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Research Article

Integrating disaster literacy in high school geography: Designing and testing a flood assessment tool

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Abstract: Indonesia's high vulnerability to flood disasters has significant social and educational impacts, especially on secondary school students. This research addresses the need for an effective flood disaster literacy tool by developing a credible and validated test instrument designed for high school geography education. Using the ADDIE model, this research involved the stages of review, creation, implementation, testing, and assessment. The study involved a sample of 30 students from SMA Negeri 1 Beber, Cirebon Regency, who were assessed for their understanding through a specially designed flood disaster literacy test. The results showed a mix of correct and incorrect answers, with notable variations in students' understanding. The test instrument showed high validity and reliability, with a KR-21 coefficient of 0.963, confirming its robustness. Despite a few invalid items, the instrument effectively evaluated key aspects of flood disaster literacy, including knowledge, attitudes and practical skills. The findings highlight strengths and areas for improvement in students' understanding, emphasising the need for targeted educational strategies. This research contributes to improving geography education by integrating disaster literacy and offers a foundation for future curriculum development.

Keywords: disaster literacy; flood management; geography education; high school; test development

1. Introduction

Indonesia, as an archipelago located in the tropics, faces major challenges due to heavy rainfall, which often results in destructive floods (Indrasari et al., 2018). Flooding has not only resulted in material losses, but has also significantly affected aspects of people's social lives and education, including children. Research shows that flood disasters can lower graduation rates, reduce school enrolment, and negatively impact students' cognitive abilities (Nguyen & Minh Pham, 2018). With the high frequency of flood events in Indonesia, this threat is a critical issue that must be addressed, especially in the context of education at the high school level.

Increasingly evident global climate change adds to the urgency of preparing future generations for various disaster scenarios. Disaster literacy, which includes the ability to understand, interpret and respond appropriately to disaster-related information, is becoming an essential component of high school geography education curricula (Brown et al., 2014). Amid the critical development of secondary school students, geography learning is significant in building disaster literacy, offering opportunities to enhance their understanding of the scientific principles underlying natural disasters, such as floods, as well as mitigation strategies and community resilience (Brown et al., 2014; Rivera & Miller, 2008). One key aspect of disaster literacy is the need for measurement tools to assess students' understanding of flood disasters (Çalışkan & Üner, 2021).

Many studies have examined various aspects of disaster literacy among students, highlighting the importance of their understanding of disaster literacy. Kamil et al. (2020) emphasized geography literacy, while Vu et al. (2023) examined predictors of disaster prevention literacy. Lestari & Fauzi (2019) and Bernal & Apdohan (2023) focused on flood knowledge and disaster risk reduction literacy. In addition, research on students' disaster preparedness and awareness was also conducted (Jamali et al., 2022; Meliana et al., 2020; Soon-Beom & Ha-Sung, 2021). Some studies developed instruments such as readiness tests (Sari et al., 2020) and safety awareness scales (Soon-Beom & Ha-Sung, 2021), as well as assessing student readiness related to earthquakes, floods, and environmental literacy (Contreras, 2014; Noviyanti et al., 2014; Syarif et al., 2023).

However, while many studies address disaster literacy in general, few specifically focus on flood disaster literacy. Syarif et al. (2023) examined the context of flood disaster literacy but did not develop an instrument to measure it. Most existing studies emphasize the preparedness aspect of disaster literacy without specifically addressing flood disaster Sari et al. (2020). In addition, existing instruments often do not meet adequate validity and reliability standards (Yari et al., 2022). Many of these instruments are also not fully focused on the context of flooding at the secondary school level (Hodges et al., 2016). This lack of measurement tools hinders the ability to accurately assess flood disaster literacy among secondary school students.

This research aims to fill the gap by developing a valid and reliable flood disaster literacy test instrument. This instrument will comprehensively evaluate students' knowledge, attitudes and skills towards flood disasters. With the right measurement tool, geography learning in senior high school becomes more relevant and applicable, so that students have the knowledge, attitudes, and skills needed to deal with flood disaster risks. Thus, this research not only contributes to efforts to develop a flood disaster literacy test instrument, but also has the potential to improve the quality of geography learning in senior high schools, with the hope that students are better prepared to face the challenges posed by natural disasters.

2. Materials and Methods

2.1 Types of research

This development research design uses the ADDIE model approach Branch (2010) as a framework to develop a flood disaster literacy test instrument among high school students. The ADDIE model, described by Branch, is a widely used framework in educational design and development (Afwan et al., 2020; Aldo et al., 2021; Liesandra & Nurafni, 2022). This research process includes five main stages; (1) analysis; (2) design; (3) development; (4) implementation; and (5) evaluation as prsesented in Figure 1.

The developing stage of the flood disaster literacy test instrument begins with the analysis stage, which includes identifying the domain of phase F geography learning outcomes in the independent curriculum and literature study to examine indicators that are relevant to the existing concept of disaster literacy. A study by Chung & Yen (2016) on disaster prevention literacy in schools in Taiwan included eight indicators into the three main dimensions of disaster literacy: knowledge, attitude and skills. These indicators were used in this study with modifications according to the domain of geography learning outcomes of phase F in the independent curriculum Table 1.

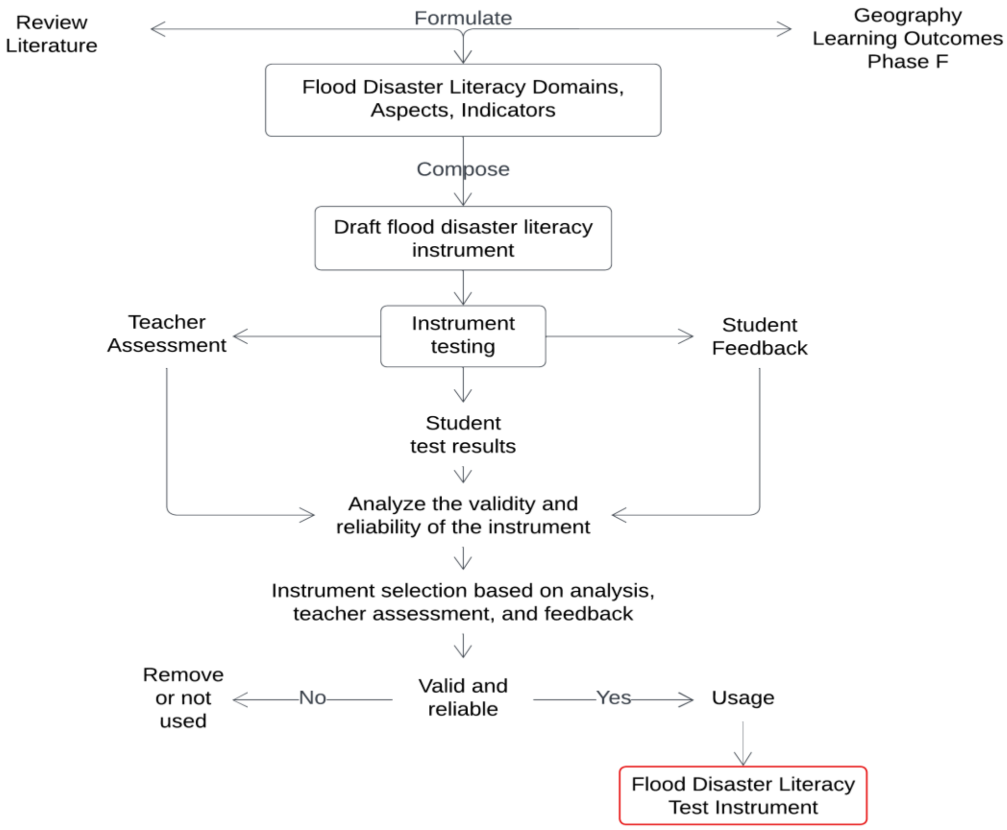

Figure 1. Research procedure

Table 1. Analysis of Flood Disaster Literacy Indicators

Concept Understanding	Process Skills	Domain	Dimension	Aspect	Indicator
At the end of the phase, learners can identify, understand, process and analyse, and evaluate spatially about Disaster and Environment.	By the end of the phase, learners are skilled in reading and writing about Disasters an Environment, and can communicate ideas among themselves, and are able to work in groups or independently with self-produced tools such as maps or learning tools.	Identify	Knowledge	Disaster knowledge	Synthesise and analyse the definition and causes of floods. Explain the impacts and hazards of floods on humans and the environment.
		Analyse		Response knowledge	Create a mitigation action plan based on data analysis.
		Evaluate		Preparedness knowledge	Develop disaster mitigation procedures.
		Processing	Behaviour	Prevention awareness	Proactively synthesise and analyse flood-related information. Evaluate the environment and recognise potential flood hazards.
				Prevention responsibility	Organise disaster prevention promotion and evacuation planning.
		Communicate		Prevention values	Promote the importance of disaster prevention and evacuation plans.
		Write and Read Collaborate	Skill	Preparedness action	Read and interpret flood risk maps. Plan and participate in drills and training.
				Response behaviour	Cooperate in evacuation and shelter placement.

Furthermore, in the design, an initial draft of the test was made according to these indicators in Table 2. In the development stage, the instrument was tested in schools to collect data. The data was then used in the implementation phase to analyse the validity and reliability of the tested instruments. Finally, in evaluation, the instrument was improved based on the analysis and feedback to ensure quality before it was applied more widely.

Table 2. Grid of flood disaster literacy test instruments

Dimension	Aspect	Indicator	Item Number
Knowledge	Disaster knowledge	Synthesise and analyse the definition and causes of floods.	1, 2, 3, 4, 5
		Explain the impacts and hazards of floods on humans and the environment.	6, 7, 8, 9, 10
	Response knowledge	Create a mitigation action plan based on data analysis.	11, 12, 13, 14, 15
	Preparedness knowledge	Develop disaster mitigation procedures.	16, 17, 18, 19, 20
Behaviour	Prevention awareness	Proactively synthesise and analyse flood-related information.	21, 22, 23, 24, 25
		Evaluate the environment and recognise potential flood hazards.	26, 27, 28, 29, 30
	Prevention responsibility	Organise disaster prevention promotion and evacuation planning.	31, 32, 33, 34, 35
	Prevention values	Promote on importance for disaster prevention and evacuation plans.	36, 37, 38, 39, 40
Skill	Preparedness action	Read and interpret flood risk maps.	41, 42, 43, 44, 45
		Plan and participate in drills and training.	46, 47, 48, 49, 50
	Response behaviour	Cooperate in evacuation and shelter placement.	51, 52, 53, 54, 55

2.2 Research Subjects and Objects

This study focused on geography teachers and social studies students in SMA Negeri 1 Beber, Cirebon Regency. The researchers selected students from class XII IPS who had previously learned about disasters in geography class. The researchers found that students who had studied geography were better prepared for a flood disaster literacy test because they were able to connect new information with prior knowledge and had better analytical skills (Rimayanti et al., 2023). The test was conducted on 30 respondents who were selected using purposive random sampling to ensure a representative sample. The researchers specifically chose students who had studied disaster materials to obtain relevant data on flood disaster literacy. Overall, using a sample size of 30 out of 134 students allowed for valid and focused qualitative insights (Boonyaratkalin et al., 2021).

2.3 Data Types and Sources

This study uses quantitative data obtained from a flood disaster literacy test. The test evaluates students' knowledge, attitudes and skills related to flood disasters, with a score of 1 for correct answers and 0 for incorrect answers. The main data source is 30 XII social studies students in SMA Negeri 1 Beber, Cirebon Regency, who were selected through purposive random sampling. The data from this test was used for further analysis.

2.4 Data collection technique

The data collection technique was carried out using a flood disaster literacy test prepared in a Google Form. The test was conducted in class under the supervision of the researcher. The form link was distributed to students, and the test results were automatically collected and recorded in the application for further analysis.

2.5 Data Analysis Techniques Data Analysis Techniques

Data analysis techniques were carried out using SPSS through several stages. First, the quantitative data from the flood disaster literacy test was analysed with descriptive statistics to calculate the mean score, answer distribution, and pattern of test results. Next, validity was tested using Pearson correlation with a 99% confidence level. Reliability was measured using the KR-21 method and interpreted based on the classification in Table 3. Invalid or inconsistent items were removed to ensure only valid and reliable test instruments were used. In addition to using SPSS, the quality of the results was also verified by manual processing using Microsoft Excel, to ensure the accuracy and consistency of the data.

Table 3. Classification of validity and reliability levels based on the Guilford coefficient

Value	Category
0,000 – 0,020	Very low
0,020 – 0,040	Low
0,040 – 0,060	Enough
0,060 – 0,080	High
0,080 – 1,000	Very high

3. Results

3.1 Overview of test results

Descriptive statistics from the flood disaster literacy test administered to 30 high school students showed a mix of correct and incorrect answers. The range of scores varied between 0 and 1, reflecting differences in students' understanding. Some questions, such as Q6 and Q30, received a majority of correct answers, indicating good understanding, while other questions, such as Q7 and Q19, received mostly incorrect answers, signalling a lack of understanding. Standard deviations show consistency in some questions, but wide variation in others. Overall, these results highlight the variation in flood disaster literacy among students, with some areas of strength and others requiring improvement, as presented in Table 4.

Table 4. Descriptive Statistics of Flood Disaster Literacy Instrument Test

Question (Q)	N	Min	Max	Sum	Mean	Std. Deviation
Q9	30	1	1	30	1	0
Q19		0	1	1	0,03	0,183
Q7, Q30		0	1	2, 28	0,07, 0,93	0,254
Q6, Q13, Q55		0	1	27, 27, 24	0,90, 0,90, 0,80	0,305
Q12, Q14, Q17, Q31, Q32, Q36, Q38, Q39, Q43, Q48		0	1	26	0,87	0,346
Q16, Q20, Q21, Q25, Q45, Q46, Q47, Q49, Q50, Q54		0	1	25	0,83	0,379
Q8, Q23, Q24, Q37, Q40, Q53		0	1	24	0,8	0,407
Q2, Q10, Q18, Q24, Q25, Q35, Q44		0	1	23	0,77	0,43
Q26, Q27, Q29, Q34, Q41		0	1	22	0,73	0,45
Q4, Q28		0	1	21	0,7	0,466
Q11, Q15, Q22		0	1	20	0,67	0,479
Q33, Q42		0	1	19	0,63	0,49
Q1, Q44		0	1	17	0,57	0,504
Q3		0	1	15	0,5	0,509
Q52		0	1	28	0,93	0,93

3.2 Instrument Validity and Reliability

Table 5, presents an evaluation of the 55 question items for validity in a research or evaluation. Six items (11 per cent) were highly valid, indicating suitability for this study. Fourteen items (25%) were considered highly valid and met the desired criteria. However, 18 items (33%) were moderately valid, meeting the standard but not as strong as the highly valid items. In addition, 17 items (31%) were found to be invalid due to lack of relevance, clarity, or alignment with the research objectives and were removed for accuracy. Although most items have acceptable validity, there is still room for improvement by addressing or removing invalid items to ensure valid and reliable results.

Table 5. The results of the validity test of the flood disaster literacy test instrument

Status	**Validity**	**Quantity**	**Question Item Number**	**%**
Valid	Very high	6	26, 34, 38, 47, 50, 53	11%
	High	14	4, 10, 12, 16, 18, 23, 31, 35, 37, 39, 40, 44, 51, 54	25%
	Enough	18	11, 13, 15, 17, 20, 21, 22, 24, 25, 28, 29, 33, 41, 43, 45, 46, 49, 55	33%
Invalid		17	1, 2, 3, 5, 6, 7, 8, 9, 14, 19, 27, 30, 32, 36, 42, 48, 52	31%
Question Total		**55**		**100%**

Furthermore, the reliability test using KR-21 is shown in Table 6, as a very high reliability value of 0.963, which indicates a strong reliability of the test instrument.

Table 6. Reliability analysis results

Reliability Statistics		
Cronbach's alpha	Cronbach's alpha Based on Standarized items	N of Item
0.963	0.964	38

Meanwhile, the results of manual verification using Excel showed positive consistency with the SPSS results. The '#DIV/0!' sign in Excel that corresponds to the 'a' sign in SPSS shows the substance of the results that remain consistent. The very high KR-21 reliability coefficient of 0.963 in SPSS in line with the result of 0.962 in Excel shows no significant difference, indicating the analysed test has an excellent level of reliability. Manual verification supports the accuracy of the analysis, reinforcing the reliability of the accurately obtained results.

3.3 Flood Disaster Literacy Test Instrument

After a careful screening process, a flood disaster literacy test instrument was designed to evaluate students' ability to deal with flood disasters. This instrument, presented in Table 7, provides an in-depth assessment of various important aspects of flood disaster literacy. It measures the extent to which students understand the causes and impacts of floods on both people and the environment. In addition, students are assessed on their ability to analyse weather data and formulate mitigation plans. They are also evaluated on their ability to design mitigation procedures, involve the community, and plan for effective evacuation. It not only assesses basic knowledge but also students' response to weather data and their adaptation to climate change. Protection of food safety and prevention of economic losses due to flooding are other aspects that are also considered. Students are tested on their awareness of risk factors such as topography and environmental changes, as well as their responsibility in promoting disaster prevention and evacuation planning. Communication aspects, including students' ability to educate the public and engage the media, are also examined. The instrument also tested students' ability to read flood risk maps, plan mitigation drills, and collaborate in evacuation and shelter placement. With this approach, the test provides a comprehensive picture of students' flood disaster literacy, from basic understanding to practical actions required for disaster preparedness and mitigation.

Table 7. Flood literacy test instrument

Indicator	No (Q)	Test question	Response options				
			A	B	C	D	E
Synthesise and analyse the definition and causes of floods.	1 (Q4)	How does unplanned land use affect flood risk in the watershed?	Increases soil water infiltration.	Accelerates water flow and reduces infiltration.	Becomes an effective water reservoir.	Does not affect risk.	Slows down water flow.
Explain the impacts and hazards of floods on humans and the environment.	2 (Q10)	How does flooding affect agricultural soil quality and food production?	Increase soil fertility.	Reduces fertility and interferes with production.	Reduces soil moisture content.	Increase crop diversity.	Lower risk of plant diseases.
Create a mitigation action plan based on data analysis.	3 (Q11)	Data shows flooding occurs after 200 mm of rainfall in 24 hours. The best mitigation measure?	Build more reservoirs.	Early warning systems and improved drainage.	Cloud seeding technology.	Expand industrial area.	Lower construction standards.
	4 (Q12)	Decreased vegetation cover upstream increases the frequency of flooding downstream. Mitigation measures?	Allow more land conversion.	Reduce agricultural taxes.	Replant vegetation upstream.	Increase mining activity.	Build more roads.

Indicator	No (Q)	Test question	Response options				
			A	B	C	D	E
	5 (Q13)	Flooding often occurs after heavy rains and inadequate drainage. Mitigation action plan?	Neglect drainage improvements.	Increase drainage and water management capacity.	Lower urban planning standards.	Reduce weather monitoring.	Build more industrial estates.
	6 (Q15)	Damage to critical infrastructure during flooding disrupts access to emergency services. Mitigation measures?	Build emergency facilities outside vulnerable areas.	Abandon infrastructure improvements.	Repair and strengthen critical infrastructure.	Reduce emergency services.	Increase public transport costs.
Develop disaster mitigation procedures.	7 (Q16)	First steps in developing flood mitigation procedures?	Build more houses.	Historical and geographical data analysis.	Reduce the frequency of meetings.	Ignore risk data.	Draw up plans without involving experts.
	8 (Q17)	Key elements in flood mitigation procedures for community engagement?	Heavy equipment training.	Emergency communication system and training.	Reduce education budget.	Infrastructure without communication.	Increase development tax.
	9 (Q18)	Prioritisation of resource allocation for flood infrastructure improvements?	Quick project completion.	Damaged vital infrastructure.	Reduce allocation for infrastructure.	Budget based on political interests.	Infrastructure not related to mitigation.
	10 (Q20)	How to handle logistics and relief during and after a flood?	Rely on international aid.	Build relief distribution system and logistics plan.	Abandon logistics planning.	Focus distribution on immediate affected areas.	Reduce storage of reserves.
Proactively synthesise and analyse flood-related information.	11 (Q21)	If weather data shows heavy rainfall and decreased water storage capacity, what is the appropriate course of action?	Reclaim coastal land.	Reduce drainage budget.	Improve drainage and evacuation plans.	Vehicle policy.	Ignore weather data.
	12 (Q22)	Forest closure is associated with increased flooding, which strategy is best?	Reduce logging, start reforestation.	Concrete infrastructure.	Focus on water disposal.	Industrial zones.	Move population.
	13 (Q23)	Floods often occur after droughts, what proactive approach should be taken?	Ignore historical patterns.	Mitigation plan for transition.	Reduce study budget.	Identify areas to ignore.	Reduce climate research.
	14 (Q24)	With climate change affecting rainfall patterns, what adaptation strategies should be adopted?	Ignore change.	Flexible drainage system.	Large infrastructure.	Reduce agriculture.	Focus on transport.
	15 (Q25)	To protect food security and prevent economic losses from flooding, what should be done?	Use more chemical fertilisers.	Divert land to industry.	Flood-proof and irrigation farming methods.	Reduce technology investment.	Postpone flood impact analyses.
Evaluate the environment and recognise potential flood hazards.	16 (Q26)	Important factors for flood risk identification are?	Economic progress.	Land use, vegetation and drainage.	Number of vehicles.	Population size.	Houseplants.
	17 (Q28)	How does topography help in recognising flood hazards?	Slope and elevation.	Number of plants.	Air pollution.	Number of buildings.	Population density.
	18 (Q29)	If coastal areas experience more frequent and intense flooding, what should be done?	Build industrial facilities.	Ignore changes.	Strengthen coastal infrastructure.	Pay less attention to the beach.	Use old data.
Organise disaster prevention promotion and evacuation planning.	19 (Q31)	The first stage in a disaster prevention promotion campaign is?	Focus on raising funds.	Develop promotional materials and target audience.	Social media only.	Disseminate information without community needs.	Single promotion method.
	20 (Q33)	How to ensure disaster prevention promotional materials are effective is?	Ignore feedback.	Develop and test materials.	Standardised materials.	Distribute without community involvement.	Materials from outside agencies.
	21 (Q34)	The step to ensure evacuation plans can be	Plan without simulation.	Periodic training and evaluation.	Training once.	Plans for some communities.	Ignore training feedback.

Indicator	No (Q)	Test question	Response options				
			A	B	C	D	E
		implemented effectively is?					
	22 (Q35)	The best strategy to raise public awareness is?	Campaign during disasters.	Involve community leaders and vary communication.	Digital campaign only.	Materials without community involvement.	One-way promotion.
Promote on importance for disaster prevention and evacuation plans.	23 (Q37)	How to educate the public about effective evacuation plans is?	Ignore training.	Training, simulations, localised materials.	Information via email.	Outdated information.	Info without accessibility.
	24 (Q38)	How to ensure disaster prevention messages are received by different groups is?	Technical language.	Simple language and images.	Materials without customisation.	Info in limited places.	Ignore group needs.
	25 (Q39)	A step to involve the media in evacuation and disaster prevention promotion is?	Ignore media.	Press conferences, articles, media co-operation.	Social media only.	Local promotion without wide media.	Info without media coordination.
	26 (Q40)	How to evaluate the effectiveness of a disaster prevention promotion campaign is?	Ignore feedback.	Collect feedback and analyse.	Online survey only.	Amount of promotional material.	Info without evaluation.
Read and interpret flood risk maps.	27 (Q41)	If a flood risk map shows red areas in coastal areas and river valleys, what is the interpretation?	Low flood risk.	High flood risk.	Region never floods.	Potential for seasonal flooding.	Safe for development.
	28 (Q43)	If flood risk maps indicate a change in pattern from year to year, what should be done?	Use old maps.	Analyse causes and update strategy.	Use data without analysis.	Focus on the latest maps.	Stick with the old plan.
	29 (Q44)	What is the meaning of areas that are not covered by flood risk information on the map?	Safe from flooding.	Data not yet available.	High flood risk.	Inaccurate maps.	Not important.
	30 (Q45)	How to plan evacuation for high risk zones on the map?	Ignore the map.	Use maps for evacuation plan.	Build new zone.	Reduce evacuation priority.	Use the old map.
Plan and participate in drills and training.	31 (Q46)	What are the first steps in planning a disaster mitigation exercise?	Start training straight away.	Determine needs and design scenarios.	Use old practice.	Make plans without stakeholders.	Focus on individual exercises.
	32 (Q47)	What is your main role as a participant in a disaster mitigation exercise?	Ignore instructions.	Follow instructions and give feedback.	Just watching.	Ignore procedures.	Participate if it's fun.
	33 (Q49)	How to ensure disaster mitigation training is effective and relevant?	Use standard materials.	Customise materials and conduct practice.	Focus on theory.	Ignore special needs.	Use old materials.
	34 (Q50)	What to do if deficiencies in mitigation procedures are found during the exercise?	Ignore problems.	Refine procedures and integrate improvements.	Keep a record of shortcomings.	Change procedures without evaluation.	Ignore feedback.
Cooperate in evacuation and shelter placement.	35 (Q51)	What are the first steps in working together for disaster evacuation?	Ignore planning.	Plan and involve stakeholders.	Use the old plan.	Focus on evacuation centres.	Ignore training.
	36 (Q53)	What should be considered when placing evacuation shelters after an evacuation?	Ignore basic needs.	Provide basic needs and security.	Without basic facilities.	Ignore security.	Easy access location.
	37 (Q54)	How to involve the community in evacuation and shelter placement?	Ignore community involvement.	Organise meetings and engage volunteers.	Only involve outsiders.	Focus on team training.	Ignore communication.
	38 (Q55)	What are the steps to evaluate the effectiveness of evacuation and shelter after a disaster?	Ignore evaluation.	Collect feedback and improve.	Evaluate the team's report.	Evaluate from one source.	Focus on administrative.

4. Discussion

This research focuses on developing and testing a flood disaster literacy test instrument for senior high school students. The instrument development process included five stages: analysis, design, development, implementation and evaluation. At the analysis stage, the use of disaster literacy indicators from Chung & Yen (2016) research provided a strong theoretical framework, but there were challenges in adjusting the indicators to be relevant to the local context. Adjustments were made by referring to the Phase F Geography Learning Outcomes in the Merdeka Curriculum, which helped to ensure the instrument was appropriate for learning conditions in Indonesia. At the design stage, collaboration with geography teachers was invaluable. Collaboration between teachers and researchers is essential to ensure the instrument is not only theoretical, but also practical and applicable in the classroom (Can & Yuksel, 2012; Holstein et al., 2019; Kennedy-Clark et al., 2017). Teachers provided practical perspectives on the challenges faced by students, but time constraints prevented their full engagement.

Next, at the development stage, the instrument is tested in schools to collect data. Schools serve as an important venue for testing and refining the instrument, allowing researchers to assess its practical applicability and effectiveness (Laurens & Laamena, 2020). However, challenges arise in student conditioning and time management. Creating a comfortable and non-stressful atmosphere for students is essential to enable them to provide honest and accurate answers (Jones et al., 2021; Wake et al., 2024). When students feel threatened or under undue pressure, it can disrupt the testing process and undermine the validity of the data collected (Coutts et al., 2011; Dahbi, 2015; Naude et al., 2014). Therefore, careful planning and working closely with the geography teacher and school management was done to organize the time and ensure a more relaxed and engaged atmosphere for the students.

The implementation phase is conducted with direct supervision to ensure controlled test conditions. This supervision is important to avoid bias, but maintaining objectivity is a challenge that arises in this process. Objectivity is a fundamental principle in academic research, as it ensures the validity and reliability of findings (Pollock, 2020). Researchers must be aware of the potential for their own biases and prejudices to influence the research process, as subjectivity can undermine the credibility of findings (Branaghan et al., 2021; Labib et al., 2021; Moskovicz, 2019). As such, it is important to maintain a balance between supervision and creating a supportive environment.

Finally, in the evaluation stage, empirical validation was conducted through test data analysis. The results show that the instrument has promising reliability, with a KR-21 coefficient value of 0.963 which is consistent between SPSS and Excel. The consistency of the analysis results between SPSS and Excel supports previous research that shows no significant difference between the two analytical tools for small sample sizes, thus strengthening the reliability of the instrument (Purwanto et al., 2020). The assessment instruments developed were empirically proven to be valid and highly reliable, and feasible to use (Mulyana & Desnita, 2023). The empirical validation process is essential to ensure that educational assessments can effectively capture students' understanding, attitudes and skills (Kiessling et al., 2017; Xu et al., 2023). Although there were 17 items declared invalid, further adjustments are necessary. Ensuring the validity of student assessments is a critical component in upholding academic integrity and fairness in educational institutions (Hastings et al., 2012). One common issue that arises is invalid responses, which can be caused by a variety of factors, such as unclear questions or difficulty in understanding the context of the assessment (Edwards, 2019).

In this case, discussions with the geography teacher were conducted to determine the necessary corrective measures. Input from geography teachers was used as a basis, so these 17 items were deleted because the remaining 38 items already represented the indicators as shown in Table 5. This classification is based on the validity and reliability coefficients established by Guilford (1956), which were also used in previous studies by

Sugiharni & Setiasih (2018) and Divayana et al. (2019). The use of this classification makes it possible to clearly evaluate the quality of each item in the instrument. Through this approach, the instrument provides a clear picture of flood disaster literacy among students, while supporting efforts to improve such literacy. Further analysis with testing in a wider population is essential in future research to ensure better validity and reliability as well as the relevance of this instrument in a more diverse context.

5. Conclusion

This study successfully developed and tested a valid and reliable flood disaster literacy test instrument for senior high school students. The instrument showed a high reliability coefficient KR-21, signifying strong consistency in the measurement of disaster literacy. Although most items were valid, some needed to be adjusted to improve overall validity. Test results showed variations in students' understanding of flood disaster literacy, indicating the need for a more focused teaching approach on aspects that are not fully understood. Overall, the instrument is a useful tool for evaluating and improving flood disaster literacy among students and provides a solid basis for developing more effective curricula and learning materials. This research makes an important contribution to integrating disaster literacy in geography education and can guide further efforts to prepare students for future disaster challenges.

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