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Measurement of the Environmental Health Literacy (EHL) Scale Validation on Peatland Context

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Abstract: This research aims to develop an Environmental Health Literacy (EHL) scale in the context of peatlands that is valid and reliable, can cover all dimensions of environmental health in peatlands, and can be applied to different locations worldwide. This research followed a scale development process to develop the measurement by collecting 53 a priori items from each of the 96 respondents. Then, a collection of items was produced through item analysis with experts. The final form (52 items) was to 96 respondents in 18 villages and two sub-districts registered in the Peat Care Village in Riau Province with the EHL scale, which have five dimensions which have been tested using focus group discussions from environmental health practitioners, environmental practitioners and academics. The scale demonstrated a four-factor construct with 50 items by explanatory factor analysis. This construct provides an excellent fit index and reliability score.

Keywords: Environmental health literacy; Peatland; Prevention actions; Scale validation

Introduction

Environmental health is an essential factor in maintaining people's quality of life. Various health problems are often related to poor environmental conditions, such as water, air, and soil pollution (Febria, 2018; Febria et al., 2023; World Health Organization, 2022). This problem impacts physical health, mental health, and social well-being (Binder et al., 2022). According to the latest report from the Lancet Commission on Pollution and Health, environmental pollution contributes to 9 million premature deaths globally yearly (Landrigan et al., 2018). In addition, climate change caused by human activities also significantly impacts public health, such as an increase in heat-related diseases, the spread of disease vectors, and disruption of food security (Watts et al., 2021).

One of the causes of environmental health problems is the destruction of peatlands, especially in Indonesia. Indonesia has the largest peatland in the world, covering around 14.9 hectares or around 7% of the country's total land area (Miettinen et al., 2016; Purnomo et al., 2017). Peatlands are unique ecosystems important in storing carbon, maintaining water balance, and supporting biodiversity (Febria, 2021; Hooijer et al., 2010). However, damage to peatlands due to human activities such as clearing land for plantations, mining, and infrastructure development has caused various environmental and health problems.

Burning peatlands is one of the main factors causing air pollution in Indonesia (Koplitz et al., 2016). In 2015, severe peatland fires in Indonesia resulted in a haze crisis that spread to neighboring countries such as Malaysia and Singapore (Huijnen et al., 2016). The smog contains fine particulates (PM2.5) and dangerous gases such as carbon monoxide (CO) and ozone (O_3), which can trigger health problems such as respiratory and cardiovascular problems and eye irritation (Koplitz et al., 2016; Marlier et al., 2013). In addition, damage to peatlands can also cause a decrease in water quality and increase the risk of flooding, which can trigger the

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spread of water-borne diseases such as diarrhea and skin diseases and threaten natural (Hein et al., 2022; Hein et al., 2022; Kiely et al., 2021; Pulunggono et al., 2022; Sumarga & Hein, 2014).

Environmental health literacy efforts in the context of peatlands in Indonesia are significant in increasing public understanding and awareness about the importance of protecting peatlands and managing them sustainably. This literacy includes understanding the characteristics of peatlands, the impact of peatland damage on the environment and health, and environmentally friendly peatland management strategies (Hein et al., 2022; Sumarga & Hein, 2014). Environmental health literacy refers to an individual's ability to access, understand, assess, and apply information about environmental health in making appropriate decisions to maintain the health of themselves and their environment (Febria et al., 2021; Finn & O'Fallon, 2017; Nutbeam, 2000; Nutbeam, 2015). Good environmental health literacy has been proven to increase pro-environmental behavior, reduce the risk of environmentally related diseases, and improve quality of life (Gray, 2018; Gray, 2018). Additionally, individuals with higher levels of environmental health literacy are more likely to engage in preventative actions such as the use of environmentally friendly products and participation in environmentally focused community activities (Ramirez-Andreotta, 2018; Ramirez-Andreotta et al., 2016).

However, the level of environmental health literacy in the community is still relatively low (Tomsho et al., 2022) and there is a lack of public understanding of environmental health risks and strategies to overcome them (Lindsey et al., 2021; Marsili et al., 2021). This has an impact on increasing the risk of disease, decreasing quality of life, and increasing economic burden, especially for low socio-economic groups and minorities (Manisalidis et al., 2020; Raufman et al., 2020; Rowlands et al., 2015) and also occurs in society. In peatlands (Febria & Saam, 2020). The Indonesian government has implemented various policies and programs to protect and manage peatlands sustainably, such as Government Regulation No. 57/2016 concerning the Protection and Management of Peat Ecosystems (Government of Indonesia, 2016). However, the implementation of this policy still needs to be improved due to a lack of coordination between institutions, limited resources, and tenure problems (Kiely et al., 2021). Therefore, environmental health literacy efforts in the peatland context in Indonesia require collaboration and active participation from various parties, including government, academics, non-governmental organizations, and local communities (Hein et al., 2022; Sumarga & Hein, 2014).

By increasing environmental health literacy, we can prevent further damage to peatlands, mitigate adverse environmental and health impacts, and support sustainable and environmentally friendly peatland management. Research on developing an environmental health literacy model in the context of peatlands in Indonesia is fundamental, considering the low level of public literacy regarding issues of peatland degradation and its impact on the environment and health. Even though the government has implemented various policies and programs to protect peatlands, their implementation still needs improvement, as there is a lack of coordination between institutions, limited resources, and tenure problems. Developing a comprehensive and contextual environmental health literacy model is crucial for increasing understanding and awareness of communities living in Indonesia's peatland areas. This model is expected to integrate main components such as Knowledge about peatland characteristics, the impact of peatland damage, sustainable peatland management practices, and effective communication and education strategies. In developing an environmental health literacy model in the peatland context, an in-depth study of appropriate strategies and approaches is needed according to the local community's social, cultural, and economic context.

Method

The level of environmental health literacy can be measured using various instruments or measuring tools that researchers have developed. One measuring tool that is quite popular is the Environmental Health Literacy Instrument (EHLI) (Dixon et al., 2009), consisting of 32 question items covering four subscales, namely: knowledge about environmental health problems; access and evaluation of information related to environmental health; skills in making decisions related to environmental health issues; and skills in communicating and advocating about environmental health issues. The EHLI uses a Likert scale with scores from 1 (strongly disagree) to 5 (strongly agree), and total scores range from 32 to 160, where higher scores indicate better levels of environmental health literacy.

The following EHL Scale instrument focuses on general health issues, having four scales with a total of 42 items: air Scale - 10 items, three knowledge items, three attitude items, four behavior items; food Scale. Scale) - 9 items, two knowledge items, five attitude items, two behavior items; water Scale - 14 items, four knowledge items, three attitude items, seven behavior items; and general Environmental Health Scale - 9 items three knowledge items, three attitude items, three behavior items (Lichtveld et al., 2019). In the development of the patient-focused EHL Scale consists

of 30 items divided into three dimensions: Interpersonal Dimension (10 items) to measure the relationship and communication between service providers and patients and their families; clinical dimension (9 items) to measure the process of health service delivery, clinical decision making, coordination and continuity of services; and structural Dimensions (11 items) to measure ease of access to facilities, equipment, health information platforms, and procedures for obtaining health services and information (Tong et al., 2023).

The following instrument focuses on well water safety with the Water Environmental Literacy Level Scale (WELLS) with three dimensions (understanding information – 3 items, doing calculations – 1 item and applying information for decision making – 2 items) (Irvin et al., 2019). Each correct answer is given a score of 1. The total score ranges from 0-6, with a higher score indicating better environmental health literacy. WELLS was developed by adapting the Newest Vital Sign (NVS) instrument, which measures general health literacy. This research developed the EHL scale in the context of peatlands in Indonesia with five dimensions, namely competence in environmental health (12 items); knowledge about environmental health (10 items); social awareness and responsible behavior towards environmental health (10 items); mapping social behavior towards environmental health (10 items); and actions of concern and prevention in improving environmental health (10 items). The EHL scale was developed (Febria & Saam, 2020) with five dimensions, which have been tested with focus group discussions from environmental health practitioners, environmental practitioners, and academics.

In developing the EHL scale, this research followed the steps recommended by DeVellis et al. (2021). First, an item pool was created (as explained in detail in the following section), building on existing literature and using open-ended survey methods. Then, a focus group study was conducted to group and refine the items produced by respondents. Then, the research continues by creating the final form of measure that will be used in the analysis, which tests the following: factor structure, reliability, and validity of the new measure.

After the clustering and screening process, the final form was distributed to a new group of respondents (N = 36,330) among residents in 18 villages and two sub-districts in the *Peduli Gambut* Village in Riau Province from the EHL Scale by testing Discriminant validity of new scales. Riau Province was chosen because peatland fires often occur, and security and prevention must be carried out. After validity testing, explanatory factor analysis was used to explore the scale's factor structure. Confirmatory factor analysis (CFA) was used for the remaining scales and the final form of the developed scales. Additionally, the researchers calculated Cronbach's alpha scores for the measure and its dimensions and compared a one-factor structure model and a four-factor structure model for the new measure. At the end of the procedure, the correlation between the scales and their dimensions is assessed.

Result and Discussion

Explanatory Factor Analysis of Environmental Health Literacy Scale in Peatland Context

Analysis factor explainer was used to explore the structure factor scale. First, research this test selected adequate samples for the analysis factor. The results of the Kaiser–Myer–Olkin (KMO) test (0.759) and Bartlett (0.000) show that data are worthy of analysis. Additionally, use the component main and methods of Varimax rotation, as well as count more factors, a big of 1 on the Eigen Value. Items with a load factor lower than 0.5 are eliminated. The form scale finally describes the factor structure. The result is presented in the Table 1.

Table 1. Results of explanatory factor analysis for EHL Scale

FACTOR 1: Competence in Environmental Health			
α = 0.686	Mean: 4.36	VAR (%): 17.765	Factor Loading
Skills (Skills) – Dimensions			
Skills in identifying and assessing the condition of peatland.			0.823
Monitoring and assessment of risk health environment on peatland.			0.795
Evaluation of environmental health risks on peatland			0.685
Designing and following up on environmental health risk factors for continuity peatland			0.780
Experience (Experience) – Dimensions			
Experience in following (implementing) a program or activity related to the management of peatland.			0.537
Experience in facing obstacles and challenges to the program or activities on the peatland			0.523
FACTOR 2: Knowledge of Environmental Health			
α = 0.673	Mean: 4.41	VAR (%): 17.848	Factor Loading
Knowledge and Understanding – Dimensions			
Characteristics peatland			0.675
Impact damage peatland (fires, floods, house gas emissions glass)			0.870
Disease/risk health consequence pollution on peatland (air, water, soil)			0.885

FACTOR 1: Competence in Environmental Health			
α = 0.686	Mean: 4.36	VAR (%): 17.765	Factor Loading
Impact damage peatland on the health of the public			0.760
Mitigation and adaptation strategies for managing risk health environment			0.566
Programs and initiatives management peatland sustainable			0.551
FACTOR 3: Awareness Social and Behavioral Responsible for Environmental Health			
α = 0.671	Mean: 4.42	VAR (%): 18.428	Factor Loading
Awareness and Personal Responsibility – Dimensions			
Realize the importance of guarding sustainable peatland			0.765
Feel responsible answer for participating in effort preservation			0.656
Willing change pattern life to reduce impact damage			0.566
Feel disturbed with behavior destruction peatland			0.663
Action and Participation – Dimensions			
Support management policies and programs peatland			0.871
Willing to disseminate information to other people			0.816
Invite family and friends to participate			0.589
Report action destruction to the party authorized			0.657
Criticize policies /programs that do not support preservation			0.650
Sure, that effort together can prevent damage more carry on			0.667
FACTOR 4: Mapping Behavior Social on Environmental Health			
α = 0.752	Mean: 3.78	VAR (%):16,668	Factor Loading
Behavior Individual – Dimension			
Throw away trash in place			0.788
Using water regularly wise			0.550
Follow the rules and prohibitions			0.770
Participate in activity cleanup/rehabilitation			0.892
Share information with other people			0.771
Rebuke behavior damage			0.653
Use a friendly environment			0.550
Avoid burning peatland			0.743
Engagement and Support – Dimensions			
Follow development issues and policies			0.552
Support initiative or movement preservation			0.661
FACTOR 5: Concern and Preventive Action in Improving Environmental Health			
α = 0.763	Mean: 3.55	VAR (%): 15,430	Factor Loading
Participation and Engagement Active – Dimensions			
Follow development information about the impact damage peatland			0.871
Participate in activity counseling or socialization			0.765
Report action destruction to the party authorized			0.551
Invite family and friends to participate in the preservation			0.768
Involved in a rehabilitation program or restoration of peatland			0.788
Submit critics or suggestions to government-related policy management			0.889
Change Behavior and Lifestyle – Dimensions			
Use a friendly environment			0.541
Avoid burning peatland			0.842
Change pattern life to reduce impact damage			0.651
Support initiative preservation with donated time or funds			0.818
Kaiser–Meyer–Olkin test of sample adequacy: 0.759			
Chi-Square: 1,714,560 df: 90 Significance: 0.000			
Total variance explained: 86.14%			

Reliability Analysis for the Measures of the Study

Analysis results in the factor explainer show that the five-factor structure of scale environmental health literacy is formed. The fifth factor, together with this, explained 60% of the variance in a variable in total. All loading factors are bigger than 0.50, and statistics reliability (Cronbach's alpha score) was calculated for scale and dimensions. Table 1 illustrates Cronbach's alpha score for dimensions scale and scale in a way whole. All dimensions and scales alone show sufficient reliability until they are tall. Reliability Score The dimensions used in the study are also given in Table 2. All score reliability shows high reliability for sizes.

Confirmatory Factor Analysis for the Scales Used in the Study

As seen in Table 3, valid indicators in measure variables were studied. Although thus, model fit varies. The Chi-squared test is very conservative and dependent

on size samples, so we had to consider indexing others. The goodness of Fit Indices (GFI) is a model's suitability level, which is identified by comparing square remaining model predictions with observational data. The higher the GFI, the better the specifications of the model. However, GFI tends to be biased. That value will Estimated too tall if the sample is great and underrated if the sample is small. Likewise, AGFI also relies on the size of the sample used. TLI is one of the indexes unsuitable influenced by size sample. Three variable studies: This has a bad TLI. RMSEA of ≤ 0.06 – 0.08 indicates that the model's goodness of fit is possibly acceptable, and RMSEA > 1.00 indicates that the model requires several repairs.

Table 3 shows the highest / best GFI, AGFI, TLI, and RMSE down to the smallest. Construct Awareness, social and behavioral responsibility (awareness and responsibility personal – dimension 1, action and participation – dimension 2), Competence (skills – dimension 1, experience – dimension 2), knowledge (knowledge and understanding), mapping behavior social (behavioral individual–dimension 1, involvement and support – dimension 2); last is Action of Care and Prevention (participation and involvement active–dimension 1, change behavior and style life – dimension 2).

Table 2. Reliability Statistics for the Scales Used in the Study

Factors	Cronbach Alpha
Competence in Environmental Health	0.686
Knowledge of Environmental Health	0.673
Awareness of Social and Behavioral Responsible for Environmental Health	0.671
Mapping Behavior Social on Environmental Health	0.752
Actions of Concern and Prevention in Improving Environmental Health	0.763

Table 3. The Resume of the Goodness of Fit from CFA

Construct	Indicator	Chi-square (expected to be small)	Probability > 0.05	GFI > 0.90	AGFI > 0.90	TLI > 0.90	RMSEA < 0.08
Competence in Environmental Health	Valid (2)	Good	n/a	Good	n/a	n/a	n/a
Knowledge of Environmental Health	Valid (3)	Good	n/a	Good	n/a	n/a	n/a
Awareness of Social and Behavioral Responsible for Environmental Health	Valid (1)	Good	n/a	Good	n/a	n/a	n/a
Mapping Behavior Social on Environmental Health	Valid (4)	Good	n/a	Good	n/a	n/a	n/a
Actions of Concern and Prevention in Improving Environmental Health	Valid (5)	Good	Good	Good	Good	Good	Good

Competence in Environmental health competency is part of personality. Somebody covers ability innate and acquired abilities from education; training expected to increase performance, somebody. Each society, institution, research, Government, health centers, sanitarians, companies, and other stakeholders possess competencies (Zweigenthal, 2015). The competent public showed the ability to increase the quality of life and prosperity (Matallana et al., 2022). Competencies possessed by institution study form the product produced in an increased health environment in communities on peatland, for example, innovation technology and its development (Thornton et al., 2020). The competence of the Government showed with regulations about literacy and health environment in overcoming problems that exist in the community on the peatland. Competent health centers and sanitarians are indicated as capable of implementing health programs and regulations made by the Government.

Competence in health environment includes identifying issues of health and environment in communities on peatland; analyzing issues of health environment in communities on peatland; evaluating issues of health environment in communities on peatland; take personal decisions as well social to issues health environment in communities on peatland; and utilize its knowledge and information obtained in finish issues health environment in communities on peatland.

Knowledge about the health environment, knowledge is something that results from curiosity through forming reasoning and sensory processes behavior somebody. Knowledge is expected to be owned by the community, Government, community health centers, sanitarians, companies, and other stakeholders so that the quality of life for people on the peatland will Keep increasing in the future (Pineo, 2022). Knowledge can be obtained through education, education, training, and literacy read all over stakeholders so that can be confirmed that all stakeholders already understand the

context from the literacy health environment. Society must have knowledge about a healthy environment to make life prosperous. Research institutions must own knowledge about health programs environment. The Government must know the health environment. Community health centers and sanitarians must know about health programs launched by the Government. Companies must know welfare life and society and how to preserve peatland.

Knowledge about the health environment, specifically peatland and disease-based environment, includes knowing the system ecology and ecosystem peatland, system health human; knowing the social, economic, cultural, religious, educational, and political in communities on the peatland; knowing issues health environment in society and peatland; knowing effort preventive and protective on the environment and quality life society, protection interpreted as something action protection For guard something; knowing the right solution in effort preventive and protective on environment and quality life community; and participation society and action real good community, Government, health centers, sanitarians, companies and other stakeholders in effort preventive and protective on environment and quality life public.

Social consciousness and behavior responsible for the health environment. Social consciousness or awareness of social or awareness society is not separated from awareness because of every man's own connection to social society in handling problems (Brown & Jennings, 2003). At the same time, responsible behavior in the health environment reflects caring and commitment to the health environment (Brown & Savulescu, 2019; Chen et al., 2022). At this stage, this expected public awareness of social and responsible behavior answers the following: To guard a healthy environment, the aim is to increase the quality of life for humans in the future.

Research institutions are aware of and responsible for the importance of environmental health programs. The Government is aware of and responsible for the importance of a healthy environment and preserving peatland. Public health centers own awareness and responsibility about the importance of health programs environment. Sanitarian, an end spear program, has awareness and responsibility about the importance of health programs environment. The company is aware of and responsible for the welfare of society and preserving peatland. After competence and knowledge all over stakeholders are confirmed to increase, the next step is to see enhanced awareness of society and change in behavior. Enhancement of awareness in society and change in behavior are needed to determine the success of a health program environment.

Mapping behavior social to health environment. Mapping social behavior becomes very important. Competence, knowledge, awareness, and responsibility answer the public in a guard health environment. Mapping is done to see if enhancement awareness and change in behavior among the public determine the success of a health program environment (Siyam et al., 2020). The Government, health centers, sanitarians mapping behavior all over society, and companies about the importance of a healthy environment and preserving peatland. Research institutions help the Government, community health centers, and sanitarians map behavior all over society and companies by educating them about the importance of a healthy environment and preserving peatland. If the results mapping shows no improvement or not, there is a change in behavior, the public becomes more OK, and then counseling and education carry on.

Preventive care action (action concern for prevention) is above health environment and context literacy health environment. The concern shown through action prevention is proof of the seriousness of the public for guarding the health environment through action prevention. Government, health centers, sanitarians, communities, and companies take action to prevent the environment and damage peatlands. To realize public life is healthy and peatlands are still awake, the Action phase of Prevention includes repairing damage and disease that occurred in the past; controlling risk damage and disease moment this; and prevent future damage and disease (Febria, 2021). Three-phase action prevention is needed all over the public to guard the healthy environment. From the fifth component, literacy, the health environment needs business Serious from all stakeholders for the health programs environment to be successful and capable increase the quality of life for people on the peatland in the future.

Serious effort all over stakeholders so that the problem health environment is more easily identified, analyzed, and the right solution and more comprehensive and holistic through an approach personally done with delivering the program effectively directly to society; approach done with socialization, workshops, Posyandu and so on; approach economy done education about preservation peatland For well-being society; approach culture done through organizing cultural events with enter element health education program environment; and a religious approach is taken with holding religious events with enter element health education program environment. This matter becomes very important for determining the success of a health program environment. Lastly, the impact of the evaluation is made to ensure environmental protection and the enhancement of quality of life for people on the peatland. After the fifth

stage, the previously so objective end of the literacy model, the health environment achieved protection environment and enhanced quality of life for people on the peatland.

Conclusion

Several significant pieces of literature have recently been developed on the EHL Scale theme. However, improving literacy is still a big challenge. Until now, the EHL Scale has not yet been checked in a systematic way. Previous EHL Scale studies experience a need for more sensitivity segments and weaknesses in outstanding methodology. Study this endeavor is to develop and validate the EHL Scale. The environmental health concepts in the context of peatland, different from studies previously from various contexts. Study this for the First time, explore the EHL Scale for context peatland as specification land owned by Indonesia as lungs of the world. With the use of existing literature, researchgives a definition of EHL and its components. This matter creates a collection of items with the use studies group focus and analysis responses from participants, who form factors operational from the study. Additionally, researchtests the reliability of our scale and compares the suitability of its structure with form more dimensions small and other scales still there is. Findings show good fit and high reliability for EHL scale. Although pattern findings show that the device is valid and feasible, the measurements are reliable. The research will elaborate on the utility-scale. Even though this EHL Scale was done in the context of peatland, researchers are certain that the EHL Scale can adapted for context others. This implication is essential for developing an efficient EHL scale to conserve land-threatened peat existence as the world's lungs in Indonesia. Study This Can made as an instrument for measuring Community awareness, including Government, taker policies, companies, academics, and other interested parties as fortress final lungs of the inner world conserve peatland.

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