INVESTIGATING THE IMPACT OF STORY MAPS IN DEVELOPING STUDENTS' SPATIAL ABILITIES ON HYDROMETEOROLOGICAL DISASTERS FOR E-PORTFOLIO ASSIGNMENTS

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Abstract

The government of Indonesia has issued a self-study curriculum for colleges based on the principles of the Fourth Industrial Revolution in the digital age. The new rule recommends an online portfolio as a tool for measuring the success of educational programs. Students at Syiah Kuala University (USK) utilized Story Map electronic portfolios to hone their spatial skills in the General Compulsory Course on Disaster and Environmental Knowledge. This study aims to improve upon the concept of the Story Map and use it as a component of students' electronic portfolios in order to evaluate their capacity to plan for and respond to hydrometeorological disasters. The concept of the Story Map is created as a digital portfolio project, beginning with secondary materials including literature studies, raster and vector data from ESRI and Mapbox. The ability to perceive spatial relationships is measured by collecting primary data in the form of a questionnaire. The findings of a F (Simultaneous) statistical test for testing hypotheses are as follows: With Fcount > Ftable = 228.338 > 3.34, we get a value of F = 0.000<0.05. Both e-portfolios and narrative maps impact students' spatial abilities in relation to hydrometeorological disasters, as shown by the F test scores. T-tests for multiple variables Students' spatial intelligence is affected by the narrative map (X1) in the proportion of 4.746 > Tcount > Ttable. 2.048. The e-portfolio variable (X2) has a positive effect on students' spatial abilities (Y), with a value of Tcount > Ttable, or 14.063 > 2.048..

Keywords : *Spatial ability, Story Map, GIS, e-portfolio, Hydrometeorological Disaster*

1. INTRODUCTION

The Indonesian government has released free curriculums (Kurikulum Merdeka) for universities. Despite the spread of Covivirus H19, it is aiding online education. E-learning and e-portfolios are two innovations of the 4.0 Digital Industrial Revolution that have found their way into the classroom. Since 2015, students at Syiah Kuala University (USK) have been required to take a General Compulsory Course in Disaster and Environmental Knowledge. The USK Faculty of Forestry (FHut) is one of the departments where students may take classes in Disaster and Environmental Knowledge Subjects taught by professors. Hydrometeorological catastrophe risk mapping is a skill that students are required to learn. Catastrophic hydrological and meteorological events. This research will only focus on the global phenomenon of flooding because of space constraints (Basri, H.et al., 2022). The flood risk map provides visual data and analysis. Story Maps are a great tool for students to use in their e-portfolios since they allow them to better visualise and assess their knowledge of hydrometeorological catastrophes.

Lukitasari et al. (2018) cite Klenowski et al.'s (2006) claim that e-portfolios may serve as a tool for reflection on learning outcomes at a particular period. E-portfolios are used to evaluate the grasp of course material by Spatial students. Story Map, as described by Farida et al. (2018), is a spatial approach to explore maps and nonspatial data in cutting-edge online apps. E-portfolio story maps may help students develop the spatial intelligence needed to interpret and act upon maps depicting the potential impact of hydrometeorological disasters. Exploring how to improve students' spatial skills, the Faculty of Forestry at Syiah Kuala University developed the idea of a

International Journal of Social Science, Educational, Economics, Agriculture Research, and Technology (IJSET)
E-ISSN: **2827-766X | WWW.IJSET.ORG**

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Story Map for an e-portfolio project on hydrometeorological catastrophes. The purpose of this research is to provide a detailed account of the process of creating a narrative map for use in catastrophe hydrometeorology e-Portfolios. Students in the Forestry Department at Syiah Kuala University will have their spatial skills and reactions to their narrative maps for eportfolios on hydrometeorological catastrophes studied in this study.

2. IMPLEMENTATION METHOD
Located in Tungku Hasan Krueng Kalee st. 4, Kopelma Division, Banda Aceh District, Aceh Province, this research facility was a part of Syiah Kuala University's Forestry Department. The geographical coordinates of the observation are 534°10.26′ N and 95°22′12.84′ E.

1.   Preparing Data
Learning resources on hydrometeorological catastrophes were collected by researchers. The following are examples of Story Map lessons designed to complement e-Portfolios:

- The data of the Geographic Information System (GIS) in hydrometeorological disasters through the execution of the main activities, which are as follows: (1) Input hydrometeorological data, such as rainy season, dry season, monthly and annual rainfall, geological data, and slope, (2) data processing by carrying out data calculation and aggregation, and (3) data information as output in the form of maps related to land evaluation (Hermon, 2012:34).
- Learning to Ask the Right Questions Perspective-taking prowess; the capacity to examine, mould, alter, and manipulate the symbolic content of a visual object. Smith, 1992 makes the following classifications of spatial competence in reading and utilising maps: Place, (1); Facilities, (2). Distance (3), Compass (4), and Degree of Relief (5). The six, atlas, globe. (7) An aerial view. Expeditions, and number 8. Positioning on a Map
- The World Organisation for Animal Health Disaster Management Cycle, 2016, classifies catastrophes into four stages: preparation, emergency response, assessment, and recovery.
- Traits shared by all natural catastrophes The seven major features for hazard assessment are as follows, as categorised by (Westen et al., 2011): (1) Triggering variables, (2) Location, (3) Duration, (4) Onset time, (5) Magnitude/Intensity, (6) Frequency, (7) Secondary events. (Khairana, 2013) adds that empirical and historical predictions of flood danger may be used to assess a region's susceptibility to flooding and inform preparation measures.
- Catastrophic rain and wind: When it comes to hydrometeorological catastrophes, Indonesia is particularly prone to floods (Marfai et al., 2015). The following categories of flooding occurrences must apply, as defined by Poljanek, K et al., 2019: Riverine flooding, stream flooding, flash flooding, infrastructure collapse, dam failure, and coastal flooding are the five most common types of floods. Research papers, articles, and inquiries on spatial skills.

Questionnaire For further information on narrative maps, check out Cope, M. P. et al. Prior to receiving the hydrometeorological catastrophe content through a Story Map for e-Portfolio work, students were given pre-test questions to gauge their existing spatial ability. Students are given a post-test to evaluate their spatial skills after being instructed on how to create Story Maps and electronic portfolios.

2.   **Data Collection**
Primary and secondary sources were used to compile the data for this research. Most information is gleaned via conversations with respondents, Survey responses from 31 students in Indonesia's Banda Aceh province were used as the primary source of information in a research on forest management (Nadendra et al., 2021).

Figure 1. Research Following Chart
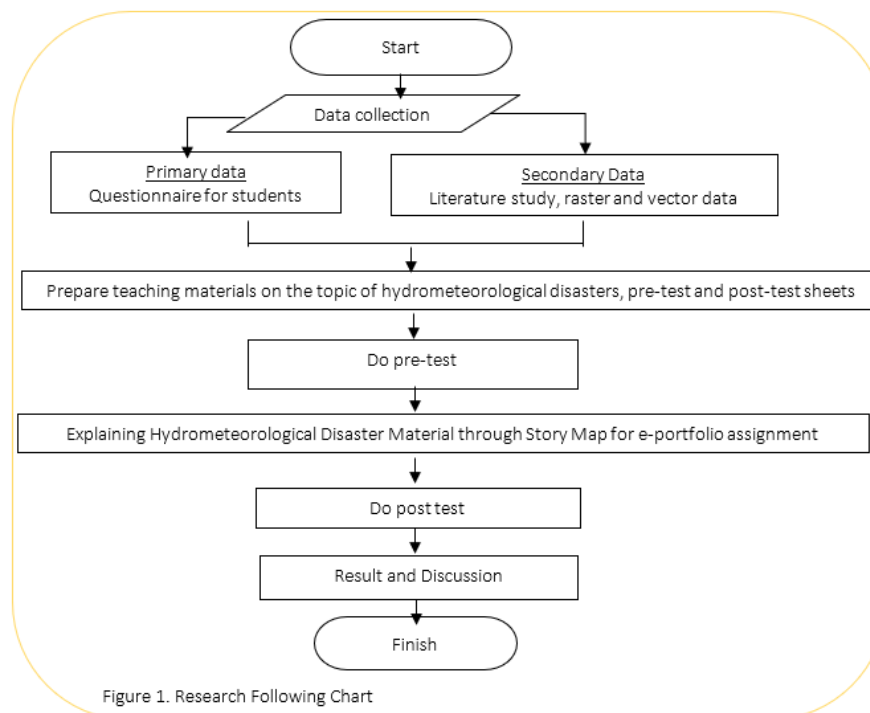
Secondary information from other sources, such agency statistics and literature reviews, is also necessary for this investigation (Daas, P. et al., 2012). Literature and agency research listed in Table 1 provide the necessary information.

Table 1. The Data needed and their sources

No.	Data and Information	Data Source	Year
1	Satellite image data	ESRI, Map Box, Google Earth, BNBP dan Knight Map	2021-2022
2	Coordinate data of Point of Interest (POI) points, river, and road networks	Map Box, Open Street Map dan Google Map	2022
3	Contour	Tanahair	2022
4	Narrative Story Map	Literature review	2021-2022

3.   Data Management

ArcMap 10.8 is required to do the necessary data processing for creating specialised maps, including performing or fixing digitisation on a raster. Data from various sources, such as Table 1, are superimposed after digitization for use in the Story Map's narrative.

4.   Making Concept Story Map and e-portfolio

ESRI and Knight Lab's GIS inspired the idea of a Story Map's creation procedure. Story Map is a web-based programme that allows scientists, educators, and others to add text, photographs, and multimedia information to interactive maps, as stated by Cope et al., (2018). Story Map is a dynamic and educational take on the traditional map presentation. Users are given storyboard templates from which they may choose meteorological disaster-related narrative maps to put in their eportfolios.

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E-ISSN: **2827-766X | WWW.IJSET.ORG**

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Electronic media such as video, audio, websites, papers, and so on may be compiled into e-portfolios for both individual and collaborative projects (Jones, B et al., 2017). The use of a Story Map to geographically show information on hydrometeorological disasters is a good illustration of the use of e-portfolios.

5.   Data Analysis

SPSS 20 for Windows was used to calculate Cronbach's Alpha for measuring internal consistency and Pearson's correlation for measuring external validity (Fristiani, 2021). The Story Map (X1) and the e-portfolio (X2) surveys' data were analysed to learn more about the factors that affect spatial intelligence (Variable Y). Multiple regression parameter estimates were used in this study, hence a standard hypothesis test was performed. According to Aksa, F. I. et al. in 2020, the first step in doing multiple linear regression analysis is to conduct a series of standard assumption tests, including those for normality, multicollinearity, and heteroscedasticity. The F-test and the t-test are two examples of frequently used parametric tests for evaluating hypotheses. If the collected data does not fit the normal distribution, however, a non-parametric test called the Wilcoxon test is used.

3. RESULTS AND DISCUSSION

The study's findings and their interpretations should be summarised briefly and presented in the results section. The author may also choose to include subheadings and subparagraphs.

E-portfolio design

To evaluate students' spatial skills, the e-portfolio idea includes both pre- and post-test activities focused on hydrometeorological catastrophes. As can be seen in Figure 2, an online portfolio may be assembled by visiting the URL https://neo Hijauxnetizen.blogspot.com/. Here are the measures required to create an electronic portfolio:

- You should gather all the information you can find on hydrometeorological disasters, such as a definition, a list of the various types of flood disasters and maps showing their locations, a description of flood disaster management cycles, and a list of the characteristics of natural disasters, and include it in your e-portfolio.
- Create a series of questions to be taken before and after exposure to flood risk maps to assess students' spatial literacy.
- Click the "Sing Up" button in the top right corner of the main page at https://neo Hijauxnetizen.blogspot.com/ to sign up for the site.
- After logging in, go to the dashboard or main page and choose the "New Page" or "New Page" option to start a brand new page.
- Give the page a fitting name for the content that will be added to it. Describe the many forms of media (books, journals, articles, photos, videos, and a Story Map) that will be used to educate the reader on the topic of hydrometeorological disasters.
- Utilise pre- and post-tests in an ePortfolio to evaluate a student's spatial reasoning skills.
- Click the "Publish" button at the top of the screen to make your e-portfolio live for the world to see.

Making Story Maps

Knight Lab and ESRI are two places where you may make your own Story Map. Story Map is an application that uses maps and other material to create and show interactive visual tales. Using story maps to educate kids about the dangers of hydrometeorological events is a great way to boost their spatial reasoning skills. The narrative map (shown in Figure 2) is one of the components of the eportfolio. The narrative map is made using the following steps:

- You should check out Knight Lab and ESRI online.
- Please register for an account, or sign in if you have one already.
- Decide on a shop map display theme or colour scheme.
- Give the narrative map a name and some context.

- Complement the discussion of hydrometeorological catastrophes with appropriate maps and locations.
- Narrate the narrative while using multimedia elements and map pins.
- Include a hypertext markup language (HTML) link to the website https://neo Hijauxnetizen.blogspot.com/ to expand access to educational resources on hydrometeorological catastrophes.
- To make changes, go to the page in question and insert the html link narrative map.
- You should publish the revised blog post after saving your modifications.

Students may enhance their awareness of hydrometeorological catastrophes and their spatial skills by creating story maps and embedding them into blog posts that can be used as e-portfolios. Students may engage in meaningful discussion and have a great time studying using story maps.
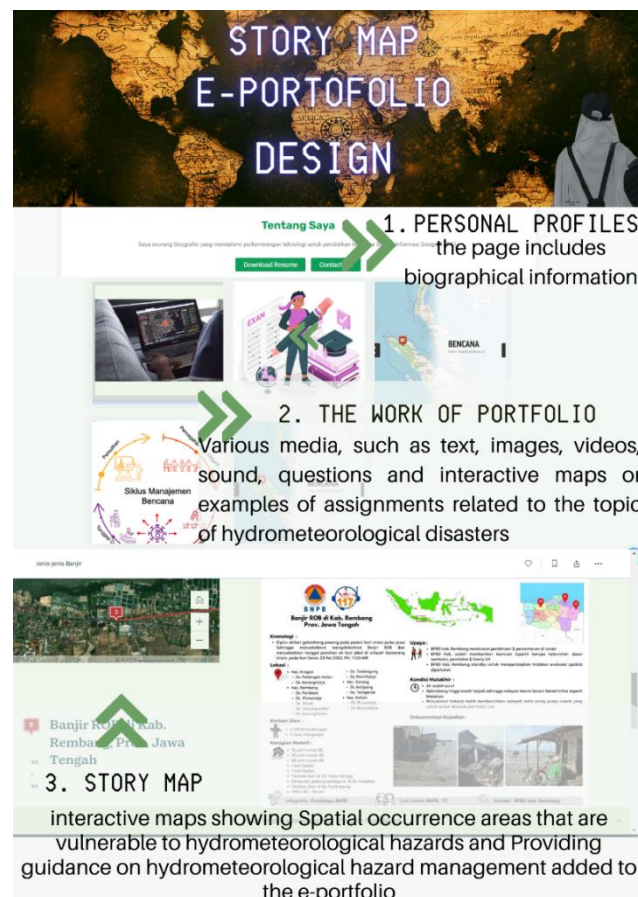

Figure 2. E-portfolio and Story Map desig

1. Static Prerequisite Analysis Test

All of the conditions for testing this hypothesis and verifying its outcomes using empirical evidence must be met. The statistical evaluation is divided into two phases: In order to determine whether our data is normally or uniformly distributed, we first use a parametric statistical test. (2) A non-parametric test is one that does not presume normality or homogeneity in its data. The results of the spatial ability test were analysed before and after the intervention using the Shapiro-Wilk test for normality and the Levene test for homogeneity. If there are less than 2,000 people in your sample, you may apply the Shapiro-Wilk test (Ariffin, M. M., et al., 2014). The experimental group used the Shapiro Wilk normality test, and the cutoff for significance was set at 5% (Baccin, C. R. A. et al., 2020). Use the t-test's option if the data is deemed normal and homogeneous. The non-parameter (Wilcoxon) test, on the other hand, should be used when the data does not follow a normal or homogeneous distribution.

International Journal of Social Science, Educational, Economics, Agriculture Research, and Technology (IJSET)
E-ISSN: **2827-766X | WWW.IJSET.ORG**

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a. Normality Test

Data from both the pre- and post-test were normalised to ensure comparability. If the probability is larger than 0.05, then a normal distribution is assumed to exist. To ensure a normally distributed sample, we run the Shapiro-Wilk test on 31 data points. According to Shapiro and Wilk (1965), cited in Razali, N. M. et al. (2011), the Shapiro-Wilk test was statistically significant with less than 50 samples. Table 2 displays the results of a Shapiro-Wilk test used to standardise the data.

Table 2. Kolmogorov-Smirnov and Shapiro-Wilk for Normality Test Results

	Tests of Normality					
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	.147	31	.084	.966	31	.424
postest	.168	31	.027	.910	31	.013

a. Correction of Lilliefors Significance

Using the Shapiro-Wilk test for normality, we find that the data are not normally distributed before treatment (W(31) = 0.966, p = 0.424) or after treatment (W(31) = 0.910, p = 0.013). Contradictory results were found in the data obtained both before and after the experiment was conducted. Each variable's p value was 0.424 > 0.05 on the pretest, but only 0.013 0.05 on the posttest. Since H0 was obtained, this result demonstrated that even if the data before the test were normally distributed, the data after the test are not. If your data set contains at least one outlier, you should use the Wilcoxon Test, also known as the Non-Parametric Paired Samples Test.

3.2 Homogeneity Test

Homogeneity tests examine the data to see whether the variables show any significant differences across a set of categories. The Levene test in SPSS 20 (Kazmi, R., 2016) is used to examine homogeneity. The homogeneity assumption may be wrong if the p-value is more than 0.05. Table 3 allows you to examine the variance and see whether it is consistent.

Table 3. Results of the Variance Homogeneity Test

Test of Homogeneity of Variances				
	Levene Statistic	df1	df2	Sig.
Based on the mean	**6.582**	1	60	.013
Based on the Median	5.624	1	60	.021
Based on the Median and with improved df	5.624	1	47.253	.022
Based on Set Mean.	6.360	1	60	.014

Table 3 shows that the pretest-posttest group's significant value based on means is 0.013 0.05. As a result, pre-test and post-test data variances are not evenly distributed.

2. Wilcoxon test

Hypothesis testing was conducted using the Wilcoxon non-parametric test since pre- and post-test data on spatial ability did not follow a normal distribution (Windi, W.A. et al., 2021). If

the p-value is less than 0.05, it is reasonable to conclude that the individual's post-test scores are higher than their pre-test scores, rejecting the null hypothesis (H0) (Rudianto D. et al., 2020). Table 4 displays the results of a test that allows for the study of differences between statistically matched data by giving a positive and negative rank sign.

Table 4. The Wilcoxon test outputs

Rankings		N	Mean Rank	Sum of Ranks
	Negative Position	0[a]	.00	.00
Post-test − pre-test	Positive Position	31[b]	16.00	496.00
	Tie	0[c]		
	The Sum	31		

information [a] is post-test < pre-test, [b] is post-test > pre-test, and [c] is post-test = pretest

Test Statistics[a]	
	Pos-test − pre-test
Z	-4.879[b]
Asymp. Sig. (2-tailed)	.000

information: a. The Wilcoxon Signed Ranks Test and b. Negative ranks.

The rationale for why the Wilcoxon test yielded negative results There is no position or difference (negative) between the results when there is no drop (decline) between the pre- and post-test data. Each correct answer or improvement (positive) between the pre- and post-tests is worth 16 of a possible 496 points. This indicates that, on average, these 31 persons improved their performance on the exam after receiving the intervention. When the value of ties is zero, no two participants enter or leave the test with the same score. Table 4 displays the "test statistics" from a Wilcoxon test. There are statistically significant differences (asymp. sig (2-tailed) = 0.000 0.05) in students' performance on pre- and post-tests of spatial ability. Since post-therapy results improved for everyone, the position value is 16.

4. The Classical Assumption Test
4.1 Normality Test
- Data Normality Test Results Graphically

     Examining a histogram graphic that contrasts the actual data with a distribution assuming a normal distribution is one of the simplest techniques to determine whether the residuals follow a normal distribution. It is important to use care while using the histogram, particularly with small sample sizes. Since it is based on a comparison to the normal distribution, the normal probability plot is more trustworthy than the cumulative distribution plot. Abnormal data is defined as information that deviates significantly from the mean or median (Sarjono et al., 2011). P-P plot tests (also known as probability plots or percent plots) and histograms were used to figure out whether the data from the survey were normally distributed. According to Ghasemi A. et al. (2012), visual normality tests may be performed using frequency distributions (histograms) and P-P plots (probability plots). To determine whether the two datasets are reliant on one another, the P-P plot test (Das K. R. et al., 2016) may be used. Normality is defined as the presence of a diagonal component in the data (Mishra P. et al., 2019). The results of the normality test are shown in the following p-p plots:
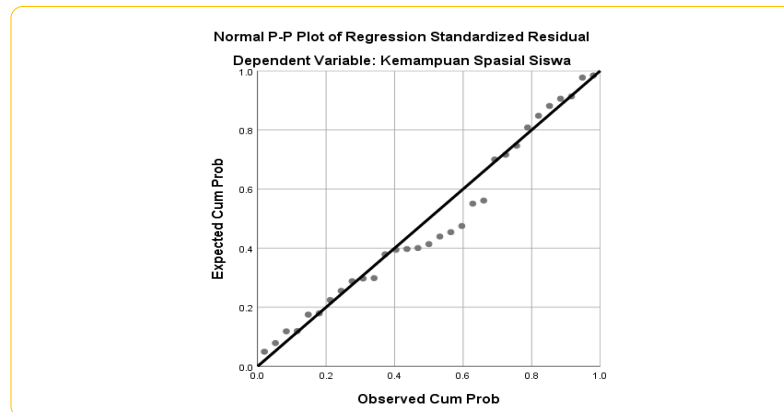
International Journal of Social Science, Educational, Economics, Agriculture Research, and Technology (IJSET)
E-ISSN: **2827-766X | WWW.IJSET.ORG**

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Figure 3. Data Normality Test Results Graphically

We say that the data is normally distributed if the points fall equally along the diagonal line and non-normally distributed if they are tilted to one side of the line or deviate greatly from it. A standard plot graph has points spread out uniformly across the diagonal. Because of the normality assumption, the regression model is beneficial, as shown by the two figures (Sarjono et al., 2011).

• Normality Test Results Displayed on a Histogram
If the first graph shows a bell-shaped distribution of the data, then the histogram is deemed normal and not skewed to the left or right. Data is not normally distributed if its distribution curve deviates from the bell shape, as shown in the second graph (Das K. R. et al., 2016).
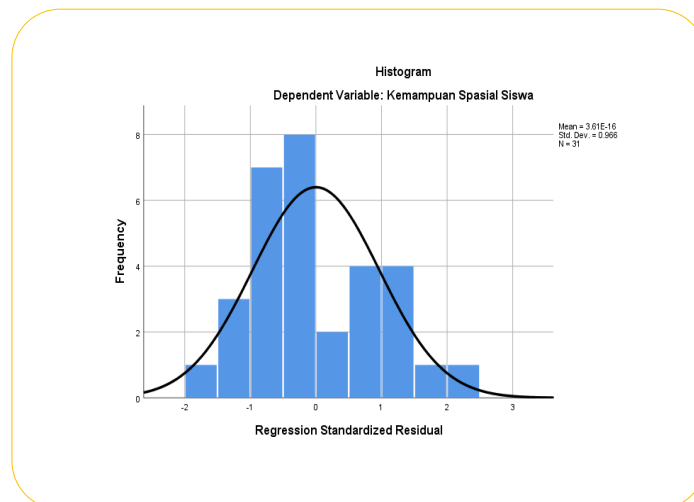

Figure 4. Histogram Data Normality

Figure 4. The histogram shows that the distribution is normally distributed since the chart has a bell shape and is not skewed to the right or left.

• Results of statistical normality tests
In the event of a reading mistake, the findings of the normalcy test may be shown graphically, or they can be analysed statistically. The Kolmogorov-Smirnov normalcy test is computed as follows:

Table 5: Results of Statistical Normality Tests

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		31
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	1.40069330
Most Extreme Differences	Absolute	.075
	Positive	.036
	Negative	-.075
Test Statistic		.075
Asymp. Sig. (2-tailed)		.200[c,d]

Information [a]. Test distribution is Normal, [b]. Calculated from data, [c]. Lilliefors Significance Correction, dan [d]. This is a lower bound of the true significance.

Table 5 shows that the Kolmogorov-Smirnov test indicates that all of the variables have sig values. Responses to the questionnaire follow a normal distribution with a standard deviation of exactly $0.200 > 0.05$.

4.2 Test for Multicollinearity

A high degree of correlation between variables suggests the possibility of multicollinearity, therefore tests were run to determine how the independent variables were related to one another (Sarjono et al., 2011). Indicators of multicollinearity include high levels of correlation among independent variables and large values of the Tolerance and Variance Inflation Factor (VIF). A VIF greater than 10 is indicative of multicollinearity (Sanusi & Anwar, 2011). Multicollinearity does not arise if the tolerance is more than 0.1 and the VIF is less than 10 (Aksa F. I. et al., 2020).

Table 6. Results of Multicollinearity Tests

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.755	.572		8.313	.000		
	Story Map	.210	.044	.250	4.746	.000	.654	1.528
	e-portofolio	.553	.039	.742	14.063	.000	.654	1.528

[a]. Dependent Variable: Spatial Ability

According to the data table provided before, the VIF for both Story Map and e-portfolio is 1.528. The following data does not show multicollinearity since it is less than the maximum VIF value of 1.528 10. Multicollinearity is not present since the tolerance value is larger than 0.654.010. There is no evidence of multicollinearity in the VIF or tolerance values shown in Table 4.5.

4.3 Test for Heteroscedasticity

The purpose of the heteroscedasticity test is to determine whether there is homoscedasticity (constant variance across data). The regression model is expected to be homoscedastic, or heteroscedasticity-free (Sarjono et al., 2011). Data analysis revealed the following upon inspection of Table 7's glacier test findings and Figure 5's scatterplot results:

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Table 7. Results of the Heteroscedasticity Test

Model	Coefficients[a]				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	1.088	.349		3.119	.002
Story Map	-.013	.027	-.061	-.475	.636
e-portofolio	.013	.024	.072	.559	.577

a. Dependent Variable: Spatial Abality

The questionnaire results were subjected to a heteroscedasticity test (Aksa, F. I. et al., 2020) to ascertain if the deviations from the regression model were caused by the same or different variations. To check for heteroscedasticity, you may apply analysis of variance (ANOVA) and scatter plots on the SPSS results (Lestari, S., 2012). The probability value of the Glesjer test must be more than 0.05 in the absence of heteroscedasticity (Hapsari, A. N. et al., 2016).

The results of the test for heteroscedasticity in Table 7 show that neither the Story Map variable $(0.636 > 0.05)$ nor the e-portfolio variable $(0.559 > 0.05)$ exhibit heteroscedasticity.
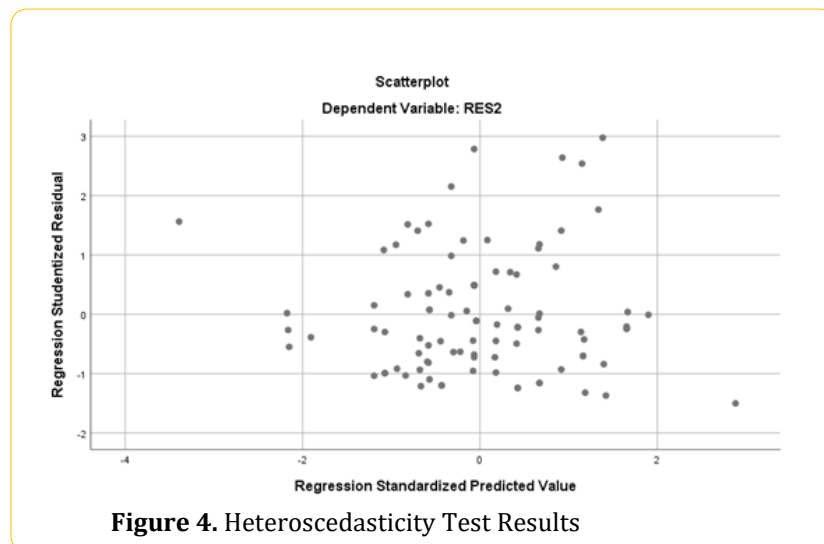
Figure 4. Heteroscedasticity Test Results

The aforementioned scatterplot graph displays data points arbitrarily scattered along the Y-axis. No heteroscedasticity was found in the regression model (Sarjono et al., 2011).

4.4 Test of Autocorrelation

Analysing how interference mistakes in period t relate to those in period t minus 1. Time series data is prone to autocorrelation problems. The autocorrelation test is not essential for cross-sectional studies. Autocorrelation may be tested for using the Durbin-Watson statistic. In a 2011 study Sarjono et al.

The Durbin-Watson Method of Decision Making:

Autocorrelation is present if and only if the value of d is between 0 and dl-4.

There is no autocorrelation if the value of d is either bigger than du or less than 4-du.

No inference may be made if d is either larger than dl but less than du or more than 4-dua but less than 4-dl.

Table 8. Autocorrelation Test Results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.911[a]	.831	.827	1.41567	1.911

a. Predictors: (Constant), Story Map, e-portfolio
b. Dependent Variable: Spatial Ability

The Durbin-Watson (d) value is 1.911, as seen in Table 8 of the Model Summary table. The Durbin-Watson table value will be compared to this one using the formula (k'; N) at the 5% level of significance. Given that there are two independent variables (k=2) and thirty-one observations (N), we get (k'; N) = (2; 31). The following data shows that at the 5% level of significance, the Durbin Watson table has the values (k'; N) = (2; 31). There is no autocorrelation if the DW statistic is 2, according to the literature (Oktarina, H., et al., 2019). The regression model with (k', N) = (2, 31) has a d value of 1.911 in the previous Durbin-Watson distribution table. That suggests a regression value of 1.5701.91141.570 = 1.5701.9112.430 for the Durbin Watson (d) statistic. The Durbin-Watson test states that autocorrelation is absent from the model if the value of d (durbin watson) is more than du and less than 4-du.

4.5 Analysis of Multiple Linear Regression

According to the research of Siregar and Syofegar (2013), multiple linear regression may be used to forecast how several factors would influence a dependent variable. Several researchers (Oktarina, H., et al., 2019) A statistical strategy for investigating the interplay between the studied dependent variable and a large sample of candidates for the independent variable. Multiple regression analysis was used to determine the degree to which Story Map Use (X1), Electronic Portfolio (X2), and Spatial Ability (Y) are all correlated with one another. The following results resulted from the processing of the data:

Table 9. The equation for Multiple Linear Regression

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.755	.572		8.313	.000
	Story Map	.210	.044	.250	4.746	.000
	e-portofolio	.553	.039	.742	14.063	.000

a. Dependent Variable: Spatial Ability

From Table 9 above, the formula equation below is obtained as follows:

$$Y = \alpha + \beta 1 X1 + \beta 2 X2 + \varepsilon \qquad (1)'$$

$$= 4.755 + 0.210 X_1 + 0.553 X_2$$

The Story Map (X1), e-portfolio (X2), and Student Spatial Ability (Y) variables' constants () and coefficients (1 and 2) are located here.
  a. Since both Story Map and e-portfolio have a value of 0, and it is common knowledge that the constant is equal to 4.755, we may calculate that the Spatial Ability of Students (Y) is equal to 4.755.

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    b.   b. the size of the 1 coefficient is 0.210, therefore a 1% increase in the Story Map (X1) is associated with a 1% increase in the Student's Spatial Ability (Y).

    c.   The student's spatial competence (Y) has improved, as shown by the e-portfolio's (X2) magnitude of 0.553 on the 2 coefficient.

3.   Analysis of the Coefficient of Determination

      The coefficient of determination quantifies how much an independent variable contributed to the dependent variable at the same time. Story Map (X1) and an electronic portfolio (X2) are being examined for their potential to improve students' spatial competence (Y). The coefficient of determination may be calculated using the information gleaned from SPSS 20 (Saputra, E., et al., 2020). The results are as follows:

Table 10. The determining coefficient

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.911^a	.831	.827	1.41567

a. Predictors: (Constant), Story Map, e-portofolio
    b. Dependent Variable: Spatial Ability

      Based on the information in Table 10, we get an R2 of 0.831. Student Spatial Ability (Y) is influenced or contributed to by both Story Map (X1) and e-portfolio (X2), as shown by the 83.1% result. In contrast, the effect of unknown factors accounts for the remaining 16.9% (100.0% - 83.1% = 16.9%).

1. **Hypothesis Testing Results**
5.1 Results of Test F (Simultaneous Test)

      In fact, this was shown (Siregar & Syofik, 2013). The goal of this test is to determine whether there is a statistically significant connection between the independent and dependent variables. We have tallied the F test results and presented them in a table for your perusal. If the p value from the f test is less than 0.05 and the calculated F value is greater than the F table (Saputra, E., et al., 2020), then Story Map (X1) and e-portfolio (X2) simultaneously alter Variables relying on Student Spatial Ability (Y) in relation to hydrometeorological disasters.

Table 11. Statistical Test Results F Simultaneously

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	915.241	2	457.620	228.338	.000^b
	Residual	186.384	28	2.004		
	Total	1101.625	30			

a. Dependent Variable: Spatial Ability
    b. Predictors: (Constant), Story Map, e-portofolio

      Fcount Ftable by 3.34, hence the F test is statistically significant at the 0.000 0.05 level, as seen in the preceding table. For instance, inputting (= 0.05), (df1 = 2), and (df2 = n-k-1) (31-2-1) = 28 yields the value (3.34), as does entering (df2 = n-k-1) (31-2-1) = 28. When utilising the regression model, if the F-value is more than the F-Table and the significance level is set at 0.05,

we may infer that e-portfolios and Story Maps have a joint effect on students' Spatial Ability in connection to hydrometeorological catastrophes.

2) T Test (Partial Testing) Result

Determine the effect of each independent variable, both alone and in combination, on the dependent variable. The weight given to each of a regression analysis's independent and dependent variables. If the p-value from the t test is less than the significance threshold (0.05), then the T count > T table (Saputra, E., et al., 2020) concludes that the independent variables Story Map (X1) and e-portfolio (X2) impact the dependent variable Student Spatial Ability (Y) in connection to hydrometeorological catastrophes. The number is split in half since there are two halves to a table count (Siregar, Syofyan, 2013). ttable's formula is as follows:

$$t_{table} = t(\alpha/2)(n-2) \tag{2}'$$

Table 12. T Partial Statistical Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.755	.572		8.313	.000
	Story Map	.210	.044	.250	4.746	.000
	e-portofolio	.553	.039	.742	14.063	.000

a. Dependent Variable: Student's Spatial Ability

- Since Story Map (X) has a favourable influence on the Student's Spatial Ability in respect to the issue of hydrometeorological disasters (Table 12), we may deduce that =0.05, df=n-k-1=31-2-1=28, and tcount > ttable i.e. 4.746 > 2.048.
- The e-portfolio has a positive effect on students' spatial ability when learning about hydrometeorological disasters, as shown by the following statistical analysis: • The e-portfolio variable (X2) has a significance value of 0.0000.05, and the t-table value for the two-party test is obtained (2.048) with =0.05, df=n-k-1=31-2-1=28.

Discussion

Independent study programmes, such as MKWU PKL at USK, have been introduced as part of Indonesia's ongoing push to modernise its higher education system. Determining what factors matter most in risk analysis and becoming an expert in catastrophe risk mapping. One way in which mapping and technology in the classroom intersect is via the use of GIS-based Story Maps, which may be incorporated in electronic portfolios. Disaster prevention, preparedness, response, and cleaning are just some of the many scenarios where geographic information systems (GIS) may be useful. Important data may be shown on a map due to its spatial nature (Adiyoso, W. 2018). Hickman, J. (2023) argues that GIS may help students develop their spatial reasoning abilities, and that this is only one of many positive outcomes of incorporating GIS into the classroom. Students' spatial skills are projected to increase because to the spatial nature of the information shown via story map-based GIS. Story Map may serve as an electronic portfolio for higher education. Students in Australia who utilise e-portfolios are more likely to develop reflective learning skills and an understanding of their own strengths and weaknesses as professionals (Hallam, G et al., 2010). It is hoped that include a Story Map in an e-portfolio would aid in developing better spatial skills for evaluating and creating risk maps.

Reading and navigating maps, as well as other aspects of geography, are good indicators of spatial intelligence. Researchers using functional magnetic resonance imaging (fMRI) showed how Geography majors had an advantage over non-majors in areas including mental rotation, spatial visualisation, and spatial connection reasoning. The spatial skills of FHut students at USK are shown by questions on reading and using maps presented both before and after the exam. In the

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context of hydrometeorological catastrophes, this research looked at how narrative maps and electronic portfolios may be used. Each instrument will undergo validation and reliability testing by agribusiness researchers. After calculating the validity and reliability tests of the e-portfolio questionnaire, 16 questions were deemed valid and reliable. In 29 out of 35 questions, the improvement in spatial ability measured by the pretest and posttest is evident. Authentic and reliable information is used in the experimental group. The USK College of Forestry hosted three days of experimental research. The Shapiro-Wilk tests performed before and after the test to establish whether or not the data were normally distributed yielded equivocal results. All of the variables in Table 2 have pre-test p-values that are more than 0.05, but post-test p-values that are less than 0.05. These results suggest that H0 should be rejected after the pre-test but approved before the post-test. The 0.013 0.05 value in Table 3 indicates that the data is definitely heterogeneous, as determined by a homogeneity test. Because pre- and post-test results for spatial ability did not match the data analysis requirements for the T-test, the Wilcoxon Test was used to examine the paired samples that made up the observation sample. As can be shown in Table 4, negative rankings have little practical use. That there are no overall population losses due to this. There are 496 total advancements, with an average position increase of 16. When there are no matching values, the tie value is 0.

Questionnaire To determine whether there is a correlation between narrative map data (X1) and digital portfolio data (X2) and gains in spatial competence (Y), we contrasted the two sets of information. The data are multivariate, heteroscedastic, and autocorrelated, as shown by the standard assumption test. If the assumption test's preconditions hold true, then the following test may be carried out. Table 9 of the multiple linear regression tests shows that students' spatial abilities (Y) are enhanced by 0.210 when they use Story Map and by 0.553 when they maintain an online portfolio. Results from the Coefficient of Determination test are shown in Table 10. Students' spatial ability (Y) is influenced by a number of factors, but we may infer that Story Map (X1) and e-portfolio (X2) combined account for 83.1% of the overall variation. Table 11 displays the results of a test of the null hypothesis using the F (Simultaneous) statistic, which showed F = 0.000 0.05 and Fcount > Ftable, or 228.338 > 3.34. Using the F test, we see that combining e-portfolios with narrative maps helps students develop better spatial skills in regard to hydrometeorological catastrophes. Table 12's Tcount > Ttable = 4.746 > 2.048 suggests there is a substantial relationship between X1 (Story Maps) and X2 (e-portfolios). 14.063 > 2.048 is the student Tcount more than the table Tcount.

Through the use of narrative maps in e-portfolios, researchers have found that students' spatial skills on the issue of hydrometeorological catastrophes have improved. This success is attributable to the e-portfolio's provision of tools for creative reflection on learning material, the Story Map's revelation of nature's true state, and the use of visually appealing colours to pique students' interest in and facilitate their understanding of learning material that can be used by each student's individual spatial abilities. The benefits of using Story Maps for e-portfolio assignments are described above, and they include the enhancement of students' spatial ability. Not many students have access to the resources required to build Story Maps for e-portfolio assignments on the theme of hydrometeorological catastrophes, restricting the breadth and depth of their projects, which is one of the negatives

6. CONCLUSION

The following may be deduced from the results of a study conducted at Syiah Kuala University to examine students' spatial skills in relation to hydrometeorological catastrophes using narrative maps for e-portfolio assignments:

1. The results of an e-portfolio project based on the Story Map concept developed for use in Syiah Kuala University's Compulsory General Course (MKWU) in Disaster and Environmental Knowledge (PKL) can be found at the following link: https://neogreenxnetizen. blogspot.com/. The project focuses on the topic of hydrometeorological disasters.

2. The Shapiro-Wilk test for normality between the pre- and post-test data showed that the pre-test data were normally distributed (p=0.424> 0.05). The assumption of normality was not supported by the post-test p-value of 0.013<0.05. Testing for homogeneity shows that the obtained data is not homogenous (p=0.013<0.05). A total of 31 people received a negative rank score of zero in the Wilcoxon test, suggesting that no one experienced a decline in health. There were 496 new positions made available. On average, people moved up 16 positions. The lack of a matching pair of values is symbolised by the null bond value.

3. Students' self-reported spatial ability (Y) was analysed using information from the Story Map Questionnaire (X1) and an electronic portfolio (X2). Results from a test of the classical assumptions show that the data are normal, multicoloured, heteroscedastic, and autocorrelated. Multiple linear regression studies show that student spatial ability (Y) is elevated by 0.210) as a direct consequence of using the Story Map (X1). Students' spatial skills (Y) increase by 0.553 with the help of e-portfolios (X2). Coefficient of Determination analysis showed that Story Map (X1) and e-portfolio (X2) both contributed 8.31% to the total, with the remaining 1.7% due to the impact of untested factors on the Y variable of Student Spatial Ability.

4. We discover that the null hypothesis fails with a P value of 0.000<0.05 and the alternative null hypothesis fails with a P value of 228.338 > 3.34 when we use the F (Simultaneous) Statistical test. In light of the F-test findings, we conclude that both e-portfolios and narrative maps have an effect on students' spatial abilities in relation to hydrometeorological disasters. Based on an X1 Story Map partial T-test, we may conclude that Tcount > Ttable, or the student's spatial ability. The spatial intelligence of pupils is influenced by X2, the e-portfolio variable, if Tcount > Ttable, or 14.063 > 2.048.

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