

## Development of Culture-Based Interactive Comic Media to Increase Students' Mathematics Learning Motivation in Elementary Schools

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### ABSTRACT

This study developed a culture-based interactive comic media to increase motivation to learn mathematics in elementary schools. This media was designed to introduce Javanese culture and create more active and creative learning. The method used in this study was Research and Development (R&D) using the ADDIE model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. Data collection was conducted through observation, interviews, and questionnaires at SD Negeri Sumberejo 01 with fourth-grade students as subjects. The results showed that the developed culture-based interactive comic was rated valid by experts, with scores ranging from "Good" to "Very Good." The practicality score reached 86.85%, classified as "Very Practical." The t-test also indicated a significant improvement in students' learning outcomes. Therefore, the interactive comic is considered valid, practical, and effective in enhancing students' motivation and learning outcomes in mathematics, particularly in fraction material.

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## INTRODUCTION

Motivation comes from the word "motive" which means the drive in a person to do activities to achieve a goal (Zulkifli, 2022). According to Hamzah B. Uno (2017), learning motivation refers to the internal and external forces that drive a person to engage in learning. These forces appear through several indicators, including the desire to succeed, willingness to learn, expectations for future achievement, appreciation of learning activities, and the presence of a supportive learning environment. (Andriani and Rasto 2019; Rahman 2022). Therefore, motivation is an important element in the learning process because it can increase students' enthusiasm for learning (Suharni, 2021).

However, students' motivation to learn is still low, one of which is because mathematics is considered difficult and becomes a scourge in learning (Indriani 2016; Shofia and Dadan 2021). Many students don't like math, so they tend not to pay attention to the teacher during the lesson (Amalia, Ermawati, and Kuryanto 2022; Silahuddin et al. 2022). Other factors such as student ability, environment, and teacher approach also affect low learning motivation (Sabrina, R., Fauzi, & Yamin 2017).

One of the solutions to increase learning motivation is support from teachers and the surrounding environment (Budiyani, A., Marlina, R., & Lestari 2021; Fitri Lintang and Ulfatun Najicha 2022). The use of technology such as quizzes has been shown to increase the effectiveness of mathematics learning (Hafiyya, N., & Hadi 2023; Melati et al. 2023), as well as creative media such as snakes and ladders that are able to attract students' attention and prevent boredom (Haptanti, Hikmah, and Basuki 2024; Nurussofa and Astuti 2023).

Unfortunately, quiz media often focuses on fixed answers, which can limit creativity and reduce opportunities for students to explore ideas more freely. When used too frequently, quizzes may also trigger boredom and pressure because students feel compelled to perform well at all times. This repetitive pattern can create unnecessary stress and reduce intrinsic motivation to learn. Meanwhile, snake and ladder learning media presents its own challenges. The rules can be difficult to follow, especially for students who struggle with complex instructions or are unfamiliar with the language used. If the topic being taught has not been well understood beforehand, this type of media can become confusing rather than supportive of learning, making it harder for students to absorb the material.

Research Kusumadewi et al. (2022) shows that digital mathematics comic media meets the criteria of valid, practical, interactive, innovative, and effective. Comics as a learning medium contain interesting pictures and stories that make it easier for students to understand (Kusumadewi et al. 2022; Meilani et al. 2024; Puspananda 2022; Putri et al. 2024; Sudioanto 2021).

Based on this, the researcher is interested in combining comics with cultural elements by incorporating aspects of Javanese culture such as batik patterns and traditional cakes into the storyline. This approach aims to introduce local culture through media that is engaging and enjoyable for students. It is expected to create a learning experience that encourages students to be more active, creative, and innovative while strengthening their appreciation for local identity. (Driyani 2018; Narestuti, Sudiarti, and Nurjanah 2021). The use of culture-based comics is expected to increase students' interest and motivation to learn (Nahak 2019; Siregar et al. 2019).

## **RESEARCH METHODS**

This research uses a Research and Development (R&D) development model. The research method used is descriptive quantitative. Quantitative descriptive research is research that describes variables as they are, supported by data in the form of numbers generated from actual circumstances (Fauzan and Rahdiyanta 2017). This study uses data collection techniques

through questionnaires, observations and interviews. This research method uses descriptive quantitative research. Quantitative descriptive research is research that describes variables as they are, supported by data in the form of numbers generated from actual circumstances. This study uses data collection techniques through questionnaires, observations and interviews. The distribution of the questionnaire was carried out with the aim of obtaining data from respondents and analyzed to find out how far the validity, practicality and effectiveness of culture-based interactive comic learning media can motivate students in the seemingly basic way. Observations and interviews were conducted to find information from schools related to

## RESULT AND DISCUSSION

### Stages of Comic Media Development "The Secret of the Fractions Behind Batik and Bakpia"

Based on the interactive comic media that has been discussed, the product development process can be explained using the ADDIE model which consists of five stages: *Analysis, Design, Development, Implementation, and Evaluation*. This model is a systematic approach that is widely used in the development of learning media and is particularly relevant to the context of basic education. The following is a description of the media development process in accordance with the full stages of ADDIE:

#### 1. Analysis

The initial stage of media development was carried out through observation, interviews, and the distribution of questionnaires at SD Negeri Sumberejo 01. The results showed that students were bored with conventional methods and less interested in mathematics, especially fractional materials. For this reason, learning media based on local culture is designed by integrating elements of Yogyakarta culture, such as batik and bakpia, to increase motivation and facilitate understanding through a contextual approach that is close to students' lives.

#### 2. Design

##### a. Theme and title determination

The title "The Secret of the Fractions Behind Batik and Bakpia Cakes" was chosen because it contains elements of local culture and is in accordance with the fractional mathematics material.



Figure 1. Comic Title

**b. Character design and storyline**

Characters like Puspa, Bima, Bu Laras, and Grandma are designed to fit the world of 4th grade elementary school children. The storyline is arranged based on the experience of going home, games, eating habits together and is associated with time related to the concept of fractions of value.



Figure 1. Character Design in Comics

**c. Content packaging**

Materials combined with stories, interactive quizzes, game-based *Wordwall*, as well as final evaluation questions to measure students' understanding of the material.



Figure 2. The Use of Wordwall in Comics

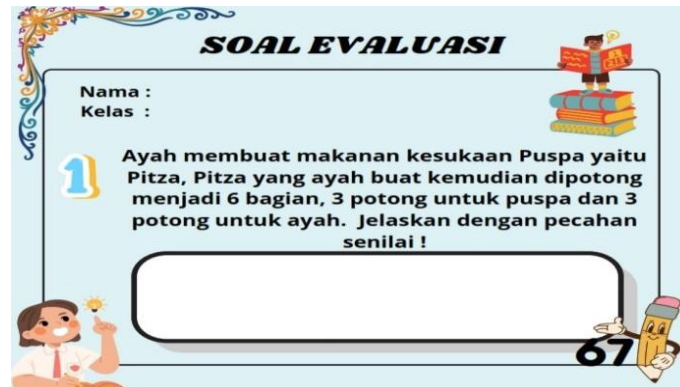


Figure 4. Evaluation Quiz in Comics



Figure 3. LKPD Quiz in Comics

#### d. Navigation design

The reading layout, quiz instructions, and mechanism for using QR codes or direct links are also intuitively designed so that they can be used independently by students.



Figure 5. The Use of QR Codes in Comics

### 3. Development

The *development* stage is a concrete process in the creation of interactive comic media. The steps taken by the researcher in this stage include:

- a. The creation of digital comic media containing educational narratives, cultural elements, interesting illustrations, and interactive elements in the form of quizzes and games.
- b. The integration of local culture is carried out by inserting Yogyakarta cultural values such as the history of batik and the origins of bakpia cakes that are presented in the story.
- c. Product validation by media experts and subject matter experts. Comics are tested to ensure the validity of the content, the effectiveness of the delivery of the material, and the suitability with the mathematics learning outcomes of grade 4 elementary school.
- d. Improvements and revisions are made based on input from validators. The revisions include visual design improvements, language level adjustments, and technical improvements to interactive question navigation.
- e. Development of technical aspects such as QR codes and direct links to quizzes through platforms such as Wordwall and ZepQuiz, so that students can access exercises independently using digital devices.

### 4. Implementation

After the media has been validated and revised, the next stage is implementation in the field. This interactive comic was tested on grade IV elementary school students as the main target, as well as classroom teachers who acted as facilitators. The purpose of this implementation is to find out the level of practicality of media in the real learning process in the classroom.

Implementation activities are carried out in a mathematics learning atmosphere where students read comics, work on interactive quizzes, discuss stories, and solve evaluation questions at the end of the session. The teacher provides guidance on the use and accompanies the learning process, but the media is made independent enough so that students can access and understand the material without relying too much on the teacher's explanation.

In addition, during implementation, a practicality questionnaire was given to students and teachers to measure how easy the media was to use, whether the content was understandable, and the extent to which students felt motivated to learn to use the media. The responses obtained were used as supporting data for the final evaluation.



Figure 6. Activity Documentation

## 5. Evaluation

The final stage of the ADDIE model is *evaluation*, which is divided into two forms:

### a. Formative evaluati

It is carried out during the development and implementation process, including input from validators and the results of field observations.

### b. Summative evaluation

It involves analysis of the results of the practicality questionnaire, the results of student learning evaluation (quizzes and final questions), and the observation of student learning behavior.

From the results of the evaluation, it can be seen that this interactive comic media is effective in improving students' understanding of the concept of fractions, especially because of its contextual and narrative approach. Many students stated that they felt more excited about learning because the material was associated with real experiences, such as splitting pizzas, dividing batik fabrics, and eating bakpia cakes. In addition, they find it easier to understand fractions of value because they are given examples in the form of stories and image visualizations.

The evaluation also showed that students who were usually passive became more active and enthusiastic when invited to learn to use comics. Teachers also gave positive feedback because this media makes it easier to relate abstract material to everyday contexts.

### Media Validation Results

The validation test was carried out as an important step in the development of the digital comic media "The Secret of the Fraction Behind Batik and Bakpia Cake" to ensure that the media meets the feasibility aspects in terms of content, media appearance, and learning design. Validation

is carried out by three experts who each represent their areas of competence: material experts, media experts, and learning design experts. Overall, the results of the validation test can be summarized and presented in the form of a Table 1 as follows:

Table 1. Validation Test Results

Yes	Validation Type	Score Range	Average Score	Score Description	Additional Details
1	Subject Matter Expert Validation	1-5	4,16	Good	Worth testing with revisions as suggested
2	Media Expert Validation	1-5	4,92	Good Close Very Good	Worth testing
3	Design Expert Validation	1-5	4,56	Good	Worth testing with revisions as suggested
4	Teacher Validation	1-5	5	Excellent	-
		1-5	4,75	Good Close Very Good	-
5	Student Validation	1-5	4,75	Good Close Very Good	-
		1-5	4,25	Good	-
		1-5	4,42	Good	-
		1-5	4	Good	-
		1-5	4,17	Good	-
		1-5	4	Good	-
		1-5	4,42	Good	-
		1-5	3,42	Pretty Good	-
		1-5	3,58	Pretty Good	-
		1-5	4,25	Good	-

### 1. Validation Test by Subject Matter Expert

Validation tests by material experts were carried out to assess the feasibility of the content, the suitability of the material with the curriculum, and the accuracy of the mathematics material contained in cultural-based interactive comic media. From the validation results, an average score of 4.16 was obtained from the score range of 1–5, which was categorized in the "Good" classification. This shows that in general the material presented is relevant and in accordance with the basic competencies that are intended. However, the media still needs to be revised according to the suggestions and inputs from material expert validators, so that the content becomes more precise, structured, and in line with the objectives of mathematics learning at the elementary school level.

### 2. Validation Test by Media Experts

Validation by media experts is carried out to assess the technical aspects of the presentation, such as visual quality, interactivity, media navigation, readability, and ease of access by users (students and teachers). The validation results showed an average score of 4.92, which is in the category of "Good Close to Very Good". This means that the interactive comic media developed has met technical and aesthetic standards in digital media-based learning. The validator stated that

the media is worthy of being tested directly in the field without the need for major revisions, because the appearance is attractive, user-friendly, and supports active student engagement.

### **3. Validation Test by Learning Design Experts**

Validation by learning design experts is focused on the suitability of the learning flow, the preparation of learning elements, and the integration between materials, activities, and evaluations in comic media. The average score obtained is 4.56, which is in the "Good" category. The validator assessed that the storyline in the comic already depicted learning that was contextual and in accordance with the characteristics of the students. However, some parts still need refinement such as adjusting the layout and strengthening the integration between the story narrative and the subject matter, which will be done through revisions according to suggestions from design experts.

### **4. Validation Test by Teachers and Students**

#### **a. Validation by Teachers**

Validation tests by teachers are carried out to determine the feasibility of media in the context of real learning in the classroom. Teachers as actors directly assess whether the media is practical to use, easy to understand, and effective in increasing student motivation and understanding. From the validation results, an average score of 5 was obtained, which is included in the "Excellent" category. This shows that teachers strongly support the use of this interactive comic media in mathematics learning, because they are able to visualize the material well and attract students' interest.

#### **b. Validation by Students**

Student validation is carried out to measure students' responses, interests, and comfort in using media. In the trial, several groups of students gave different scores, but the overall score was in the range of 3.42 to 4.75, with a general average of 4.25 – 4.75. This shows that most students give a rating of "Good" to "Good close to Very Good", with two scores in the "Quite Good" category (3.42 and 3.58). This assessment reflects that students generally like the developed media, feel helped in understanding fractional material, and enjoy the learning experience through narration, illustrations, and interactive quizzes. The score is quite good indicating that there is a need for improvement in some parts, for example in the clarity of instruction or ease of use for certain students.

### **Data Analysis Results**

This research aims to develop culture-based interactive comic media to increase the motivation to learn mathematics of elementary school students. In the development of this media, several stages of data analysis are carried out to ensure that the media produced has quality that can

be accounted for scientifically. The analysis test includes: questionnaire reliability test, data normality test, effectiveness test through paired sample t-test, practicality test, and media effectiveness test.

### 1. Questionnaire Reliability Test

Table 2. Reliability Test

Reliability Statistics	
Cronbach's Alpha	N of Items
.833	2

The reliability test was carried out to determine the extent to which the questionnaire instrument used was consistent and reliable. Based on the results of the reliability test presented in Table 4.2, Cronbach's Alpha value was obtained at 0.833. This value is in the high category, which means that the questionnaire instrument has good reliability and is suitable for use in collecting data on student learning motivation.

### 2. Normality Test

Table 3. Normality Test

Variabel	Kolmogorov Smirnov Statistic	df	Sig.	Shapiro Wilk Statistic	df	Sig.
Pretest	0.240	10	0.107	0.886	10	0.152
Posttest	0.195	10	0.200*	0.878	10	0.124

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The normality test is carried out to find out whether the pretest and posttest data are distributed normally, which is a requirement in conducting parametric tests such as paired sample t-tests. The results of the normality test are shown in Table 4.3 using two methods, namely Kolmogorov-Smirnov and Shapiro-Wilk. In the pretest data, the significance value of Shapiro-Wilk was 0.152 and in the posttest data was 0.124. Since both values are greater than 0.05, it can be concluded that the data is normally distributed, making it feasible to test using the t-test.

### 3. Uji Paired Sample t-Test (Pretest vs Posttest)

Table 4. Paired Samples t-Test

Pasangan	Mean	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig.(2tailed)
Pretest Posttest	- 10.00000	2.35702	0.74536	-11.68611	-8.31389	-13.416	9	0.000

This test aims to find out if there is a significant difference between student learning outcomes before and after the use of media. The results of the analysis are shown in Table 4.4. The

mean difference was -10.00, with a t-value of -13.416 and a significance (p-value) of 0.000. Since the significance value is less than 0.05, it can be concluded that there is a significant difference between the pretest and posttest scores. Thus, this culture-based interactive comic media has proven to be effective in improving student learning outcomes in fractional materials.

#### 4. Practice Test

A practicality test was carried out to find out whether the learning media developed was easy to use and could be implemented practically in an elementary school environment. Based on the calculations, the Total Effective Score (TSE) was obtained of 812 and the Total Expectation Score (TSH) of 935, so that the percentage of practicality was calculated as follows:

$$\text{Percentage} = \frac{\text{Total Effective Score (TSE)}}{\text{Total Expectation Score (TSH)}} = \frac{812}{935} = 86,85\%$$

This percentage indicates that the media falls into the "Practical" category, meaning that it can be used well by students and teachers in the field, although it can still be improved in terms of efficiency in terms of use or display improvement.

#### 5. Effectiveness Test

In addition to practicality, testing the effectiveness of media is also carried out to see the extent to which media can help achieve learning goals. Based on pretest and posttest data, all students (10 out of 10 students) experienced an increase in learning outcomes. Thus, the effectiveness is calculated with the formula:

$$\text{Kepraktisan} = \frac{P_a}{P_b} \times 100\% = \frac{10}{10} \times 100\% = 100\%$$

With 100% results, it can be concluded that the culture-based interactive comic media that is developed is very effective in improving student motivation and learning outcomes. All students showed an increase in grades, which proves that this medium is able to transform the math learning experience into a more engaging and easy to understand.

## Discussion

### 1. Development of Culture-Based Interactive Comic Media in Increasing Motivation to Learn Mathematics in Elementary School

The media development in this study follows the ADDIE model which includes five stages. At the stage of analysis, observation, interviews, and questionnaires in elementary schools showed that students were saturated with conventional methods, less motivated, and had difficulty understanding fractional material due to the lack of interesting and contextual media. Based on these findings, the researcher designed a digital comic titled "The Secret of the Fragments Behind Batik and Bakpia Cake" that integrates local culture with characters and stories that are close to the lives of students. Comics are developed with illustrations, narratives, and interactive quizzes based on Wordwall and QR codes, then validated by experts and revised according to input. The media was then tested limited to grade IV students and teachers to assess the practicality and user response. Evaluation was carried out through motivational questionnaires, quizzes, and observations to measure the effectiveness of media in increasing understanding and interest in learning mathematics.

The development of culture-based interactive comic media in this study is also supported by previous research showing that culture-based learning media can increase students' learning motivation (Siregar et al. 2019). Furthermore, other research also shows that the use of comics as a learning medium can improve students' understanding of mathematical concepts (Kusumadewi et al., 2022). Pengembangan Media Komik Matematika Digital untuk Pembelajaran Materi Pecahan di Sekolah Dasar. *Jurnal Pendidikan Matematika*, 11(1), 34-45..Therefore, the development of culture-based interactive comic media in this study is expected to increase students' motivation to learn mathematics in elementary schools.

The results of this study align with previous research showing that culture-based learning media can increase student learning motivation (Siregar et al. 2019). Furthermore, other research has shown that using comics as a learning medium can improve students' understanding of mathematical concepts (Kusumadewi et al., 2022). Therefore, the development of culture-based interactive comic media in this study is expected to increase student motivation to learn mathematics in elementary school.

## **2. The Practicality of Culture-Based Interactive Comic Media in Increasing Motivation to Learn Mathematics in Elementary Schools**

Practicality is a crucial aspect in developing learning media, which includes ease of use by teachers and students in terms of appearance, navigation, and understanding of the material. In this study, practicality was measured through a questionnaire distributed after the use of the media, with the results of a Total Effective Score (TSE) of 812 from a Total Expected Score (TSH) of 935, resulting in a practicality percentage of 86.85% and is in the "Very Practical" category. Teachers considered that the comic was easy to use and able to visualize fraction material well, while students felt happy because the comic story was relevant to everyday life and easy to understand. The comic navigation was intuitive, equipped with QR codes and interactive links that made it easy to access quizzes, both via mobile phones and computers, and enabled students to learn independently.

The results of this study indicate that the developed culture-based interactive comic media has a very high practicality rating of 86.85%, with a rating of "Very Practical." Teachers and students rated the comic as easy to use, well-visualized fraction material, and relevant to everyday life. The comic's intuitive navigation, complemented by QR codes and interactive links, also facilitates quizzes and allows students to learn independently. These results align with previous research by Hasanah & Fernandes (2024), which demonstrated that digital comic media can be implemented in the classroom and is highly practical. Other research also indicates that comic media can improve student learning outcomes, with a rating of very effective. In conclusion, the results of this study support previous research demonstrating that culture-based interactive comic media can be an effective and practical learning tool in improving student motivation and learning outcomes.

## **3. The Validity of Culture-Based Interactive Comic Media in Increasing Motivation to Learn Mathematics in Elementary School**

The validity aspect of the media is tested through validation by subject matter experts, media experts, and learning design experts to ensure content quality, visual appearance, and design suitability. As a result, the subject matter experts gave an average score of 4.17 ("Good" category), indicating the suitability of the material with the curriculum and the local cultural context. Media experts gave it a score of 4.92 ("Good Close to Very Good"), indicating that the illustrations, layout, colors, and readability are very adequate. Learning design experts gave it a score of 4.56 ("Good"), indicating the structure, sequence, and integration of the quizzes were already effective. Teacher validation shows a maximum score of 5 ("Very Good"), while students give a score between 3.42

to 4.75 with an average of "Good" to "Good close to Very Good". These results confirm that the developed interactive comics are valid and suitable for use in learning.

Previous research conducted by Anggini, 2023 also showed that the development of interactive comic media can improve students' mathematical problem-solving abilities, making them more enthusiastic in learning. Digital comic learning media can improve student learning outcomes and make learning more enjoyable. Other research shows that interactive learning media based on local culture can be an innovative means of improving elementary school students' mathematical literacy. Therefore, the development of interactive comic media based on culture can be one solution to increase motivation to learn mathematics in elementary schools by presenting material that is more interesting and relevant to everyday life.

The validity of the culture-based interactive comic media developed in this study supports the findings of Anggini's (2023) study, which showed that interactive comic media can improve students' mathematical problem-solving abilities. These findings also align with other research showing that digital comic learning media can improve student learning outcomes and make learning more enjoyable. Developing culture-based interactive comic media can be a solution to increase motivation to learn mathematics in elementary schools by presenting material that is more engaging and relevant to everyday life.

#### **4. The Effectiveness of Culture-Based Interactive Comic Media in Increasing Motivation to Learn Mathematics in Elementary School**

The effectiveness of the media was measured through the improvement of student learning outcomes before and after the use of the media by the paired sample t-test using SPSS. The results showed that the average posttest of 83 was higher than the pretest of 94 with a difference of 10 points and a significance value of 0.000 ( $< 0.05$ ), which means that the difference is statistically significant. In addition, all students (10 out of 10) showed an increase in learning outcomes, so that the effectiveness of manual media reached 100%. These findings show that culture-based interactive comic media is effective in increasing students' motivation and understanding of fractional material. The increase is also reflected in the change in learning attitudes, where students become more active and enthusiastic because the material is associated with real experiences such as distributing pizza, receiving batik cloth, and eating bakpia cakes.

Another study conducted by Putri et al., 2024 also showed similar results. The development of mathematical comic media can improve numeracy literacy in the material of prism and pyramid spatial shapes with the results of the effectiveness test of mathematical

comic media of 96.6% with a very effective category. In addition, research on the effectiveness of interactive learning media through QuizWhizzer also showed that interactive media can increase student learning motivation with the average results of the learning motivation questionnaire after using interactive media being higher (69%) than the average learning motivation questionnaire before using interactive media (46%).

Thus, the development of culture-based interactive comic media can be a solution to increase motivation to learn mathematics in elementary schools by presenting material that is more interesting and relevant to everyday life.

The effectiveness of the culture-based interactive comic media developed in this study supports the results of research by Putri et al., 2024, which showed that mathematical comic media can improve students' numeracy literacy. The development of culture-based interactive comic media can be a solution to increase motivation to learn mathematics in elementary schools by presenting material that is more interesting and relevant to everyday life. In conclusion, the results of this study support previous research showing that culture-based interactive comic media can be an effective learning tool in improving student motivation and learning outcomes.

## CONCLUSION

Research shows that themed learning in primary schools is effective in encouraging children's creativity with a holistic approach that integrates various subjects in a single theme. This method helps students understand the interconnectedness between concepts, think critically and divergently, and generate original ideas. Collaborative activities in themed learning also develop social skills and enrich the creative process through the exchange of ideas. In addition, the use of technology such as computers and learning applications expands access to information, encourages the exploration of ideas, and allows students to create innovative digital works in an interactive and engaging learning environment.

## REKOMENDATION

For future researchers, this media development still has room for improvement. Future researchers could develop this comic medium for other math materials, different grade levels, or even expand it to include other local cultures so that students in various regions can experience learning that's relevant to their environment.

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