to 135, consisting of 57 men and 78 women. They are lecturers with master's degree (S2) 119, and doctoral degree (S3) 16. Lecturers with academic positions: 41 instructors (Asisten Ahli), 58 assistant professors (Lektor), and 36 associate professors (Lektor Kepala).

This research measured the lecturer self-efficacy construct. The measurement is based on the lecturers' perception of their self-efficacy in carrying out their duties as lecturers. Demographic aspects of respondents collected in this study consisted of gender, education level and academic position. The type of scale used is a Likert rating scale with five ranking choices [19].

The lecturer self-efficacy measurement uses 7 sub-constructs: (1) confident of achieving success, (2) being a learner, (3) recipient of persuasion, (4) making change, (5) conducting self-evaluation, (6) evaluating tasks, and (7) evaluating the situation.

The raw data from the lecturer self-efficacy questionnaire in the form of an ordinal scale will then be transformed into an interval scale using Rasch modeling with Winsteps software version 3.73. Rasch modeling overcomes the problem of data integrity by accommodating logit transformations, by applying logarithms at odd ratios of raw data obtained from respondents [20].

Analysis of the instrument validity testing in this study uses Rasch modeling with criteria: (1) Outfit Mean Square (MNSQ) received: $0.5 < MNSQ < 1.5$, (2) Outfit-Z Standard (ZSTD) received: $-2.0 < ZSTD < +2.0$, and (3) Point Measure Correlation (Pt Mean Corr) received: $0.4 < Pt Mean Corr < 0.85$. If the instrument items meet one of these criteria, the lecturer self-efficacy instrument is suitable for use [21].

III. RESULTS AND DISCUSSION

A. Results

The first sub-construct of lecturers self-efficacy: confidence to succeed, with items: (b1) My research proposal is sure to get funding from research institutions, (b2) I am sure that I will be an outstanding lecturer, (b3) The learning media that I have developed are sure to inspire other lecturers, (b4) I

am sure that I can successfully develop a learning module, (b5) I am sure that the results of my research will be cited by other researchers. Based on figure 1, all items qualify for use. Item b2 is the easiest to get approval and b4 is the most difficult to get approval.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD	PT-MEASURE CORR.	EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
2	242	134	1.65	.12	1.09	.7	.97	-.2	.70	.65	47.0	53.5	b2
5	363	135	.09	.11	.87	-1.2	.87	-1.1	.69	.65	54.1	47.8	b5
1	373	135	-.03	.11	1.34	2.7	1.45	3.4	.51	.64	51.9	48.1	b1
3	411	135	-.53	.12	.75	-2.2	.76	-2.1	.69	.63	64.4	52.6	b3
4	455	135	-1.17	.12	.85	-1.2	.82	-1.4	.63	.61	61.5	54.7	b4
MEAN	368.8	134.8	.00	.12	.98	-.2	.97	-.3			55.8	51.4	
S.D.	71.2	.4	.94	.01	.21	1.7	.25	1.9			6.4	2.8	

Fig. 1. Item measure of believes in success.

Person DIF Plot analyses on confidence to succeed with gender shows that there are differences, where male lecturers (line 1) consider it easier than female lecturers (line 2) in item b1.

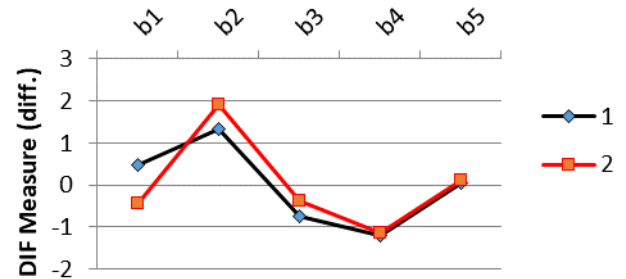


Fig. 2. Person DIF plot, confidence to succeed with gender.

Person DIF Plot analysis on confidence to succeed with education shows that there are differences where lecturers with S3 (line 3) are easier to approve b1 than lecturers with S2 (line 2).

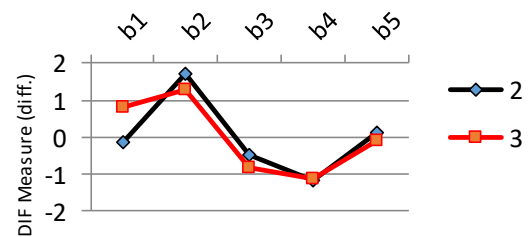


Fig. 3. Person DIF Plot on confidence to succeed with education.

Person DIF Plot analysis between the confidence to succeed with the academic position of the lecturer indicates that there is a difference, where the lecturer who holds the position of associate professor (line 3) considers it more difficult to agree on item b1.

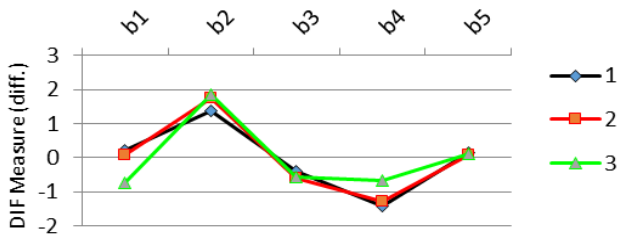


Fig. 4. Person DIF plot between the confidence to succeed in the academic position.

The second sub-construct lecturer self-efficacy: being a learner with items: (11) I learned the management of effective lectures to more experienced lecturers, (12) I read the latest reference books related to my knowledge, (13) I learned to communicate effectively to lecturers who are more skilled at communicating, (14) I take part in research method training, (15) I attend seminars related to the knowledge that I teach. Based on figure 5, all items can be used. The easiest item to be approved is 14, and the most difficult item is approved, 12.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL		INFIT		OUTFIT		PT-MEASURE		EXACT MATCH		Item
				S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%		
4	468	135	1.40	.14	.97	-.2	1.02	.2	.72	.74	62.6	59.9	14	
1	522	135	.19	.16	1.08	.7	1.08	.7	.68	.72	63.4	63.7	11	
5	523	135	.16	.16	.96	-.3	.92	-.6	.70	.71	64.1	63.9	15	
3	537	135	-.19	.16	.86	-1.1	.82	-1.5	.80	.71	74.0	64.6	13	
2	585	135	-1.57	.18	1.16	1.2	1.03	.2	.63	.66	73.3	69.6	12	
MEAN			527.0	135.0	.00	.16	1.01	.1	.97	-.2		67.5	64.3	
S.D.			37.4	.0	.95	.01	.10	.8	.09	.8		5.1	3.1	

Fig. 5. Item measure of being a learner.

Person DIF plot analysis between items of being a learner with gender shows that there are differences between male lecturers (line 1) and women (line 2) on items 13 and 15.

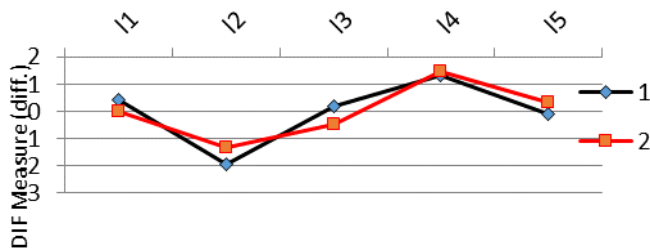


Fig. 6. Person DIF Plot between items being a learner with gender.

Person DIF Plot analysis between items being a learner with lecturer education shows that there are differences, where lecturers have S2 (line 2) and S3 (line 3) different on items 13 and 15.

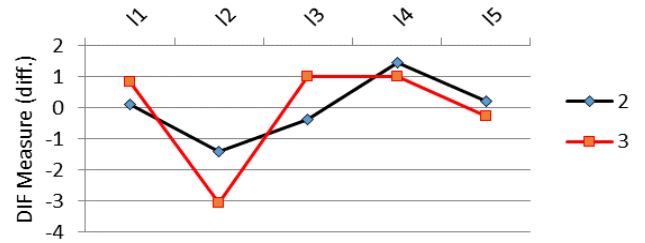


Fig. 7. Person DIF plot between items being a learner with education level.

Person DIF plot analysis between being a learner with academic position of lecturers shows that there are differences, where the associate professor (3) and the instructor differ in item 13.

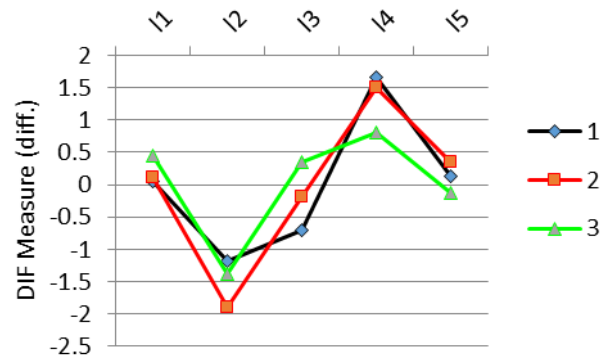


Fig. 8. Person DIF Plot between being a learner with academic position.

Third sub-construct of lecturer self-efficacy: recipient of persuasion with items: (o1) Through observation of colleagues, I try to improve my professional abilities, (o2) To be more professional, I openly accept criticism from other lecturers, (o3) I noted tips that are useful for improving my lecture activity process, (o4) I apply advices that brings change in my life, and (o5) I ask for advice from senior lecturers to motivate me. Based on figure 9, all items can be used for research. The most easily agreed is o1, while the most difficult item is o2.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL		INFIT		OUTFIT		PT-MEASURE		EXACT MATCH		Item
				S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%		
1	529	135	.73	.17	.95	-.3	1.00	.1	.72	.77	67.8	66.8	o1	
5	534	135	.58	.17	1.30	2.1	1.24	1.7	.76	.76	65.3	66.8	o5	
3	552	135	.01	.18	.93	-.5	.91	-.6	.77	.75	65.3	68.4	o3	
4	564	135	-.39	.19	.73	-2.2	.71	-2.2	.81	.74	72.7	69.5	o4	
2	574	134	-.92	.19	1.08	.6	1.05	.4	.68	.72	72.5	71.9	o2	
MEAN			550.6	134.8	.00	.18	1.00	-.1	.98	-.2		68.7	68.6	
S.D.			17.2	.4	.61	.01	.19	1.4	.17	1.3		3.3	1.9	

Fig. 9. Item measure of recipient of persuasion.

Person DIF plot analysis between recipient of persuasion and gender shows that there is a difference which states that it is easier for male lecturers (line 1) to agree than female lecturers (line 2) on items o3.

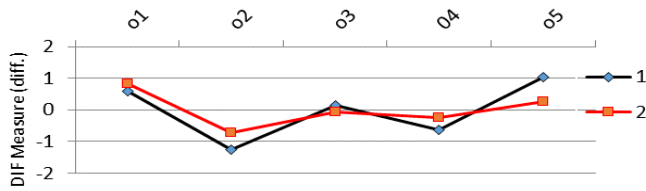


Fig. 10. Person DIF plot between recipient of persuasion and gender.

Person DIF plot analysis between recipient of persuasion items with education level of lecturer shows that lecturers with S2 (line 2) and S3 (line 3) do not have differences on items.

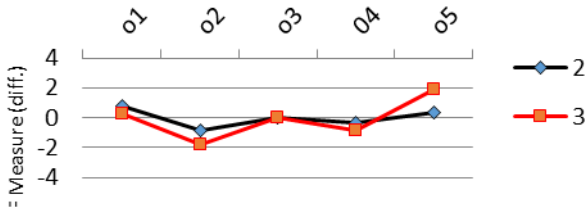


Fig. 11. Person DIF Plot between recipient of persuasion items with education level.

Person DIF plot analysis between the recipient of persuasion items and academic position points out that there are differences which show that the instructor (line 1) is the most difficult to approve the item o3 and most easily approves on o4.

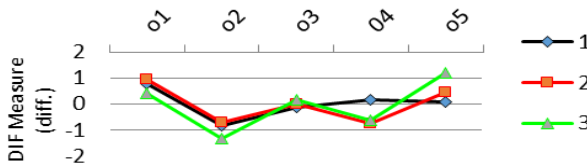


Fig. 12. Person DIF plot between recipient of persuasion items and the academic position.

The fourth sub-construct: make changes with items: (ch1) I establish close friendships with outstanding lecturers, (ch2) I adapt to the changing demands of the environment, (ch3) In order to live better, I change my self-perception by thinking more positive, (ch4) In order to be able to improve myself, I do self-reflection on a scheduled basis, and (ch5) In order to be able to face challenges, I try to be more confident. Based on figure 13, all items can be used for research. The easiest to agree on is ch4, while the hardest is approved ch3.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MODEL MEASURE	S.E.	INFIT MNSQ ZSTD	OUTFIT MNSQ ZSTD	PT-MEASURE CORR.	EXACT MATCH OBS% EXP%	Item
4	491	135	1.98	.16	1.07 .5	1.18 1.3	.75	.78 65.1 65.0	ch4
1	526	135	.99	.17	1.43 3.0	1.44 3.0	.73	.76 54.0 67.1	ch1
2	568	135	-.35	.18	.71 -2.5	.72 -2.2	.79	.73 74.6 69.0	ch2
5	583	135	-.88	.19	.85 -1.1	1.00 .1	.71	.71 77.8 72.2	ch5
3	605	135	-1.74	.20	.81 -1.4	.85 -1.7	.72	.68 79.4 75.3	ch3
MEAN	554.6	135.0	.00	.18	.98 -.3	1.04 .3		70.2 69.7	
S.D.	41.0	.0	1.33	.01	.26 1.9	.25 1.8		9.5 3.7	

Fig. 13. Item measure of making changes.

Person DIF plot analysis between making changes items and gender shows that there is no difference between male lecturers (line 1) and women (line 2) on items.

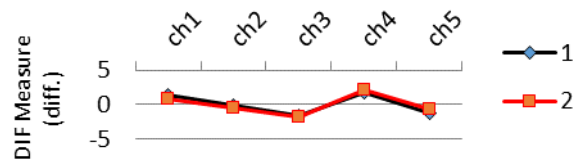


Fig. 14. Person DIF plot between make changes items with gender.

Person DIF plot analysis between make changes items with education level shows that there is no difference between lecturers S2 (line 2) and lecturers S3 (line 3) on items.

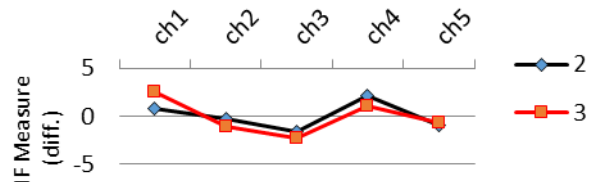


Fig. 15. Person DIF plot between make changes with education.

Person DIF plot analysis between making changes and academic position shows that there was difference, where the instructor (line 1) is easier to agree than the assistance professor (line 2) and associate professor (line 3) in ch2.

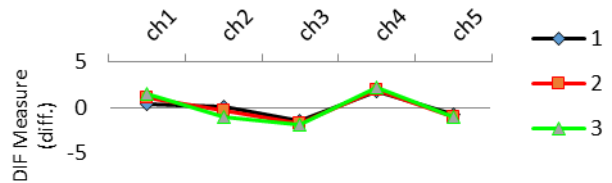


Fig. 16. Person DIF plot between making changes with academic position.

The fifth sub-construct of lecturer self-efficacy: self-evaluation with items: (se1) To live better, I try to learn from failure, (se2) I can detect my weaknesses as a lecturer, (se3) I can recognize my strengths as a lecturer, (se4) I can cover my weaknesses with other advantages that I have, (5) I can control myself fully. Based on figure 17, all items can be used for research. The easiest item to be approved is se3, while the most difficult one is approved se1.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MODEL MEASURE	S.E.	INFIT MNSQ ZSTD	OUTFIT MNSQ ZSTD	PT-MEASURE CORR.	EXACT MATCH OBS% EXP%	Item
3	515	135	.84	.19	.97 -.2	.97 -.1	.80	.77 75.4 70.4	se3
4	520	135	.66	.19	.91 -.7	.89 -.8	.80	.77 75.4 70.6	se4
2	537	135	.06	.19	.77 -1.9	.72 -2.2	.80	.76 75.4 71.7	se2
5	537	135	.06	.19	1.16 1.2	1.17 1.2	.75	.76 65.1 71.7	se5
1	583	135	-1.62	.19	1.20 1.6	1.22 1.3	.64	.72 68.3 71.9	se1
MEAN	538.4	135.0	.00	.19	1.00 .0	.99 -.1		71.9 71.2	
S.D.	24.0	.0	.87	.00	.16 1.3	.18 1.3		4.4 .6	

Fig. 17. Item measure of self-evaluation.

Person DIF plot analysis between items of self-evaluation with gender shows that there are differences stating that it is

easier for male lecturers (line 1) to approve than female lecturers (line 2) on se2, but on the contrary they were different on se5.

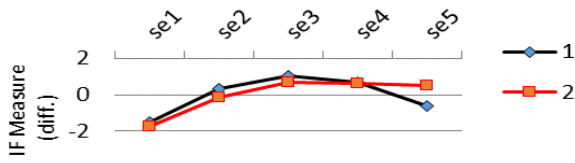


Fig. 18. Person DIF plot between items of self-evaluation with gender.

Person DIF plot analysis between self-evaluation items with education level shows that there is a difference stating that it is easier for S3 (line 3) to agree on se2 but it is more difficult for them to agree on se5.

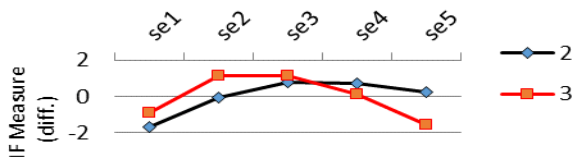


Fig. 19. Person DIF plot between items of self-evaluation with education level.

Person DIF plot analysis between self-evaluation items with academic position shows that there is a difference stating that it is more difficult for the assistant professor to agree than the lector (2) and instructor (1) on se2 and se5.

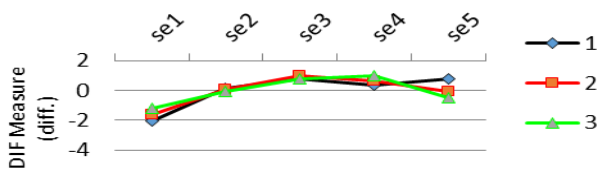


Fig. 20. Person DIF plot between self-evaluation items with academic position.

The sixth sub-construct: evaluating tasks with items: (t1) I can recognize tasks that are suitable for me or vice versa, (t2) I can analyze the steps for implementing effective lectures, (t3) I can evaluate the implementation of the study according to the guidelines research, (t4) I can evaluate the process of implementing community service according to the rules, and (t5) I can evaluate the causes of the lack of active participation of students in lectures. Based on figure 21 it can be stated that all items can be used for research. The easiest item to be approved is item t4, while the most difficult item is approved t2.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL		INFIT		OUTFIT		PT-MEASURE		EXACT MATCH		Item
				S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%		
4	521	135	.73	.17	1.07	.6	1.04	.4	.79	.76	64.2	66.2	t4	
3	539	135	.17	.18	1.04	.3	1.03	.3	.77	.75	67.5	68.3	t3	
5	547	135	-.09	.18	.87	-.9	.89	-.8	.73	.74	74.0	69.4	t5	
1	551	135	-.22	.18	1.00	.1	1.01	.1	.72	.74	68.3	69.6	t1	
2	562	135	-.60	.19	.95	-.3	.98	-.1	.72	.73	75.6	71.6	t2	
MEAN			544.0	135.0	.00	.18	.99	-.1	.99	.0	69.9	69.0		
S.D.			13.7	.0	.44	.00	.07	.5	.05	.4	4.2	1.8		

Fig. 21. Item measure of evaluating tasks.

Person DIF plot analysis between task evaluation items with gender shows that there is a difference stating that it is easier for male lecturers (line 1) to agree than female lecturers on item t5.

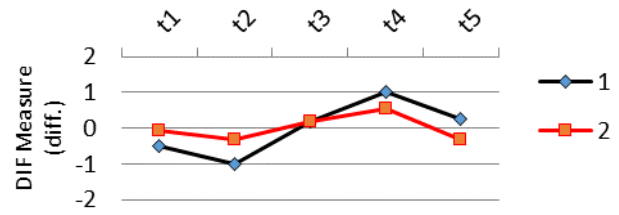


Fig. 22. Person DIF plot between task evaluation items with gender.

Person DIF plot analysis between the task evaluation item with education shows that there is a difference stating that it is hardest for S3 (line 3) to agree on item t3 but easier for them to agree on item t5.

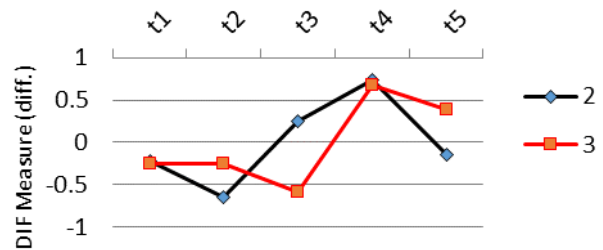


Fig. 23. Person DIF plot between task evaluation items with education level.

Person DIF plot analysis between the task evaluation item with the academic position shows that there is a difference stating that it is more difficult for the associate professor (line 3) to agree than the assistant professor (line 2) and the instructor (1) on item t3, but the opposite on item t5.

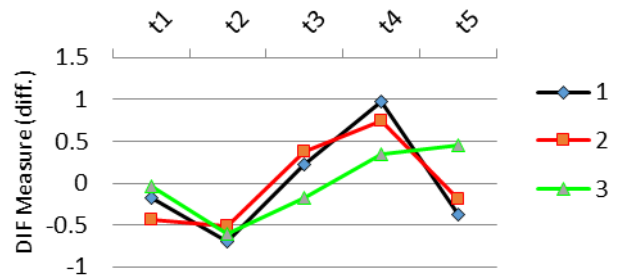


Fig. 24. Person DIF plot between task evaluation items with the academic position.

The seventh sub-construct of lecturer self-efficacy: evaluating the situation with items: (en1) I can analyze the situation that developed in the lecture process, (en2) I can compare the context of success in one class with another class, (en3) I can find out the situation right to choose one suitable approach in lectures, (en4) I can choose a suitable situation to make a decision, and (en5) I can identify the factors that cause a student to succeed in the academic field. Based on figure 25, all items can be used for research. The items that are easiest are en3, while the most difficult items are approved items en5.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MODEL MEASURE	MODEL		INFIT		OUTFIT		PT-MEASURE		EXACT MATCH		Item
				S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%		
3	534	135	.35	.20	.91	-.7	.82	-1.1	.84	.79	71.0	72.1	en3	
2	536	135	.27	.20	1.24	1.8	1.22	1.3	.74	.79	65.3	72.7	en2	
4	539	135	.14	.20	.94	-.4	.91	-.5	.80	.79	75.0	73.4	en4	
1	546	135	-.16	.21	.99	.0	1.00	.1	.77	.78	77.4	74.6	en1	
5	556	135	-.60	.21	.88	-.9	.83	-1.0	.78	.78	75.0	76.5	en5	
MEAN			542.2	135.0	.00	.21	.99	.0	.96	-.3			72.7	73.8
S.D.			8.0	.0	.35	.00	.13	1.0	.15	.9			4.2	1.6

Fig. 25. Item Measure of evaluating the situation with items.

Person DIF plot analysis between evaluating the situation items with gender shows no difference, where the male (line 1) and female (line 2) have similarities to all items.

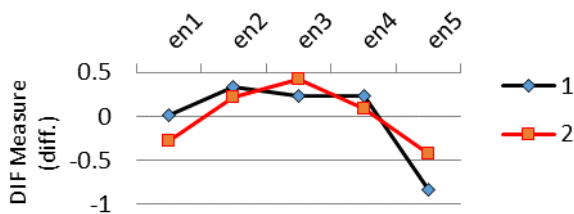


Fig. 26. Person DIF plot between evaluating the situation items with gender.

Person DIF plot analysis between evaluating the situation items with education shows there is no difference. S2 (2) and S3 (3) have similarities to all items.

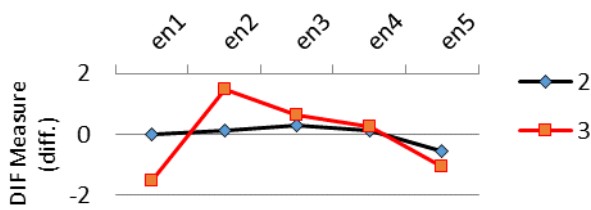


Fig. 27. Person DIF plot between evaluating the situation items with education level.

Person DIF plot analysis between evaluating the situation items with the academic position shows that there is a difference stating that the assistant professor (line 2) and associate professor (line 3) have difficulty agreeing on item en1, the instructor (line 1) is the most difficult to agree on item en2.

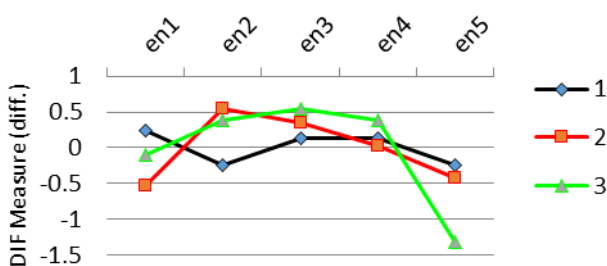


Fig. 28. Person DIF plot between evaluating the situation items with the academic position.

B. Discussion

The use of Rasch model to analyze instrument research items about the self-efficacy of lecturers shows that researchers do not only get a description of item validity, but more than that, researchers can find which items are most easily approved and items that are most difficult to be approved [22]. The items that are most difficult to approve can be taken into consideration by managers of educational institutions to carry out policies or actions in improving the lecturer self-efficacy.

Examples of items that are most difficult to be approved by lecturers include: (b4) I'm sure I can successfully develop learning modules, (l2) I read the latest reference books related to my knowledge, (o2) To be more professional, I am open to receiving criticism from other lecturers, (ch3) In order to live better, I change my self-perception by thinking more positively, (se1) To live better, I try to learn from failure, (t2) I can analyze the steps of implementing an effective lecture, and (en5) I can identify the factors that cause a student to succeed in the academic field. This information can make it easier for administrators of educational institutions to take necessary actions to improve the self-efficacy of lecturers [23].

The use of Rasch models through analyzing DIF people Plots between items with gender, education and academic position show that there are differences and there is no difference in person to items. If there are differences, then it is important information for decision makers in the organization to make policies or actions that are more specific to the person [24].

For example, there is a difference, where the associate professor states that it is more difficult to agree than the assistant professor and the instructor in item t3: "I can evaluate the implementation of the research according to the research guidelines". Decision makers in organizations can ask: why does the associate professor find difficulties in evaluating research? This information is important for decision makers to take action.

The findings of items that are difficult to approve, then findings of differences caused by persons (demographics) can help decision makers to take necessary actions. There are many ways to improve the self-efficacy of lecturers, such as training, coaching, giving freedom and responsibility, showing exemplary, giving praise, motivating, reducing stress, caring, and giving assistance [8], but to determine which ways are more effective and efficient, using Rasch model can help resolve to choose how to improve lecturer self-efficacy.

IV. CONCLUSION

Using of the Rasch Model to analyze 7 sub-construct lecturers' self-efficacy and each sub-construct consisting of 5 items has been proven to meet the required standards. The 7 sub-constructs are: (1) confident of achieving success, (2) being a learner, (3) recipient of persuasion, (4) making change, (5) conducting self-evaluation, (6) evaluating tasks, and (7) evaluating the situation. The 7 sub-constructs of lecturer self-efficacy instruments and its items can be used for research.

The results of the person DIF Plot analysis between lecturer self-efficacy items with gender, education level and academic

positions found that decision makers can use these findings to make policies or actions needed to improve the lecturers' self-efficacy.

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