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Developing and Validating E-Learning Module for Islamic Higher Education Digital Literacy in Preventing Hoax (EMODILPH)

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Abstract: The digital literacy curriculum in universities, especially Islamic universities, needs to be developed intensively to respond to the rapid exposure of hoax news among students. Therefore, this study aims to develop an e-module for digital learning and to investigate how this product can be implemented in a digital literacy curriculum model at Islamic universities. The Rasch measurement was used to assess fit validity and reliability criteria based on validator assessment and student responses. Many Facet Rasch Measurement was used to confirm validity and reliability from 4 different validators based on e-module development in phase 1 and phase 2 using 10-item criteria. A rating scale analysis was used to check validity and reliability according to 233 student responses and item category interactions. The e-module achieved fit validity and reliability. The e-module implementation showed students gave higher responses, 55% (agree) and 39% (strongly agree), if the e-module can help them with digital literacy for understanding hoax information. The bias interaction and the differential item functioning have been discussed in this study. The findings will provide initial knowledge in the development and implementation of e-modules for preventing hoaxes and will improve students' understanding of filtering information in the digital literacy curriculum.

INTRODUCTION

The fourth industrial revolution is progressing rapidly (Benešová & Tupa, 2017; Crnjac et al., 2017; Ivanova et al., 2018). Consequently, the development of the Internet, users, and matters related to it continue to grow and increase. Consequently, the development of the Internet, users, and matters related to it continue to grow and increase, fostering an unprecedented transformation in education as online platforms and digital resources redefine the landscape of learning and knowledge dissemination.

The need for extensive data with open access and human activities centered on internet speed and data is one of its characteristics. The Industrial Revolution has also existed in the educational area (Anwar et al., 2018; Emejulu & McGregor, 2019; Handayani et al., 2020; Hijriyah et al., 2022). These changes create opportunities at primary, secondary, or higher education levels, both formal and informal. The real opportunities that can be seen and felt are the vast options of learning resources and the easier and faster access to learning that can be done anywhere. In short, the industrial

revolution has forced the world of education to enter the digital era (Gu & Belland, 2015; Hashim, 2018; Ivanova et al., 2018). On the other hand, the changes pose their risks. The rapid flow of information has created a pile of information. Excellent and accurate information is mixed with false and misleading information. Students are forced to filter the information obtained even though they do not have a good ability to filter it. They often become victims of false information, fake news (hoax) (Gumilar et al., 2017), hate speech (Kurnia & Astuti, 2017), radicalism (Lim, 2005), pornography (Arsawati et al., 2021; Ly et al., 2018) and various other irresponsible information. There is much confusing information that the public can obtain, so it requires the ability to filter various information. Digital literacy abilities are needed to obtain clearer information (Desi, 2020; Fatkhurahman, 2018; Nahdi & Jatisunda, 2020).

Several recent research results show that many students are exposed to hoaxes (Alif et al., 2018; Fatkhurahman, 2018; Ahmad et al., 2020). The hoaxes can cause misunderstandings and misconceptions and expose misleading teachings and sayings. To avoid and prevent the situation from getting worse, students must have a digital literacy curriculum. This curriculum is an answer to the demands of the 21st century for the quality of educational outcomes. Digital literacy can be defined as a person's ability to correctly and optimally read, write, analyze, or utilize digital devices such as computers, the Internet, telephones, and other digital devices as communication support tools (BNSP, 2018; Irwandani, 2016; Jaya, 2012; Parmin & Peniati, 2012; Tharayil et al., 2018). There are several indicators of digital literacy: the ability to use digital devices effectively, analyze day-to-day application usage, and use digital devices after training (Radovanović et al., 2020).

Digital literacy curricula must be made more adaptive, flexible, and capable of responding to current challenges and needs. Digital literacy curriculum development can be done in various ways. Through this study, the researchers try to develop a digital literacy curriculum more practically by developing learning resources of the electronic module (e-module) for Islamic higher education students. Several recent research results show that many students in the Islamic higher education environment are exposed to hoaxes (Alif et al., 2018; Fatkhurahman, 2018; Ahmad et al., 2020). Unfortunately, they do not have specific guidelines on handling and managing the information they obtain on the Internet and social media. Therefore, Developing an e-module is needed so that students can manage the various information they obtain to improve their digital literacy. We also investigate how this product can be implemented in Islamic universities' digital literacy curriculum model. In this study, the developed e-learning module for Islamic higher education digital literacy curriculum to prevent hoaxes was called "EMODILPH."

METHOD

This research adopted a research and development approach, encompassing both qualitative and quantitative methods. The qualitative facet encompassed the delineation of digital literacy in Indonesia, utilizing data from the Digital in Indonesia website. The quantitative facet comprised evaluating the fit validity of the EMODILPH through expert validation and student assessment, alongside analyzing post-implementation student responses. Quantitative data were analyzed using the Rasch measurement.

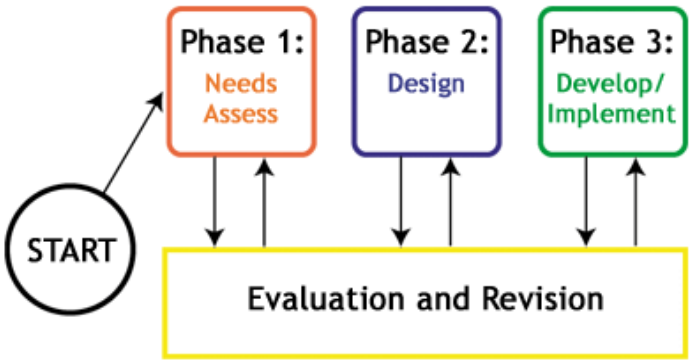

Figure 1. Hannafin and Peck Development Model.

The research and development model, patterned after Hannafin and Peck's (1998) three-stage framework involving needs analysis, design, and development/implementation stages, was employed (Alif et al., 2018; Fatkhurahman, 2018; Ahmad et al., 2020). Notably, previous studies have successfully employed this model for educational material development. In the needs analysis phase, data on internet users and students exposed to hoax news were collected from The Digital Indonesia website. Additionally, the requirements of Islamic higher education students for a hoax news prevention guide were analyzed. Subsequently, the electronic literacy e-learning module (e-module) was designed in stages two and three, taking into account practicality, accessibility, and cost-effectiveness. The module's appealing design was developed considering student needs.

The study incorporated four e-learning experts as validators for content validity, 233 students (134 female and 99 male students) to assess product feasibility, and 205 students (100 female and 105 male students) to evaluate the EMODILPH's impact after implementation in Islamic higher education institutions. The e-learning experts were chosen based on their extensive teaching and e-learning development experience. The student participants were randomly selected using stratified random sampling.

For the evaluation of content validity, the EMODILPH was assessed by validators using a 10-criteria evaluation form employing a five-point scoring rubric. A questionnaire with 17 evaluation criteria and a Likert scale was used to assess product feasibility. Furthermore, a questionnaire with four indicators and ten evaluation criteria was employed to evaluate the EMODILPH's effect after classroom implementation.

Rasch measurement, facilitated by FACETS and Winsteps software, was used to analyze the data. Validator assessments underwent Many Facet Rasch Measurement analysis, while student responses were analyzed using WINSTEPS software. The analysis encompassed aspects like rater severity, fit validity, reliability, inter-rater agreement, gender bias, and variable maps for content validity. Additionally, fit validity, reliability, and the effect of the EMODILPH were analyzed concerning student responses. Rasch measurement was preferred due to its comprehensive capabilities in item difficulty assessment, person-item interaction detection, identifying outliers, and detecting bias interactions.

RESULT AND DISCUSSION

The Development of the Internet and Its Users in Indonesia

Based on the data summary from the Digital in Indonesia website, the development of internet users in Indonesia in the last five years is presented in Table

1, and the population of social media users from 18-24 years is shown in Table 2.

Table 1. The Development of Internet Users in Indonesia in the Last Five Years.

Year	Internet Users (Million)	Social Media Users (Million)
2021	202.6	170.0
2020	175.0	160.0
2019	150.0	150.0
2018	132.7	130.0
2017	132.0	106.0

Table 2. The Population of Social Media Users.

Year	Social Media Users (Million)	Duration of Using Social Media in a Day
2021	51.0	3 Hours 14 Minutes
2020	48.0	3 Hours 26 Minutes
2019	49.5	3 Hours 26 Minutes
2018	45.0	3 Hours 23 Minutes
2017	40.0	3 Hours 16 Minutes

Table 1 illustrates that internet users in Indonesia have continued to grow in the last five years. Likewise, the number of social media users grew by more than 50 million at the same time, as shown in Table 2. In terms of duration, the average use of social media among students is around three hours per day. This is more than enough time to consume information from social media. The longer the duration of social media usage, the more possible students are exposed to various hoax information. In Table 3, we also investigated the proportion of the social media platform types used by the user whereby the circulation of hoax information was spreading.

Table 3. Percentage of Social Media Platform Types.

No	Social Media Platforms	Frequently Received Hoax Information (%)
1	Facebook	81.25
2	WhatsApp	58.55
3	Instagram	29.48
4	Line	11.37
5	Twitter	10.38
6	Telegram	5.86
7	Others	1.67

Based on this fact, it is necessary to develop a curriculum or teaching material to strengthen students' digital literacy, especially in countering hoax content. In this study, researchers conducted research and development of teaching modules on digital literacy for Islamic higher education students to prevent the impact of the hoax from getting worse. It is essential to be trained in digital literacy skills to counteract harmful content and replace it with positive values relevant to educational values (McDougall et al., 2018).

The Validity and Reliability of the EMODILPH

Initially, The EMODILPH was analyzed using MFRM by utilizing FACETS Software. Ten item criteria were used to analyze the EMODILPH based on four validator assessments. We found that the data fit the Rasch model with global Pearson chi-squared = 78.7269, df =30, p = 0.02. All facets, including the EMODILPH, achieve validity and reliability criteria based on Rasch measurement, as presented in Table 4. The acceptable range for infit and outfit Mean Square (MNSQ) is from

0.5 to 1.5, where the ideal values for fit criteria are close to 1.00 logits (Andrich, 2018; Boone et al., 2014), and the acceptable range for infit and outfit z-standardized (ZSTD) should range from −2 logits to 2 logits (Boone et al., 2014; Fisher, 2007). The acceptable reliability criteria range from 0.68 to 1.00 (Boone et al., 2014; Fisher, 2007). Fisher (2007) stated that values more than 0.67 represent acceptable reliability. Table 4 represents the summary statistics of MFRM analysis for three major facets. Dummy facets, such as gender, will be used to demonstrate bias interaction.

Table 4. The Summary Statistics of MFRM Analysis.

Psychometrics	The EMODILPH	Item criteria	Validator
Number	2 (phase I and II)	10	4
Measure			
Mean	1.68	0.00	0.00
SD	1.72	0.66	0.68
SE	0.03	0.02	0.02
Outfit MNSQ			
Mean	0.98	0.98	0.98
SD	0.03	0.22	0.19
Infit MNSQ			
Mean	0.94	0.95	0.95
SD	0.01	0.29	0.16
Outfit ZSTD			
Mean	−0.2	0.1	0.0
SD	0.1	0.5	0.5
Infit ZSTD			
Mean	0.0	0.0	−0.1
SD	0.1	0.5	0.5
Strata	12.99	2.16	2.51
Reliability	0.98	0.78	0.73
Chi-square/df	91.1/1*	12,5/4*	9.7/3*
Inter-rater reliability			
Exact agreements			27.1%
Expected agreements %			26.3%

*p < 0.01, SD = Standard Deviation, SE = Standard Error

The scale category also functions well with a clear peak from poor (1) to excellent (5), as represented in Figure 2, whereby the average measure increases monotonically from −1.44 to 3.56. This result indicates that all validators can understand the scale category in all item criteria to do content validity evaluation.

The variable map was depicted in Figure 3 to investigate the interaction among all facets. The strata for all facets have a value of more than two, indicating that at least each facet consists of two-level groups. The EMODILPH (e-module) phase 2 has a higher measure (3.39 logits) than The EMODILPH (e-module) phase 1 with −0.04 logits, indicating that validators give a higher score to The EMODILPH evaluation after the revision process in The EMODILPH phase 2 evaluation. The most severe validator is validator 1, with 0.43 logits, and the most lenient validator is validator 2, with −1.01 logits. All validators achieve fit validity with Infit and Outfit MNSQ ranging from 0.71 to 1.19. The result of the inter-rater agreement revealed that the observed agreements (27.1%) are close to the expected agreements (26.3%), indicating that validators act independently, confirming fairness with no cooperation in scoring the evaluation process. The item criteria C2, C9, and C10 have the

highest level of difficulty (0.78 logits), which means that validators are more lenient in assessing these items, and C4, C5, and C7 have the easiest level of difficulty, which means that validators are more severe to assess these items. All item criteria achieve fit validity, with Infit and Outfit MNSQ ranging from 0.62 to 1.35.

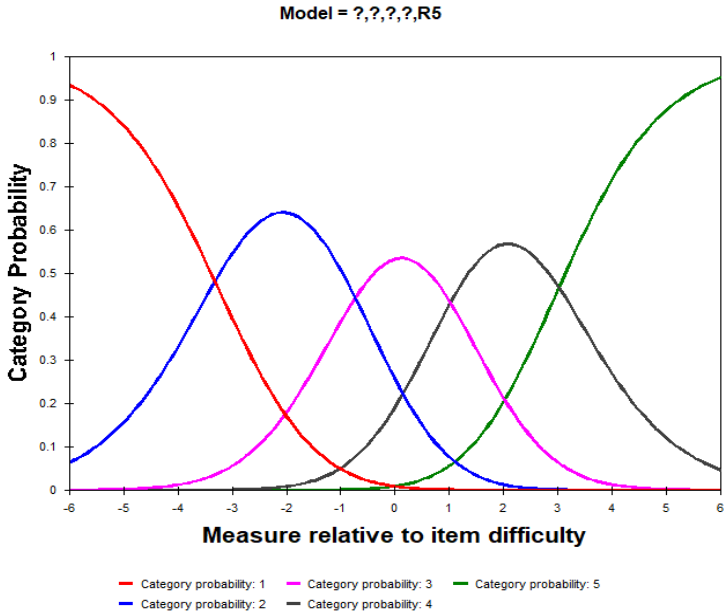

Figure 2. Scale Category Probability based on Validator Evaluation.

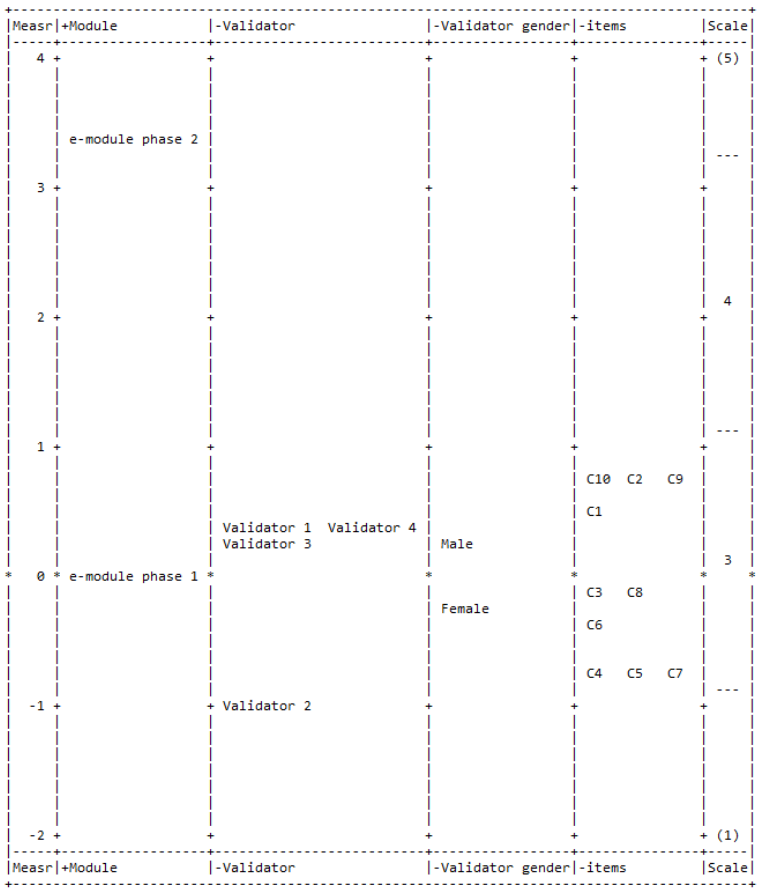

Figure 3. Variable Map.

Gender Bias in Raters' Assessment

Table 5 illustrates how validator gender interacts with item criteria. The fixed chi-square test for bias interaction between validator gender and item category is not significant ($\chi 2(20) = 14.3$; p =.83), indicating that the magnitude of the observed measurement variation is not substantive or no bias interaction. This result is essential to perform fairness in validator evaluation. However, suppose a significant bias exists in a certain rater measure. In that case, the detected bias needs to be excluded from the assessment model to achieve fairness in evaluating the content validity of The EMODILPH. Bias interaction analysis was also performed to verify the validator gender bias assessment toward item category, as shown in Table 5. Bias interaction analysis indicates no significant bias interaction ($p > 0.01$) for validator gender toward all item criteria from C1 to C10.

Table 5. Bias Interaction Analysis between Raters' Gender and Item Criteria.

Item	Measure (logits)	Validator Gender	Measure (logits)	Validator Gender	Target Contrast (logits)	T	p
C1	0.47	Female	0.51	Male	-0.04	-0.4	0.9688
C2	0.47	Female	1.07	Male	-0.6	-0.6	0.6019
C3	1.07	Female	-1.26	Male	2.32	2.1	0.0921
C4	-0.9	Female	-0.63	Male	-0.27	-0.2	0.8258
C5	-0.18	Female	-1.26	Male	1.08	0.9	0.3936
C6	-0.9	Female	-0.05	Male	-0.85	-0.7	0.496
C7	-0.9	Female	-0.63	Male	-0.27	-0.2	0.8258
C8	-1.77	Female	1.07	Male	-2.84	2.3	0.0706
C9	1.64	Female	-0.05	Male	1.69	1.6	0.1734
C10	0.47	Female	1.07	Male	-0.6	-0.6	0.6019

p = probability (Significant if p is less than 0.01), t = t-statistic

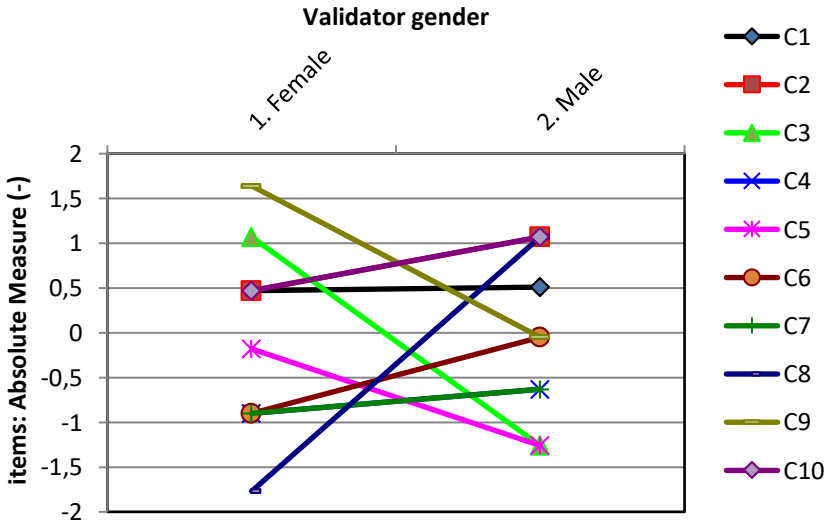

Figure 4. Bias Interaction of Validator Gender toward Item Category.

The Validity and Reliability of Students' Responses

We ran Rasch analysis using WINSTEPS software based on the Joint Maximum Likelihood Estimation (JMLE) equations, whereby the raw data were converted to interval data (logits) (Linacre, 1998, 2020). Rasch analysis was utilized to know specific interactions between 233 students and 17 items in the form of a questionnaire with a scale from strongly disagree (1) to strongly agree (4). As represented in Table 6, the students and items achieve fit validity and

reliability whereby the mean infit and outfit MNSQ range from 0.98 to 1.00. The fit validity can also be observed from the mean infit and outfit ZSTD ranging from −0.33 and 0.00 (Andrich, 2018; Bond et al., 2020). The reliability values of students and items achieve the acceptable criteria with 0.82 and 0.93 (Fisher, 2007; Taber, 2018). The chi-squared score indicates that the data achieve the normal distribution criteria and globally fits the Rasch model (Engelhard, 2013; Linacre, 2020). The mean measure for students and items is 3.83 and 0.00, confirming that students give a high score (3.83) in evaluating the EMODILPH, whereby the items were scaled with an average logit measure (0.00). The item measure values range from -1.23 to 1.02. We draw the item-person map in Figure 5 to depict the interaction between students and items for responding to the EMODILPH feasibility.

Table 6. The Summary Statistic Based on Students and Item.

	Student	**Item**
N	233	17
Mean		
Measure	3.83	0.00
SD	1.89	0.61
SEM	0.01	0.00
Mean Outfit MNSQ	0.98	0.98
Infit MNSQ	0.99	1.00
Outfit ZSTD	−0.01	−0.33
Infit ZSTD	0.00	−0.18
Strata	2.57	5.28
Reliability	0.82	0.93
Chi-squared (χ2)	4086.9 (df = 4103)	
Probability	0. 5675*	

*Normally distributed, SD = Standard deviation, SEM= Standard error measurement

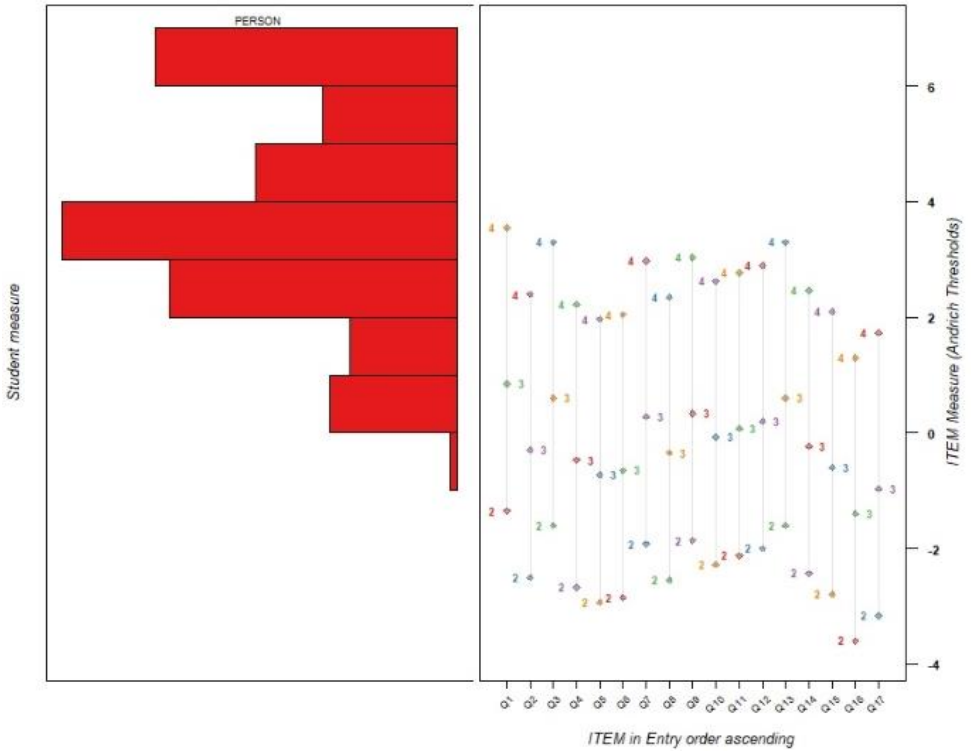

Figure 5. Item/Person Map in Responding to the EMODILPH Feasibility.

To understand if students can distinguish the scale category from strongly disagree (1) to strongly agree (4). The scale category probability analysis was performed in Figure 6. The result indicates that all category probabilities have a clear peak (not overlapping), with the average measure increasing monotonically from 0.92 to 3.85.

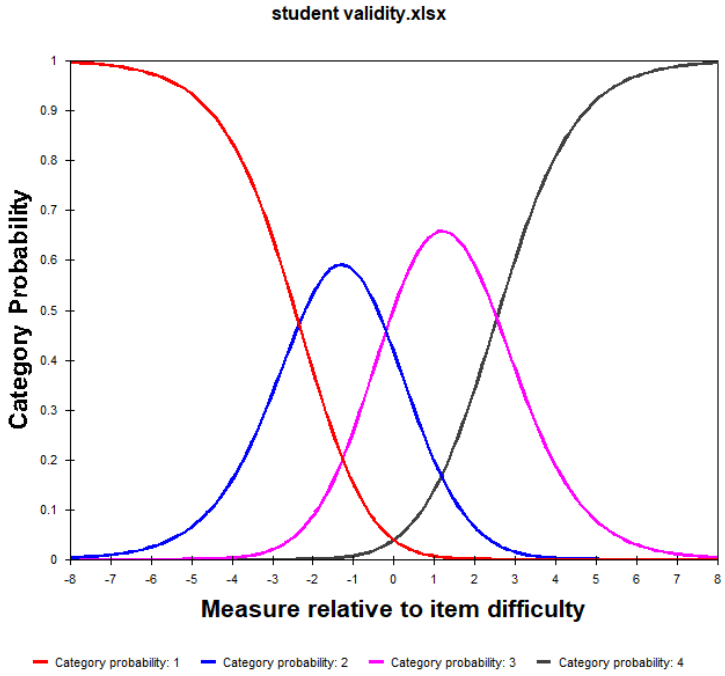

Figure 6. Scale Category Probability based on Student Responses.

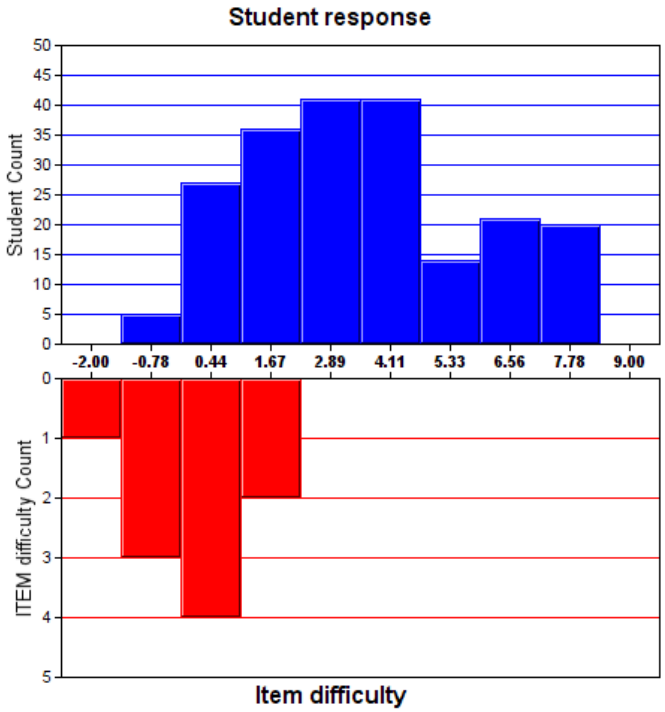

Figure 7. The Bar Chart Comparison between Student Responses and Item Measure.

In this section, we focused on analyzing the person measure estimate to check the effect of the EMODILPH implementation after confirming student and item criteria achieve fit validity criteria ranging from 1.00 to 1.07 for the mean infit and outfit MNSQ and ranging from −0.19 to 0.23 for the mean infit and outfit ZSTD. Figure 7 represents the comparison between student responses and item measures in logits. Figure 8 depicts that most students give higher and more positive responses, with 55% (agree) and 39% (strongly agree) toward all item criteria representing the EMODILPH helpful in understanding hoax information at Islamic higher education institutions after two-month classroom implementation. The individual student measures range from −0.68 (only five students) to 8.27, whereas the item measures range from −1.80 to 1.75.

The independent sample t-test was conducted to compare female and male students after the implementation of EMODILPH. No significant differences were found in the test ($p>.05$) ($t(172)=1.18$, $p=0.241$). The mean measure of female and male students is 3.71 and 3.47, with female students having higher positive responses than male students. Differential Item Functioning (DIF) analysis based on gender was run to check bias items based on gender. Figure 9 indicates that no bias was detected for 10 item criteria with ($p>.05$), confirming that all item criteria are free from the effect of gender bias.

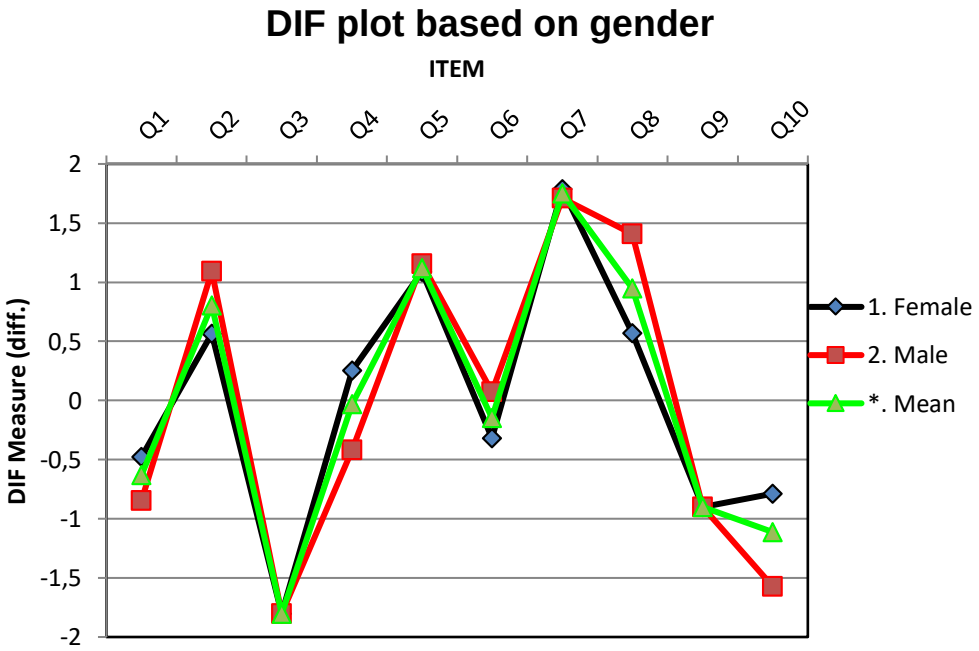

Figure 8. DIF Analysis based on Gender.

The data summary from Digital in Indonesia in Table 1, Table 2, and Table 3 shows that hoax information has a high chance of contaminating students. Previous research results showed that many students are exposed to hoax information in institutions such as Islamic higher education institutions (Alif et al., 2018; Fatkhurahman, 2018; Ahmad et al., 2020). Based on this fact, it is necessary to develop an e-module to educate and strengthen students' digital literacy, especially in countering hoax content.

Recognizing the pressing need to address the proliferation of hoax content,

it is imperative to develop an e-module that focuses on educating and fortifying students' digital literacy, equipping them with the essential skills to discern and combat misinformation in the online environment. Because this module serves as a proactive measure, empowering students with digital literacy and online discernment, it plays a pivotal role in preparing them for the challenges posed by the digital landscape.

The researchers have conducted research and developed an e-module on digital literacy for Islamic higher education students called the EMODILPH. It is essential to be trained in digital literacy skills to counteract negative content and replace it with positive values relevant to educational values(McDougall et al., 2018).

The Rasch measurement is used to perform an objective measurement to assess fit validity and reliability. The Rasch measurement is the individual center statistics that is popular in developing tests, teaching materials (module), and questionnaires in previous research (Kudiya et al., 2018; Soeharto, 2021; Soeharto & Csapó, 2021; Sunjaya et al., 2021). We performed the EMODILPH evaluation according to the validator assessment and student response. The results show that the EMODILPH achieves fit validity and reliability criteria based on Rasch measurement. The bias was not detected in the interaction between rater gender and item criteria when validators evaluated the EMODILPH in phase 1 and phase 2. Therefore, we can confirm that the EMODILPH can be used to improve digital literacy in Islamic higher education institutions.

To confirm the effect of the EMODILPH implementation in the classroom context. We implemented the EMODILPH for teaching and learning activities for two months to educate students about digital literacy pertaining to false information, hoaxes, and hate speech. The result shows that most of the students gave higher and more positive responses, with 55% (agree), 39% (strongly agree) toward all item criteria, 5% (neutral), and 1% (disagree). The previous research by Reyna et al. (2018) found that digital literacy content succeeded in making students have a better experience dealing with hoax information. This study also confirms no significant gender differences between female and male students, and no item criteria bias was detected in the DIF analysis.

Lastly, the researchers want to suggest that stakeholders implement the EMODILPH or plan a curriculum improvement policy by adding digital literacy as part of learning in Islamic higher education institutions. This study can be used as initial knowledge in developing a digital literacy curriculum whereby learning-related digital content can later be integrated into various courses. This integration has proved to increase student insight into various problems and phenomena around them to the ideal concept (Reyna et al., 2018, 2019). By carrying out 21st-century learning, especially in the digital literacy context, students can solve contextual and current problems according to the issues currently being discussed. Solving problems is the ultimate goal of learning in the digital era in the 21st century (Anagun, 2018; Caena & Redecker, 2019; Talmi et al., 2018; van Laar et al., 2018, 2019; Wolff et al., 2015).

CONCLUSION

Students are vulnerable to being exposed to hoax information without digital literacy knowledge in Islamic higher education. Therefore, the EMODILPH has developed with fit validity and reliability criteria achieved using the Rasch measurement approach. The EMODILPH also has a higher

positive score in educating and strengthening students' digital literacy insight to understand false information, hoaxes, and hate speech. No significant gender differences and no item criteria bias were detected in the EMODILPH implementation. This research recommends that the EMODILPH product can be implemented on a larger scale among all students in Indonesia.

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