STUDENTS' ENGAGEMENT ONLINE-LEARNING: ANALYSIS IN RASCH METHOD

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Abstract

The problem of research is how the level the students in online learning has been implemented since the COVID-19 pandemic at Faculty of Teacher Training and Education Universitas Palangka Raya. The purpose of study was to investigate how students engagement in online learning based on demographic factors such as age, gender, study program, year of class and domicile domicile when online learning is carried out. The research approach is quantitative (non-experimental) with a survey method by developing instruments based on three dimensions of learning engagement. Data were collected from 267 students using an online learning engagement instrument. Measurements used the Rasch method with the WINSTEP application to determine the validity and reliability of the research instrument, then a Differential Item Function (DIF) was carried out to assess student involvement in online learning specifically from the demographic factors of gender, study program, know generation and domicile. It was found that students had high cognitive involvement compared to behavioral and emotional involvement. Furthermore, it shows that there are differences in student involvement based on demographic factors such as gender, study program, year of class and domicile. This research can be a reflection and input for lecturers in choosing the right learning method in online learning and also for further research.

Keywords: Engagement, online learning, rasch method

1 INTRODUCTION

Online learning in Indonesia has only been widely recognised since the Covid-19 hit the world, so inevitably have to study from home. Learning from home without face-to-face meeting with a teacher is like students only receiving assignment from teacher in primary to secondary schools and even universities. In fact, online learning has actually been carried out since the 20th century in developed countries, including Australia with its open University and even in Indonesia. In relation to the interactions that take place in learning, the involvement of students is important and can affect student satisfaction in learning (El-Sayad et al., 2021). Actually, online learning has begun to develop in this century at world-renowned universities known as MOOCs (Massive Open Online Courses) which can be accessed by anyone and is free (https://www.mooc.org/).

In a survey conducted by researchers during the Covid-19 pandemic related to the use of lecturers' methods in conducting online learning to Teacher training faculty of universitas palangka raya related to the use of applications in conducting online learning, the most common is Google Classroom application (80,9%), which was then followed by the Zoom app (55,5%), and the use of Google Meet (24,6%). According to Shamin Akhter and his colleagues (Akhter et al., 2021) online learning is a process of providing information from a variety of different media such as E

books, CD, etc which is a change in the traditional teaching and learning style. According to Zhang (Shi et al., 2017), online learning is a learning that utilizes digital technology , applications that are specifically designed to meet the needs of learning. These applications can include Microsoft team, Zoom, Meet, Jitsi Meet, etc which are provided on a limited free or paid.

Many studies have been conducted on this online learning in student learning readiness during the Covid-19 Pandemic, which looks at the effect of zoom online-based learning on learning readiness (Vhalery et al., 2021). In addition to other studies that examine the effectiveness of online-based learning media such as Edmodo (Muhajir et al., 2019);Muzyanah et al., 2018). More research related to Google Classroom on learning in higher education (Cristiano & Triana, 2019; Heggart & Yoo, 2018; Kumar & Bervell, 2019). With the use of apps in online learning, it is equally important to know the extent of their engagement in online learning, because this is different from face-to-face learning. Furthermore in the research conducted to see student engagement in online learning (Nasution et al., 2022; Purba et al., 2021) similarly, research conducted in Malaysia linked to student demographics such as gender, ethnicity, study level, showed high engagement in study levels but was limited in research result in terms of domicile at the time of online learning (Adams et al., 2021).

Engagement in learning is generally the active role and collaboration of learners involved in participation every activity carried out inside and outside the classroom (Peter T.Ewell, n.d.). Whereas in online learning is the involvement in independent activities, interaction with learning resources and interaction according to the application used. Students involvement is described by Peter (Peter T.Ewell, n.d.), as an active collaborative activity in learning. Meanwhile Fredricks et al (Fredricks et al., 2004) illustrates that engagement is complex, as a process that is influenced by contextualized situation. There are three component to "engagement": cognitive engagement, emotional engagement, and behavioral engagement. Cognitive engagement is a mental process, which includes knowledge and skills in learning; emotional engagement is the feeling felt towards lecturers, and institutions, study programs, departments, faculties, and the university in general. While behavioral engagement is a mental process in which students have positive action towards their institutions, social environment, lecture materials, activities outside of lectures that are still related to academics (extra-curricular).

Student involvement in online learning using Google Classroom during the Covid-19 pandemic (Febrilia et al., 2020), shows that online learning carried out by students is quite good with high student participation in asking question, answering lecturer questions, collecting assignments, according to deadline, being active in discussion forums between students and lecturers. Whereas involvement in learning is involvement in terms of feelings, cognitive and behavior. Therefore, this research is more focussed on student involvement in online learning related to these three thing more specifically based on involvement seen from age, gender, regional origin (considering that students come from many different backgrounds).

In this research, to measure the extent of student involvement in online learning, an instrument will be developed called "Students Involvement in Online Learning Instrument". With the Rasch method, the quality of the data that has been collected through the survey will be assessed first. If in classical theory the number of samples is very decisive, while in Rasch modelling it is calculated based on calibration of items at a certain precision and at a trust level of up to 99%, the size of which is the stable calibration of items in the logit (as described in Chapter 3, table 3.2). Then, the WINSTEP software version 3.73 (the application used in this study) will detect outliers (respondent who answered all minimum or maximum values) and misfit responses (respondens whose MNSQ Outfit index is greater than 2 or less than 0,4) (Adams et al., 2021). Whereas in the research conducted by Gabriel Nababan and company in measuring student involvement in online learning in Mathematics using indicators from " The Online Student Engagement Scale/OSE, namely Skill, Emotion, Participation, and Performance.(Purba et al., 2021).

The instrument was developed based on questions about age, gender, regional origin, field of study/major. Then the closed questionnaire item were developed from 3 dimensions : 1) Emotional Engagement 8 items, 2) Cognitive Engagement 6 items, and 3) Behavioral Engagement 7 items. Thus, an operational definition was developed as a basis for making the following instrument development: Engagement in online learning is an interaction in the teaching and learning process that occurs in students who involve cognitive, emotional and behavioral in learning. Cognitive engagement is a mental process, which includes knowledge and skills in learning; emotional engagement is the feeling felt towards lecturers, and institution, study program, departments, faculties and the University in general. While behavioral engagement is a mental process in which students have positive actions towards their institution, social

environment, lecture materials, activities, outside of lectures that are still related to academics (extra-curricular).

2 METHODOLOGY

The research approach used is quantitative research, a non-experimental research with a survey method. The instrument used was "The Online Learning Enggement Questionnaire" which was developed based on question of cognitive, emotional and behavioral engagement. The closed-ended questionnaire items were developed from 3 dimensions : 1) Emotional Engagement, 2) Cognitive Engagement, and 3) Behavioral Engagement. The responses from the questionnaire developed with open-ended questions for age, gender, domicile when online learning was conducted, field of study/major and closed-ended question according to Curley, McLure, Spence and Craig (Spence et al., 2002) to obtain the " Engagement in Online Learning" instrument on a 1-5 Likert scale with answer options; (a) strongly agree (score = 5); (b) agree (score=4); (c) moderately agree (neutral) (score=3); (d) disagree (score=2) and (e) strongly disagree (score=1).

The minimum sample size is 150 respondents (Boone et al, 2014). Precision item calibration calculation at 0,5 logit and 99 % trust level. There were 317 students who participated in this study. The next step was to clean and validate the data using WINSTEP version 3.73, Rasch measurement model software, to detect outliers (2 respondents who answered all minimum or maximum values) and misfit responses (48 respondents with MNSQ Outfit index greater than 2 less than 4) (Widhiarso & Sumintono, 2016). The resulting 267 respondents were further analysed in this study, the demographic profile is presented in table 1.

The Rasch rating scale model approach was used to assess the data. Student engagement in online learning involves latent traits that refer to students opinions, perception, and attitudes in activities that require precise and accurate measurement models (Andrich, 2019). There are two types of logit data generated from software, namely item logits that are used to inform instrument quality and item calibration, and person logits that inform about respondent engagement. Data input with Microsoft Excel which was then imported into WINSTEP version 3.73, with the RASCH measurement model for data validation.

Table 1. Demographic Profile of Respondents (N=267)

Demographic	Respondents	Persentage (%)
Gender		
Male	65	24,347%
Female	202	75,66%
Batch (Year)		
2016	2	0,75%
2017	7	2,22%
2018	17	6,37%
2019	31	11,61%
2020	95	35,58%
2021	115	43,07%
Study Program		
Mechanical Engineering		8,9%
Education	24	51,31%
English Education	137	6,74%
Biology Education	18	31,09%
PAUD	83	0,37%
PPKN	1	0,75%
PGSD	2	0,37%
Guidance Counseling	1	0,37%
Mathematics Education	1	
Domicile		58,80%
Palangka Raya	157	41,20%
Outside Palangka Raya	110	

3 FINDINGS AND DISCUSSION

3.1 Finding

3.1.1 Instrument Quality

To determine whether the instrument has good quality, the validity and reliability aspects are shown in table 4.2, indicating that the data collected fits the model seen outfit mean square because the average value is close to one (ideal value) for both person and item, also confirmed by the significant value of the Chi-square test. The reliability index for person (0,85) is categorizes as good, item (0,99) as special and Alpha (0,87) excellent.(Sumintono & Widhiarso, 2014). The separation index of both person (3,48) and item difficulty (12,02) shows an index of more than 3 (minimum acceptable value). The greater the separation value, the better the overall quality of the

instrument for respondents and item, in other words, it support the fact that the instrument and the data collected are very reliable.

Table 2. Summary Statistics of Person and Item

Psychometric properties.	Person	Item
N	267	21
Outfit Mean Square		
Mean	0,06	0,21
		0,92
SD	0.92	12,02
Separation	3,48	0,99
Reliability	0,85	
Cronbach'sAlpha	0,87	
Chi-square(X^2)	5316*	
Raw variance	41,3*	
Unexplained variance Eigen value	2,2	

* $p < .05$

From table 2. Above the result of measuring the raw variance of the data is 41,3%, this show the minimum unidimensionality requirement of 40% can be met and also from the unexplained Eigen value there are less than three, namely 2,2. (Cavanagh & Romanoski, 2006) which indicates this instrument is more favourable or satisfactory. The five-rank scale used in this study Figure 1 shows that the average person measured by category moves up monotonically indicating each rating scalehas its own peak (*Summary-LinacreJM-Set*, n.d.), meaning that all Likert scale categories function well.
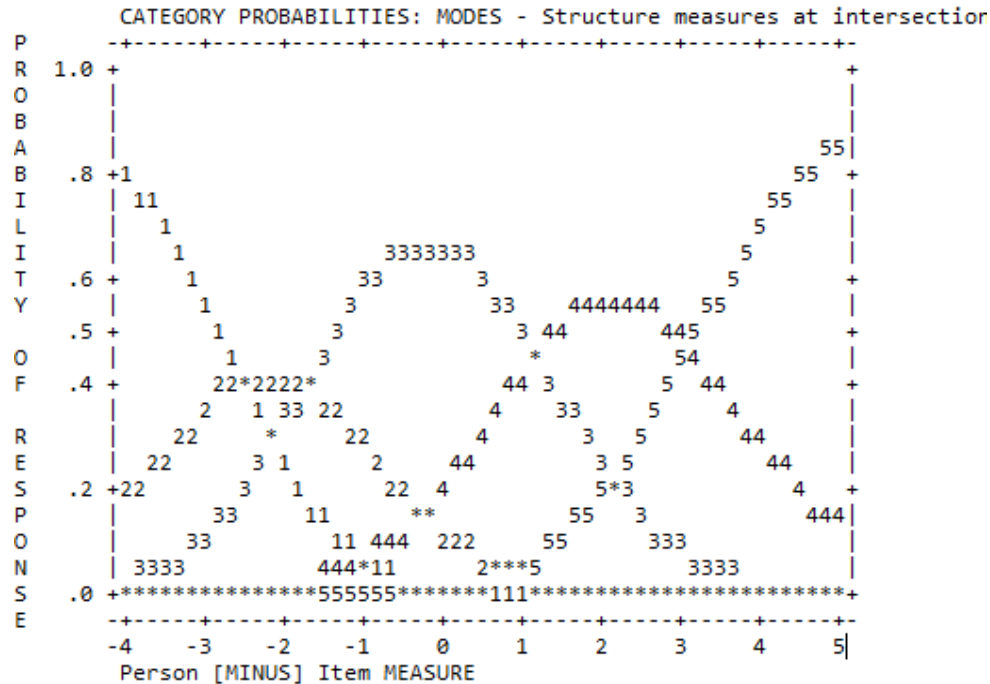
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        CATEGORY PROBABILITIES: MODES - Structure measures at intersectior
P       -+-----+-----+-----+-----+-----+-----+-----+-----+-----+-
R   1.0 +                                                              +
O       |                                                              |
B       |                                                              |
A       |                                                         55|
B    .8 +1                                                       55   +
I       | 11                                                   55    |
L       |    1                                                5      |
I       |    1                   3333333                     5       |
T    .6 +      1             33        3                     5        +
Y       |       1           3            33    4444444    55         |
     .5 +        1         3              3 44        445            +
O       |         1       3                *            54           |
F    .4 +          22*2222*              44 3         5  44          +
        |         2   1 33 22           4      33     5    4         |
R       |      22      *      22        4        3  5      44        |
E       |   22       3 1        2    44          3 5        44       |
S    .2 +22        3   1        22  4            5*3           4     +
P       |        33      11       **          55   3          444|
O       |      33        11 444  222       55        333           |
N       | 3333          444*11      2***5          3333            |
S    .0 +***************555555*******111*********************+
E       -+-----+-----+-----+-----+-----+-----+-----+-----+-----+-
         -4    -3    -2    -1    0     1     2     3     4    5|
           Person [MINUS] Item MEASURE
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*Figure 1. Analysis of the Online Learning Engagement Instrument
rating scale*

3.1.2 Online Learning Engagement Item Calibration

In the analysis using the Rasch method in this study, the estimation of item location (calibration) or logit value item (LVI) means that the higher the level of seriousness or difficulty of the item on the scale, in other words, the item tends not to be easily agreed by respondents. The item logit average was set at 0,00 logit, and the item standard deviation (SD) in this study was 0,93 logit. Mean and SD are used to categorize items based on difficulty level (Table 4.1). Provisions for items that are very difficult to approve if LVI > 0,93, while those that are difficult to approve arw (+ 0,93 > LVI > 0,00, the category of respondents easily approve (0,00 > LVI > 0,93 and the category very easily approved by respondents (LVI < ÿ 0,93 logit).

Table 3. Item calibration of student engagement in online learning

Construction of Engagement	Difficulty Level			
	Very Difficult	Difficult	Easy	Very Easy
Cognitiv	-	-	C4	C6,C5, C1,C2, C3,
Emotional	E2,, E5	-	E	E7, E3, E4, E8, E1
Behavior		-	B6, B7, B3	B5, B4, B1

As shown in Table 2, the three dimensions in the instrument showed three different response pattern. For cognitive engagement, there were no item that were very difficult for respondents to agree with. As for emotional engagement (2 items) that are very difficult for respondents to agree with, namely item number 2 (The task given by lecturer are very many.) and item number 5 (I like to send chats or online discussion or make comments with lecturers). Whereas in the behavioral engagement there is 1 item that is very difficult to agree with, namely item B2 (I post opinions or responses in the forum regularly). The finding suggest that students perceptions of cognitive behavior do not have the same level difficulty to do so compared to the process of emotional engagement and behaviors associated with psychological attachment for emotional engagement.

The location of the person and the completed item in the logit measurement continuum in Figure 2 (Wright item map) which show how the position of the item and the respondent fit together in the logit continuum, the higher the LVI means the item is difficult to agree with. On the right side of the Wright map, item E5 (I like to send an online chats or discussions or make comments with lecturers with a logit of LVI + 1,86) is the most difficult item to agree with. This means that students rarely ask questions in online lectures with lecturers. While item E8 is located at the bottom right of the Wright map whichis an emotional connection with the institution (I am happy if there is credit assistance provided by the institution. with logit LVI – 2,06), is the item that is mostly agreed by respondents, meaning that this item is the most expected by students if online learning is carried out
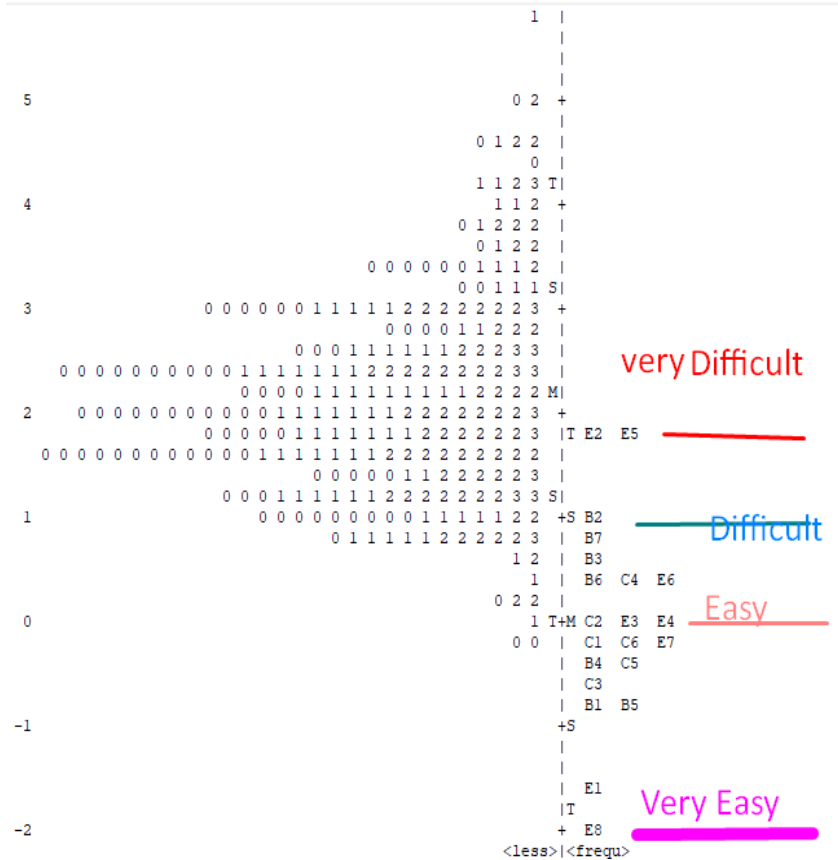
Figure 2. *Position of people and items (Wright map)*

3.1.3   Students Engagement Level in online learning

On the left side of Figure 2 is the spread of person level engagement. The higher the logit person value (LVP) located in the upper left, indicates that respondents answer to I item tends to agree or strongly agree, indicating that the level of student involvement in online learning is very high. In this study, the mean LVP was 2,15 with a standard deviation of 1,03, indicating that respondents tended to be higher than the item. This indicates that the level of engagement of this sample is higher than the level of difficulty seen in the item, this also means that the placement of the test items is satifactory.

As above in the items there are grouping of difficulty levels, so categorization of student responses is also possible, as the Rasch model provided an accurate and precise measurement of engagement in online learning (Table 3). Using the LVP mean and SD, there are four level of learning engagement (from very high engagement to low engagement), which identify the number of students in each group. This analysis has the benefit of being able to steer towards individual-centered statistics rather than group-centered statistics, which provide a lot of detail (Engelhard et al., 2018).

Table 3. Online learning engagement rate by demographics (N=267)

Demographic	Very High LVP > 3,18	High +3,18 > LVP > + 2,15	Moderate +2,15 > LVP > 0,36	Low LVP < 0,36
Gender				
Male	7	17	38	1
Female	33	69	97	5
Batch (Year)				
2016	-	1	1	-
2017	1	1	4	-
2018	3	9	6	-
2019	4	10	12	2
2020	18	35	43	2
2021	14	30	68	2
Study Program				
Mechanical Engineering	3	7	14	-
Education	20	49	67	1
English Education	5	5	7	1
Biology Education	15	25	40	3
PAUD	-	1	-	-
PPKN	-	-	2	-
PGSD	-	-	1	-
Guidance Counseling	-	-	-	1
Mathematics Education				
Domicile				
Palangka Raya	20	46	85	6
Outside Palangka Raya	20	40	80	-

From table 3 above, student engagement in online learning based on student gender found about 24 out of 65 male students (36,92%) and 102 out of 202 female students (50,50%) are in very high online learning engagement. Thet moderate engagement, male were 38 (58,46%) and female 97 (48,02%), while at low engagement, male were only 1 out of 65 (1,54%) and female 3 out of 202 (1,48%). This shows that in online learning, female engagement is on average higher than male.

When viewed from the class year of students, the high number of engagement is balanced between students in 2020 and 2021. This is possible because the number of courses programmed by students in this batch (2020 and 2021) was the highest when this research was conducted.

The result of the analysis based on the Study Program, student engagement in online learning with very high engagement are balanced with moderate and low engagement. English Education study program 69 out of 137 (50,36%) were in the very high learning engagement range. While the Biology Education Study Program has very high engagement 10 out of 18 (66,67 %) with moderate and low engagement 7 out of 18 (38,89%), While the PTM Study Program 10 out of 24 (41,67 %) are in the category very high engagement and PAUD 40 out of 83 (48,19 %) are in the category of very high engagement. While the Counselling Study Program, Mathematics Education with few respondents did not fall into the very high categories. Only the PPKN Study Program with 1 respondent is at a high online learning engagement. So, the Study Program with the highest percentage of online learning engagement is the Biology Education Study Program.

Online learning engagement based on domicile at the time of learning which is categorized for Palangka Raya area and outside Palangka Raya (both outside the area within one province and outside the island), From the research findings, students with domiciles outside of Palangka Raya on average have high engagement than students who live in Palangka Raya during online learning. This can be seen from the engagement of students outside Palangka Raya, there is no low engagement.

3.1.4   Differential Item Functioning (DIF) Respondent Demographic Factors

The next analysis is to detect item bias, which in the Ranch method is represented by Differential Item Functioning (DIF). For this analysis, there are two demographic variables, namely gender and domicile. An item is said to have DIF if it has DIF contrast value of less than – 0,5 or more than 0,5, and a t value of less than – 2,0 or more than 2,0, and a p (probability) value of less than 0,05 or more than – 0,05 (Boone & Staver, 2014). Table 4 shows that it is possible to have DIF on gender, only two criteria are eligible, while DIF on domicile that meets 3 conditions is E2 (*The task given by the lecturer are very many*) , while the others only meet one or 2 conditions.

 In addition, looking at the DIF plot for the whole items provides very interesting findings. If the location of the item is in the top row, it means that the item is considered difficult to agree with. Figure 3 shows the DIF plots by gender, with each dimension having a varying response pattern. For the cognitive dimension, item C3 *(I listen to the explanation of the material by the lecturer during online learning*) there is no difference between male and female students; while item C4 (I listen to the lecturer in online learning while taking notes) up to C5 *(I like to send chat or*

online discussions or make comments with the lecturer) is a very difficult item to be approved by
male students respondents than female students respondents.

Table 4. Differential Function of Online Learning Engagement Instrument Items

Item	DIF Contrast	t	Probability	Demographic
C1	- 0,03	- 0.14	0,8872	Gender
C2	- 0.17	- 0,79	0,4337	
C2	- 0,26	0,3554	0,1838	
E2	- 0,18	1,5163	0,0090	Domicile
E4	- 0,22	- 0,9151	0,7731	
E6	- 0,24	0,1773	0,2520	
E8	- 0,02	- 0,2261	0, 4259	
B4	- 0,31	- 0,2704	0,4527	
B5	- 0,21	0,4863	0,1416	
C1	-0,24	0,2379	0,2286	
C4	- 0,02	- 1,4025	1,00	
E5	- 0,22	0,1816	0,2473	
E8	- 0,21	- 0,2261	0,4259	
B2	- 0,17	- 0,1260	0, 3827	
B4	- 0,15	- 0, 2704	0, 4527	
B7	- 0,09	- 0,6677	0, 6529	

In Figure 3, the emotional dimension, items E2 (*The task given by the lecturer are very many*)
and E5 (I like to send chats or online discussions or make comment with the lecturer) as the most
difficult items for both female and male respondents to agree on. Whereas item E8 (I am happy
if there is internet credit assistance provided by the institution in online learning) is the item that
is most easily agreed upon by both female and male respondents. There is a difference in response
between male and female on items (C2, C4, C5, E6, B2, B5 dan B6), while the others are almost
the same, there is no difference in response from male and female. At item C2 (*I read the material
that has been sent by lecturer or given by the lecturer during the virtual meeting*) is more easily
agreed by male students than female, C4 (I listen to the lecturer in online learning while taking
notes) and C5 (*I make notes for assignments given by the lecturer*) are more easily agreed by
female students than male. This shows that the perseverance and attention of female students in
participating in online learning. Similarly E6 (*I am happy with the University's implementation
of online learning*) and B2 (I post opinions or responses in the discussion forum regularly) are

more agreed upon by female students. What is different is that items B5 I post assignment that I do myself) and B6 (*Assignments made are not copy and paste assignments from internet*) are more easily approved by male students.
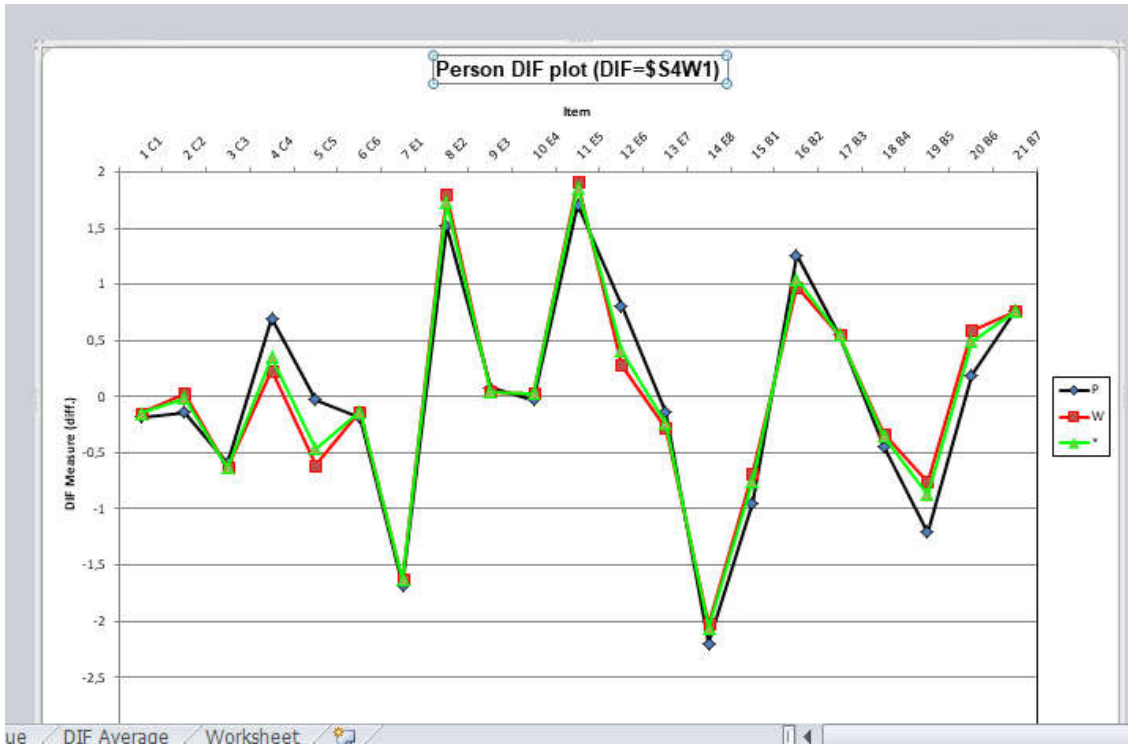

Figure 3. DIF plot of people by gender for all items

Figure 4 shows the DIF plot based on domicile during online learning, namely in Palangka Raya city (P) and outside Palangka Raya city (D). Outside the city of Palangka Raya is not grouped in a particular area, only differentiated between those in the city and outside Palangka Raya, considering that this research is only for students of Palangka Raya University. Of the two groups of students residing in Palangka Raya and outside Palangka Raya in general do not have many different responses outside of item E2 (*The task given by lecturer are very many*) which are detected as DIF items, only in item C2 (*I read the material that has been sent by the lecturer or given by the lecturer during the virtual meeting*) which is slightly different for students outside Palangka Raya who more easily agree to the item than students who live in Palangka Raya. This

shows that students who are outside Palangka Raya city when online learning is conducted are more prepared to participated in online learning.
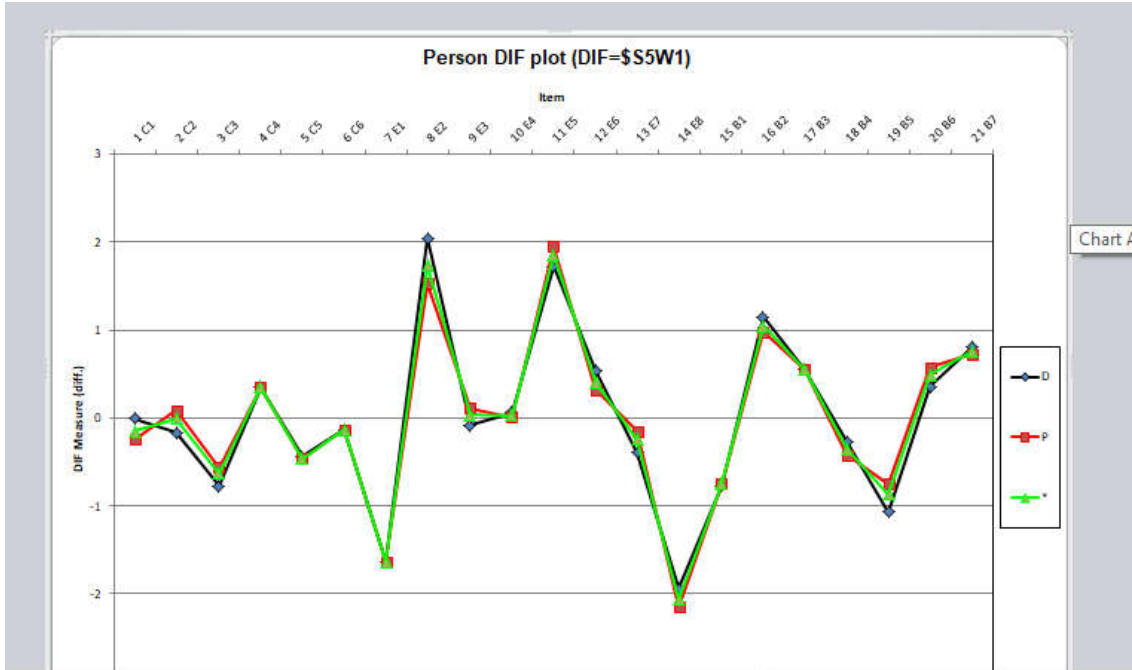

Figure 4 DIF plot of people by Domicile for all items

3.2 Discussion

This study aims to investigate students engagement in online learning, specifically to find out how their engagement is based on gender, study program, class year, and domicile when online learning is implemented at FKIP Palangka Raya University. Based on the result of the study, it is obtained the level of cognitive engagement is easier to do, which shows that students have a high level of cognitive engagement compared to emotional and behavioral engagement. This contrasts with the findings of previous studies that found high levels of behavioral engagement compare to cognitive and emotional engagement (Adams et al., 2021). The different findings are in line with what is stated in the discussion of the limitations of research conducted in Malaysia which cannot be generalized so this study also has limitations which are only carried out at one university.

At a high cognitive level, it shows that students academic performance does not affect their engagement in online learning. This is in accordance with the results of research that has found e-learning structures that emphasize cognitive and behavioral engagement tend to produce better academic performance (Al-Qahtani & Higgins, 2013).

There is something interesting from this research that in online learning, students feel that the task given by lecturers are not much. This can be detected from the statement of item E2 on the dimension of emotional engagement (The task given by the lecturer are very many) which is very difficult for students to agree with. This illustrates that the task given by lecturers are perceived to be no different from the many tasks that lecturers usually do during face-to-face teaching. This item detected bias in the demographic factor of student domicile, meaning that this item contain bias in domicile. This is in line with research conducted by Adam and colleague that student background factors also affect the learning model carried out (Adams et al., 2020).

Regarding the Indonesia Government policy through the Medikbud Ristek during the Covid-19 pandemic which provides free internet credit for students is the most agreed upon thing from the findings in this study. Based on the results of the research for the statement item which is a form of the dimension of emotional engagement with the institution as the item that is most easily agreed upon by respondents who have an *INFIT MNSQ* value that is smaller than the sum of the mean value and standard deviation of the *INFIT MNSQ* value which indicates this item is a suitable item not out of the model. This is also reinforced by the Outfit Mean Square value E8 (I am happy if there is credit assistance provided by the institution in online learning , 1,12) which is accepted 0,5 < MNSQ < 1,5; value Outfit Z- Standart (ZSTD) E2 (0,8), which is accepted -2,0 < ZSTD < + 2,0.(Sumintono & Widhiarso, 2014).

The limitations of the findings of this study for cognitive engagement is higher than emotional and behavioral engagement cannot be generalized because this study only limited to one faculty as well as research conducted at the University of Malaysia in Adam and colleagues (Adams et al., 2021).

4   CONCLUSION

From the results of this study, we can conclude that the implementation of online learning is the preparation of a learning environment that allows students to learn conductively. Because in online learning there are several factors that can be an obstacle, especially the network that needs to be prepared for the alternatives to be able to follow online learning well. I n terms of communication constraints between lecturers and students also. The higher cognitive engagement in online learning can be a recommendation that online learning can still be done even if face-to-face learning can be done.Online learning can be done with conducive environmental conditions related to the internet network and also the readiness of students and lecturers. High cognitive engagement is also accompanied by behavioral and emotional engagement. This research has limitations because it was only conducted in one faculty, thus this research can be carried out again at a wider area level.

ACKNOWLEDGEMENTS

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