



Developing numeracy module based on local culture in Indonesia

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Abstract

Using the numeracy module helps students learn mathematics by providing learning content and improving their motivation. However, it was found that only a few researches were conducted to develop a module designed based on local cultures, like Aceh culture. This study aimed to develop a module based on Aceh culture that supported numeracy. The design of this study was based on a research and development procedure in which the developed module has gone through the stages of analysis, design, development, implementation, and evaluation. The Likert scale type of questionnaire was used as it was very effective in analyzing and gathering views from language and media experts and students. The results indicated that the integration of local culture in elementary school students' modules was evaluated to be valid by teaching module experts in terms of media, materials, and language. In addition, the developed-local culture module was regarded as feasible and effective, identified from students' views as having average scores of 3.58 or 89.77 %. The feasibility and the effectiveness of the elementary school's literacy and numeracy module based on local culture were very appropriate to be applied in the classroom.

Keywords: developing; local culture; module; numeracy

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Introduction

Various areas of literacy need to be crafted for students, from providing attitude-based numeracy content to a source that deals with local culture (Lipka et al., 2007). Furthermore, incorporating cultural identity, the importance of ancestral language, and culture was considered a fundamental aspect in teaching mathematics as it increases students' intellectuality and knowledge (Kisker et al., 2012). Students would find it meaningful, relevant, and stimulating to learn mathematics when they are taught aligned with their values of culture and community. In addition, students are emphasized to learn in the area that grows their critical thinking skills (Sari, 2018). It can be done using printable, visual, digital, and auditory materials (Fath et al., 2018). Muliana et al. (2021) regard media as a series of activities designed to develop students' control of learning by sending and receiving messages.

Such designs make students more literate in reading, writing, numeracy, science, and culture (Rochmah & Bakar, 2021). Moreover, Evans (2000) refers to mathematical numeracy as an individual ability to form, analyze and apply numerical, spatial, statistical, and quantitative data in a way that corresponds to an appropriate context and cultural value. The student's skill numeracy must be improved and taught in multiple trajectories (Han et al., 2017). They can be engaged in activities such as numerical literacy through forming data interpretation and reasoning (Abidin et al., 2021).

In line with the above views, using module-based critical thinking content integrated with the students' local culture has been recognized as essential in teaching and learning. As such, Aceh culture was used as core content in developing students' sources of literacy and numeracy. It is known as a value consisting of habit in a particular society or community, and it is a part or close to attaching to the life of its people (Marzuki, 2014). For instance, the tradition of slaughtering livestock in welcoming the Holy Ramadhan, welcoming the blessed month of the prophet's birthday, greeting or kissing the hand of *the ulama* (preacher), and so forth (Usman, 2021). The cultures accrue from their people's values, identities, beliefs, and habits, meaning hereditary conduct passed on from one generation to another (Noviana, 2018).

Although Indonesia has been characterized as one of the countries that were considered capable of and successful in reducing illiteracy, the insufficiencies of numeracy books were regarded as the main challenges that most students faced (Syawahid, 2019). Besides, students need more motivation and interest to improve their learning situation (Sari, 2018). These problems are so concerning that students must have strong literacy and numeracy skills to understand text or information (MoEC, 2018). The Indonesian PISA (the Program for International Student Assessment) scores in 2000 and 2018 were considered very low (Narut & Supardi, 2019).

Previous studies in numeracy have been conducted, and the core of problems has also been investigated, which were outweighed by constructing a new mathematical literacy and numeracy module. For example, Widiantari et al. (2022) studied improving students' numeracy and character. The numeracy problems were compensated for by constructing the

E-Module-based Ethno mathematics. The developed E-Module was valued to have played its role as a successful and positive effect in increasing students' literacy of numeracy and character.

Similarly, [Sulistiyani and Kusumawardana \(2022\)](#) conducted a study on the assistance in the preparation of minimum competency assessment-oriented numeration modules in an elementary school. They came across that the *Asesmen Kompetensi Minimum* (Minimum Competency Assessment) had been very effective and necessary for classroom use, making teacher easier to draw and arrange the basic competency of students. [Sari et al. \(2021\)](#) study revealed that applying learning-based Science, Technology, Engineering, Art, and Math (STEAM) could strengthen students' numeracy.

However, this study differed from the above findings in a very particular variable in that it has been conducted to develop literacy modules based on students' local culture, and Aceh background, by investigating its feasibility, practicality, and efficacy. The scarcity of research conducted to analyze and improve students' numeracy based on Aceh culture was very tangibly unavailable. In particular, this research applied question items based on Aceh culture in the elementary school's numeracy module.

Methods

This study employed the Research and Development (R & D) procedures since it was used to develop the literacy and numeracy module applied in elementary school students, *Sekolah Dasar Negeri* (State Elementary School) 7 Muara Satu Lhokseumawe. The developed-numeracy module was designed based on the value of Aceh culture. Hence, the research model used in this investigation was the analysis, design, development, implementation, and evaluation model (ADDIE). From the initial stage, the analysis was closely related to an early observation of the module used in elementary school. This analysis collected information on the current module used, and the alternative preference of the module was presented. Once the problems had been investigated, the stages of the design of the research and development procedure were applied and primarily associated with the construction of a numeracy module based on Aceh culture. The numeracy products underwent the development stage. A detailed review of the module was done in this part of the procedure. This investigation was performed to value and examine the module in terms of its design, pictures, and language have a greater contrast of differences with the numeracy module currently used in elementary school. The inspection of the attributes of the module was done by two different experts, the media and materials.

The implementation stage was done in two product trials: the limitation and application tests. The limitation test or small group scale trial defined the use of questionnaires. Several nine students acted as the subject of this study and overviewed the newly developed module based on their local culture in terms of its feasibility of media use. After performing the first trial of the product, the developed module was ready to be disseminated to students of *Sekolah Dasar Negeri* (State Elementary School) 7 Muara Satu Lhokseumawe. Students were asked to complete questionnaires to gather their responses to numeracy products. The

last stage of the process was evaluating the product or module. The revision of the product took its turn in this stage; it was conducted following students' responses at the previous stages. In addition, the created module was adjusted by considering the response and evaluation valued by two experts. The effectiveness of the developed numeracy module was subsequently revised based on the performance of students' tests of the exploited test items used in the new module.

The further trial examined the feasibility, practicality, and effectiveness of the literacy and numeracy module based on Aceh culture. The process of this evaluation was exerted into two stages of trials. The former was recognized as media and material expert evaluation, while the latter was identified as the trial of implementing the numeracy product. The evaluation of the numeracy module in terms of its feasibility and the effectiveness of media and its materials used was conducted, validated, and assessed by linguistics experts. In addition, the trial was conducted in a small group of nine students. This stage was also critical in that the developed module went through its advanced revision before it was distributed to the other trial group consisting of 35 students.

The numeracy module was analyzed and revised after the large group trial's second stage. The interpretation of the feasibility range of media was crucial, and this study used the criteria provided by [Baharudin and Cholik \(2021\)](#). The numeracy module for elementary school students, designed based on Aceh culture, were examined to unearth the feasibility validated by expert using guidelines taken from [Ismiyanti et al. \(2021\)](#). For the classification of the module validation, the Likert scale model was used, and it was considered appropriate to be applied for the substantiation of the product ([Sugiyono, 2018](#)). Meanwhile, the practicality test of the developed numeracy module was analyzed based on students' earlier responses. The effectiveness analysis measured students' learning mastery level after using the numeracy module based on local culture. [Adawiyah et al. \(2021\)](#) state that student learning completeness can be calculated by using particular criteria. The classical completeness criteria were used to classify the level of effectiveness of the elementary school's numeracy. A class is considered completeness of learning if the percentage is greater or equal to 85% of students completed their task.

The data relating to the feasibility, practicality, and effectiveness of the module designed based on Aceh culture were taken questionnaire. The type of questionnaire that was used was the Likert scale. The use of a Likert scale questionnaire for both students and experts was done because it was appropriate to analyze each item of questions. The questions were designed based on module feasibility and culture presented in the developed module.

The design of the appropriate questions in the questionnaires was oriented differently in two of the subject of this research. The experts' examining the module was based on its module content in terms of its media and language used. The questionnaires used for students were designed to have students' views on the attractiveness of the module. The analysis was based on the following grading criteria, as a Table 1 below.

Table 1. Likert scale category

Scores	Remarks
4	Strongly Agree
3	Agree
2	Disagree
1	Strongly Disagree

The highest score in the Likert scale category was identified as strongly agree, showing a score of 4, as seen in Table 1 above. Once students selected the questionnaire items presenting their view, which is agreeable to them, the score was identified as 3. At the same time, each type of question gave students an option to answer in a way that they could agree or strongly disagree with the statement. Meanwhile, the percentage rating of validity level was based on its test result concerning the obtained and highest score.

$$\text{Validity Level} = \frac{\text{Obtained Score}}{\text{Highest score}} \times 100\% \quad (1)$$

The percentage level of validity was of paramount importance. This level was applied to support the data emanating from students' tests in the two trial groups, a task designed on the numeracy module based on Aceh culture. The validity level was reached, as can be seen from the above formula, by identifying students' obtained and highest scores. The obtained score was divided by the highest before it turned out to be the percentage of validity level. The data interpretations were classified from intervals ranging from 0 to 100 used to analyze the validation results. The validation given by an expert in two module sections, media and language, was analyzed using the criteria. Students' responses to the questionnaire followed the procedure as it was done for experts' validation, as Table 2 below.

Table 2. Module interpretation

Interval	Criteria
$80 < V \leq 100$	Very Valid
$60 < V \leq 80$	Valid
$40 < V \leq 60$	Fairly Valid
$20 < V \leq 40$	Less Valid
$0 < V \leq 20$	Not Valid

The evaluation results from experts and students were analyzed using the interval with particular criteria. The grading scores between 80 to 100 were considered very valid. Meanwhile, grading scores made less than 20 were considered not valid. The interval used in the above table concerns the criteria from very valid, valid, fairly valid, and less valid to not valid.

Results

Analysis

This study was done through the Research and Development (R & D) model consisting of five stages. The result of the stage of analysis was found that there were no literacy and

numeracy previously developed and distributed to *Sekolah Dasar Negeri* (State Elementary School) 7 Muara Satu Lhokseumawe, which were made on students' local culture. They were also encountered to have less motivation to do the numeracy task. Moreover, the numeracy program was in a severe gap compared to the numeracy guidelines. It was also discovered that the numeracy program had been conducted mainly in the school's library without fully fulfilling the numeracy standard guidelines issued by the government.

Similarly, the analysis revealed that teachers' innovations were not supported by their counterparts in their parallel classes. Besides, students' motivations for numeracy tasks were also shallow. They believed that performing numeracy was relatively insignificant and very dull. These drawbacks were also triggered by insufficient training, which must be provided to school teachers. Overcoming the above issues for better actualization of the numeracy program, constructing a supported literacy and numeracy material must be considered. Thus, these findings implied that the design of the numeracy module was considered very important in helping students learn mathematics.

Design

As the name implies, the second stage of this research was conducted to construct a product consisting of numeracy modules based on Aceh culture. This process was done in contrast with the result of the previous step of this research, the analysis stage. In this particular procedure, the module's design took its turn to cover its contents.



Figure 2. Literacy and numeracy module cover

Figure 2 above shows that the design of the elementary school students' module has been created following Aceh culture by adding the image of a typical Aceh house. Students found it meaningful as they could figure out and reflect on the actual image.

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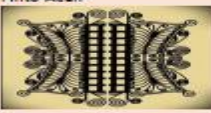
Kegiatan 2 dan 3 70 Menit

Kegiatan Numerasi

Ayo Menemukan 60 Menit

Coba perhatikan lingkungan sekitarmu. Apakah kamu bisa memanfaatkan matematika di lingkunganmu? Apa yang bisa kamu perbaiki di lingkunganmu dengan matematika?





1. Kesenian budaya apa saja yang kamu jumpai? Salin dan isilah tabel berikut di buku kerjamu!

No	Nama Kesenian Budaya	Bentuk Kesenian	Perkiraan Panjang Kesenian Budaya
1.	Pinto Aceh	...	...

Modul Belajar Literasi dan Numerasi Jenjang SD

Figure 3. Students' numeracy activity

The design of numeracy learning content was based on students' local culture, as seen in Figure 3, testing students to determine the length of *Pintoe Aceh* (Aceh Door). Students were given 60 minutes to name the local arts and analyze and predict their length and width. Students were instructed to calculate the local culture and visual arts.

2.	Rumoh Aceh	...	...
3.	Keukarah	...	...
4.	Rapat	...	...
5.	Kupiah Maukeutop	...	...

2. Pilihlah salah satu kesenian budaya yang bisa kamu ukur.
a. Kesenian apa yang aku pilih adalah...
b. Kesenian tersebut berbentuk...

3. Tentukan panjang dan lebar kesenian tersebut! Kamu dapat mengukur menggunakan langkah kaki, jengkal, ataupun tali.
a. Panjang kesenian adalah ... tali
= ... x ...cm = ...cm
b. Lebar kesenian adalah ... tali

4. Gambarlah sketsa kesenian tersebut di buku kerjamu atau di kertas berpetak yang dapat ditemukan pada **halaman 89**. Sebelum menggambar, tentukan skala sketsa yang akan kamu buat, misalnya 1 cm pada skala = ...cm jarak sebenarnya

Refleksiku 10 Menit

Temukan lembar refleksi di **halaman 94**

Modul Belajar Literasi dan Numerasi Jenjang SD

Figure 4. The numeracy task of local visual arts

The other types of local visual arts were to predict the length and width of Aceh's typical house, cake, and hat. The task instructions were designed to ask students to provide

information based on their chosen arts. Students were also instructed to give and guess the information of the art's width and length on the actual size.

Development stage

In the development part, it was discovered that the material and media were regarded as very valid. The experts on the material were asked to give their views on the feasibility of module content, as shown in Table 3 below.

Table 3. The experts' validation of material

Criteria	Indicators	Material Expert 1	Material Expert 2
Content feasibility	The completeness of material	12	10
	Accuracy	18	18
	Updates	8	8
	Curiosity	7	8
Presentation feasibility	Techniques	4	3
	Supplementary presentation	20	20
	Learning presentation	3	4
	Coherence	8	6
Culture feasibility	The nature of Aceh culture	7	7
	Culture components	15	15
Total		102	99
Percentage (%)		91.07	88.39
Category		Very Valid	Very Valid
Average		3.64	3.53

It can be inferred from Table 3 above that the validation of material by the two experts revealed a significant outcome; the materials used were validated very valid. This validation can be seen from assessing score made by the first material expert, 91.07%, while the second expert gave validation marks of as much as 88.39 %. The media used in the literacy and numeracy module based on Aceh culture was evaluated, revealing the following findings, as in Table 4.

Table 4. The expert validation of media

Indicators	Media Expert 1	Media Expert 2
Module Size	6	8
Cover Design	22	25
Content Design	57	64
Total	85	97
Percentage	78.70	89.81
Category	Valid	Very Valid
Average	3.14	3.59

Based on Table 4 above, the percentage of numeracy module of the first media expert was 78.70%, which is considered valid. Meanwhile, the validation of the second expert value was as much as 89.81, and it was considered very valid. The appropriateness of language

used in the developed module was validated and examined by two linguistics experts, as in the following Table 5.

Table 5. The evaluation indicators

Indicators	Expert 1	Expert 2
Using standard and appropriate grammar	3	3
Using appropriate terms with the subject	4	3
Using simple and easy phrases	4	4
Using communicative language	4	4
The accuracy of language use	3	4
Sentence selection is conveyable to the message	4	4
Simple and Straight right sentences	3	4
The accuracy of spellings	3	3
The consistency use of terms	4	4
The consistency use of symbols or icons	4	4
Total	36	37
Percentage	90	92.5
Category	Very Valid	Very Valid
Average	3.6	3.7

Table 5 above shows that the percentage of literacy and numeracy modules for elementary school based on Aceh culture was validated by the first expert, gained 90% and was considered very valid. The percentage validation of the second expert was 92.5%, which was also classified as very valid. Hence, this result of validation was used for subsequent module evaluations.



Figure 5. (a) Before revision (b) After revision

The cover of the developed module, which was used to improve students' numeracy, was revised in two different stages. This modification of the cover was of paramount importance. Figure 5 (a) illustrates that the cover was designed without the insertion of the typical Acehnese house. The expert media validated the cover, and the typical local house was added in the module's second revision (Figure 5b).

Implementation

The implementation stage requires the developed product, the numeracy module, to be tested or responded to by students. The module was examined or assessed by two different group scales. The product trial, the literacy and numeracy module, was conducted to examine its attractiveness by nine students involved in this stage. The subjects, elementary school students of Muara Satu Lhokseumawe, were asked to give their views through questionnaires directing them to value the attractiveness of the module, as in Table 6 below.

Table 6. Small group average scores

Initials	Total Scores	Average Scores	Percentages (%)	Criteria
P1	49	3.5	87.5	Very Valid
P2	50	3.57	89.28	Very Valid
P3	51	3.64	91.07	Very Valid
P4	50	3.57	89.28	Very Valid
P5	53	3.78	94.64	Very Valid
P6	52	3.71	92.85	Very Valid
P7	45	3.21	80.35	Valid
P8	43	3.07	76.78	Valid
P9	43	3.07	76.78	Valid
Overall Average		3.46	86.50	Very Valid

Table 6 shows that the results of students' responses in several nine students who participated in this study were considered valid. From the initial P1 students to P6 and P9, the validity percentage criteria were all very valid. Three students overviewed the literacy and numeracy module to be valid. It can be inferred that the overall percentage and the average score were 86.50 % and 3.46 allowing the module had been implemented in the large trial of the tested group.

Table 7. Large group average scores

Initials	Average Scores	Percentages (%)	Criteria
MF	3.42	85.71	Very Valid
MRA	3.5	87.5	Very Valid
MZB	3.5	87.5	Very Valid
RF	3.57	89.28	Very Valid
FA	3.5	87.5	Very Valid
PA	3.85	96.42	Very Valid
AA	3.85	96.42	Very Valid
MJ	3.35	83.92	Very Valid
HM	3.85	96.42	Very Valid
MSF	3.64	91.07	Very Valid
AM	3.5	87.5	Very Valid
SA	3.57	89.28	Very Valid
IN	3.42	85.71	Very Valid
AS	4	100	Very Valid
TA	3.5	87.5	Very Valid
ZS	3.42	85.71	Very Valid
ZA	3.64	91.07	Very Valid
AP	3.78	94.64	Very Valid

Initials	Average Scores	Percentages (%)	Criteria
NA	3.42	85.71	Very Valid
AS	3.28	82.14	Very Valid
NR	3.42	85.71	Very Valid
H	3.92	98.21	Very Valid
Overall Average	3.58	89.77	Very Valid

The overall average score of 22 students involved as the subject of this study is indicated in Table 7. It was 3.58, while the overall percentage was 89.77%. Following students' responses on the developed literacy and numeracy module based on Aceh Culture was deemed worthy of use and regarded and evaluated as a very valid source in their literacy and numeracy task. In short, it can be inferred that the module is very appropriate to be used for the source of literacy and numeracy needs at the state elementary school, *Sekolah Dasar Negeri 7, Muara Satu, Lhokseumawe*.

Evaluation

The product evaluation was used to validate, examine and analyze the module that had been processed in the previous implementation stage. It aimed to revise the literacy and numeracy product designed for Aceh culture. The process took into account the experts' commentary and evaluation as well as students' responses of large and big-scale trials of the group on module content underlying language and media used. The evaluations of experts in media and language, the literacy and numeracy module applied in elementary school, were deemed very feasible. Similarly, the numeracy product could be applied to classroom literacy and numeracy as it was regarded as feasible by the evaluators. It was also investigated based on experts' evaluation; the module has been constructed with more formal language and with the attachment of Aceh's typical house at the back cover. Regarding the result of the evaluation, the numeracy product was improved to produce a feasible and qualified module.

Discussion

Based on the development results, it was found that the product, which was constructed to reflect Aceh culture, can be applied to elementary school students. The module was tested, examined, validated, and evaluated in several systematic stages. It was performed with a research model used the analysis, design, development, implementation, and evaluation, a framework of procedures in which the final form of distributed literacy and numeracy module had gone through. Furthermore, the validation stages done by two lecturers of Malikussaleh University in terms of material and media use put forward the importance of using the numeracy module as an additional source for learning mathematics.

The validation of the numeracy module was valued at 78.70%. It was also worthwhile to use in the classroom, aligned with the figures of validation given by the first media expert. The other evaluator gave a royal value of 89.82 %, assigned at a very valid level. The materials used were regarded as appropriate in as much as a percentage of 91.07% and 88.39

%, consecutively evaluated by the two material experts. The media and material used were synonymous with the value of Aceh culture and the language used; the module was easy to comprehend for elementary school students. In this case, students' response is considered positive if the attained score settled within the interval of $81 \leq \text{value} \leq 100$, recognized as a very valid criterion. The literacy and numeracy module has been designed as so attractive a mathematic learning source that students were motivated to learn, constructed based on Aceh culture. The analysis of questionnaires revealed that of the two subjects assigned and taken from different groups, the trial result of the large group had a greater percentage, valued at 89.77 %. While in the product of the module tested, a small group of students attained as much as 86.50 %.

Hence, the result suggested that the module was very valid, positive, and appropriate for all elementary school students as a teaching and learning source for flat-side space materials. Integrating with students' local culture, the literacy and numeracy of students were very proper and suitable for supporting their literacy and numeracy skills as they could reflect the mathematical concept in their real life. These findings were synonymous with those of [Jana and Kintoko \(2019\)](#) in that the local culture is suitable for students' teaching-learning materials.

The primary activity of students' mathematic learning that can be applied in an elementary school is numeracy. This learning activity has it that in an attempt to interpret numerical information, one has to deal with reasoning ability. In the pursuit of the appropriateness of the application of the numeracy process, one can go through a developed module. The development of the numeracy module was intended to assist the state elementary school teachers as it made it easier for them to convey, teach and have students comprehend mathematics ([Lipka et al., 2007](#)). These results showed that the module-based Aceh culture could be applied to elementary school students. Connecting teaching and learning mathematics with local culture's values helped students gain learning motivation ([Rickard, 2017](#)). Thus, the teacher should also be aware of and familiar with students' cultural identity and its value in that it can be used to connect their cultural and linguistic knowledge with school-based math ([Nuraina et al., 2022](#)).

Conclusion

The designed mathematics literacy and numeracy source based on Aceh culture were very valid to have been developed. The feasibility and the effectiveness of the literacy and numeracy module based on Aceh culture were weighed and viewed by students involved in this study showing high validity.

The data from the trial of the numeracy product of the large group marked the total average score as very valid. Students were motivated to do the numeracy task as they found it meaningful, which reflects their heredity of culture. These findings concluded that the developed numeracy module based on Aceh culture was very appropriate, feasible, and effective to further employ in teaching and learning. The module can be used without any differences for group work or individual tasks. Nonetheless, the module must be shared with

students having a mutual understanding of Aceh culture, applying to non-Acehnese students complicated in understanding local terms.

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Conflict of interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

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Author Contributions

Muliana: Conceptualization, Methodology, Software. **Hayatun Nufus:** Curation of research data, Writing-Original draft preparation. **Nuraina:** Visualization, Investigation. **Nur Mahyuni:** Supervision. **Asmaul Husna:** Writing-Reviewing and Editing.

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